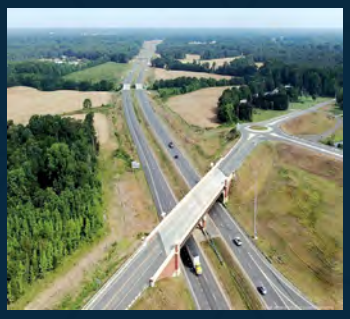
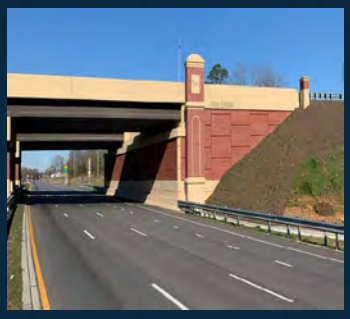
NORTH CAROLINA
Turnpike Authority

Maintenance Rating Program Monroe Expressway

Quarter 4 MRP Assessment


February 2023

CONSULTANT CERTIFICATION OF COMPLETION

December 20, 2022

Alan Shapiro, P.E.

Director of Highway Operations, NCTA

1 South Wilmington Street

Raleigh, NC 27601

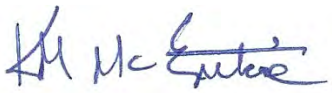
NCTA Monroe By-Pass Roadway Maintenance Performance Rating Program; Q4, CY 2022 Rating

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



Ken M. McEntire, PE

Principal Project Manager – Operations and Maintenance

1101 Haynes Street, Suite 101

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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 2022 Fourth Quarter Assessment of the Monroe Expressway.

The overall 2022 fourth quarter rating of the Monroe Expressway was 97.5. 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 2022 Fourth Quarter Assessment

Element	MRP Rating	Target Rating
Road Surface	98.8	85.0
Unpaved Shoulders and Ditches	100.0	85.0
Drainage	97.6	85.0
Roadside	94.2	85.0
Traffic Control Devices	97.0	85.0
Overall MRP Performance Rating	**97.5**	**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 96.7.

Table 2: MRP Rolling Element Results

Element	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Road Surface	96.7	94.5	100.0	98.8	97.6
Unpaved Shoulders and Ditches	96.6	98.4	100.0	100.0	98.8
Drainage	100.0	98.8	98.5	97.6	98.7
Roadside	95.0	92.9	90.1	94.2	93.0
Traffic Control Devices	96.2	94.4	96.5	97.0	96.0
Overall MRP Performance Rating	**96.7**	**95.4**	**97.0**	**97.5**	**96.7**

All the element ratings were above the desired rating of 85, and one characteristic scored below the minimum 80 rating. It is important to note that these results are only representative of the fourth 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.

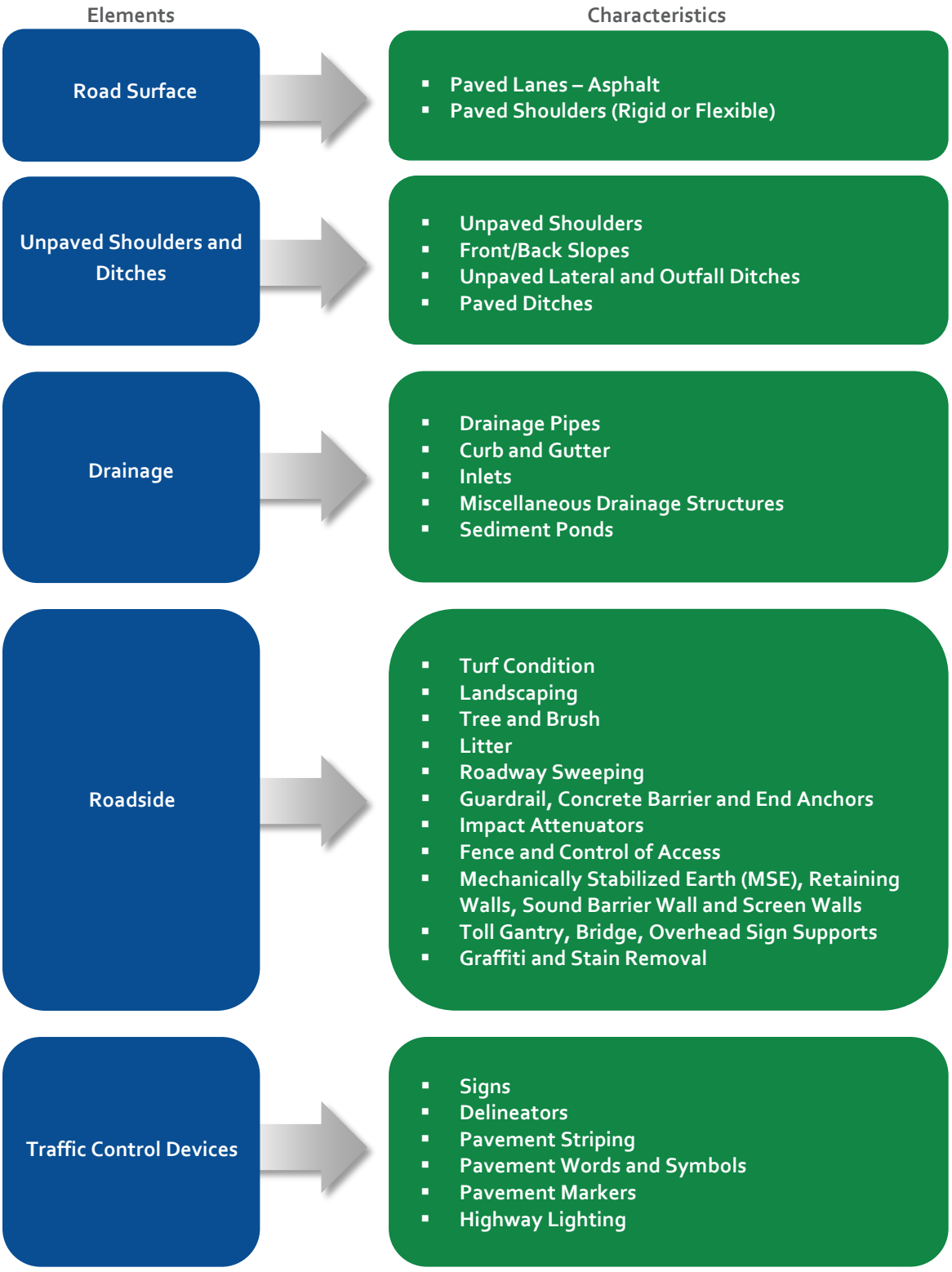
The NCTA performance standards, threshold criteria, and maintenance rating program were developed through a collaborative effort by NCTA managers, NCDOT maintenance staff, and consultants.

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 Q4 2022 MRP rating for the Monroe Expressway is 97.5. 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 one characteristic 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 Q4 2022

Element	MRP Rating
Road Surface	98.8
Unpaved Shoulders	100.0
Drainage	97.6
Roadside	94.2
Traffic Control Devices	97.0
Overall MRP Performance Rating	**97.5**

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 Q4 2022

Road Surface	Sample Passed	Sample Total	Weighted Values	Actual PTS	Available PTS	Quarter Rating
Paved Lanes Asphalt	30	30	9	270	270	100
Paved Shoulder	29	30	5	145	150	97
Element Total				**415**	**420**	**98.8**
Unpaved Shoulders & Ditches	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual PTS**	**Available PTS**	**Quarter Rating**
Unpaved Shoulder	30	30	9	270	270	100
Front/Back Slopes	30	30	6	180	180	100
Lateral and Outfall Ditches, Unpaved	30	30	6	180	180	100
Ditches, Paved	9	9	5	45	45	100
Element Total				**675**	**675**	**100.0**
Drainage	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual PTS**	**Available PTS**	**Quarter Rating**
Drainage Pipes	32	32	7	224	224	100
Curb and Gutter	29	30	6	174	180	97
Inlets	29	30	7	203	210	97
Misc. Drainage Structure	19	20	4	76	80	95
Sediment Pond	3	3	7	21	21	100
Element Total				**698**	**715**	**97.6**
Roadside	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual PTS**	**Available PTS**	**Quarter Rating**
Turf Condition	34	42	7	238	294	81
Landscaping	14	14	4	56	56	100
Trees and Brush	18	18	4	72	72	100
Litter	30	30	4	120	120	100
Roadway Sweeping	30	30	5	150	150	100

Guardrail, Concrete Barrier and End Anchors	32	32	9	288	288	100
Impact Attenuators	6	6	9	54	54	100
Fence, Control Access	24	28	7	168	196	86
Retaining Walls and Sound Barrier Walls	14	14	5	70	70	100
Toll Gantry Supports	7	7	5	35	35	100
Graffiti and Stain Removal	30	30	4	120	120	100
Element Total				**1371**	**1455**	**94.2**

Traffic Control Devices	**Sample Passed**	**Sample Total**	**Weighted Values**	**Actual PTS**	**Available PTS**	**Quarter Rating**
Signs	63	66	7	441	462	95
Object Markers and Delineators	30	30	3	90	90	100
Pavement Striping/Marking	30	30	8	240	240	100
Words and Symbols	32	32	7	224	224	100
Pavement Markers	28	30	9	252	270	93
Highway Lighting	2	2	6	12	12	100
Element Total				**1259**	**1298**	**97.0**

6.0 Analysis & Recommendations

MRP Elements

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

Road Surface (98.8) experienced a 1.2 point decrease to the previous quarter's rating. This quarter there was one asphalt pavement linear sections that did not pass the paved shoulder criteria.

Unpaved Shoulders and Ditches (100.0) remained unchanged from the previous quarter's rating.

Drainage (97.6) rolling rating decreased by 0.9 points from the previous quarter's rating. Curb and Gutter, Inlets, and Misc. Drainage Structures all decreased slightly from the previous quarter's rolling rating.

Roadside (94.2) rolling rating increased by 4.1 points from the previous quarter's rating. Turf (85) saw an increase from the previous quarter's rating. ROW Fence (86) saw a decrease from the previous quarter's rating.

Traffic Control Devices (97.0) experienced an increase in rating of 0.5 points from the previous quarter. Signs (95) saw an increase from the previous quarter. Pavement Markers (93) decreased from the previous quarter.

MRP Characteristics

All characteristics exceeded the NCTA minimum threshold criteria of 80.

7.0 Current Rolling MRP Rating

The rolling maintenance rating of the Monroe Expressway was 96.7, 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 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

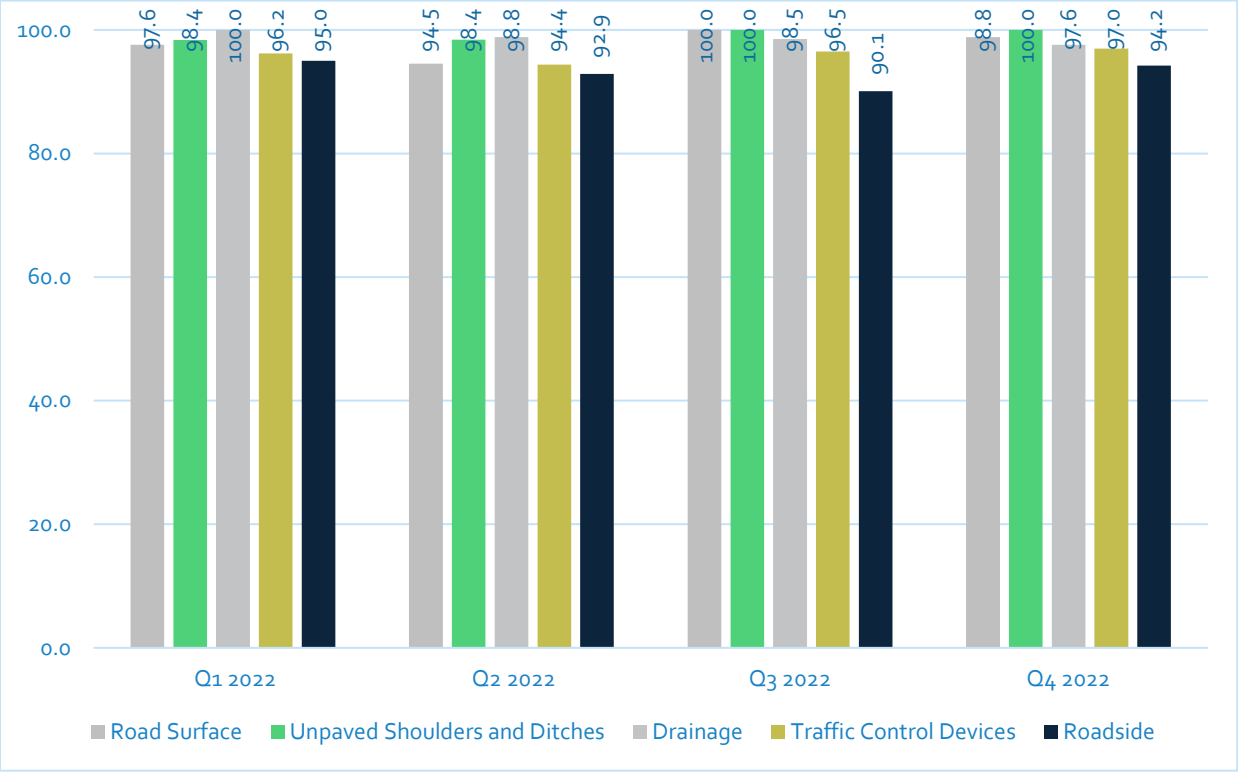


Table 5: MRP Rolling Element Results

Road Surface	Q1 2022 Rating	Q2 2022 Rating	Q3 2022 Rating	Q4 2022 Rating	Rolling Rating
Paved Lanes Asphalt	97	93	100	100	97.6
Paved Shoulder	97	97	100	97	97.6
Element Total					**97.6**
Unpaved Shoulders and Ditches	**Q1 2022 Rating**	**Q2 2022 Rating**	**Q3 2022 Rating**	**Q4 2022 Rating**	**Rolling Rating**
Unpaved Shoulder	93	100	100	100	98.4
Front/Back Slopes	100	97	100	100	99.2
Lateral and Outfall Ditches, Unpaved	100	100	100	100	100
Ditches, Paved	91	92	100	100	95.2
Element Total					**98.4**
Drainage	**Q1 2022 Rating**	**Q2 2022 Rating**	**Q3 2022 Rating**	**Q4 2022 Rating**	**Rolling Rating**
Drainage Pipes	100	100	100	100	100
Curb and Gutter	100	100	100	97	99
Inlets	100	100	97	97	98.4
Sediment Basins	100	100	100	100	100
Misc. Drainage Structure	100	89	95	95	94.9
Element Total					**98.7**
Roadside	**Q1 2022 Rating**	**Q2 2022 Rating**	**Q3 2022 Rating**	**Q4 2022 Rating**	**Rolling Rating**
Turf Condition	77	74	65	81	74.0
Landscaping	100	100	87	100	96.4
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	100	100	94	100	98.5
Impact Attenuators	100	100	100	100	100
Fence, Control Access	97	92	95	86	92.6
Retaining Walls and Sound Barrier Walls	100	86	100	100	96.3
Decorative Supports	100	100	100	100	100
Graffiti and Stain Removal	100	100	100	100	100
Element Total					**93.0**
Traffic Control Devices	**Q1 2022 Rating**	**Q2 2022 Rating**	**Q3 2022 Rating**	**Q4 2022 Rating**	**Rolling Rating**
Signs	90	90	91	95	91.9
Delineators	100	93	100	100	98.4
Pavement Striping/Marking	100	93	100	100	98.4
Words and Symbols	97	100	97	100	98.5
Pavement Markers	100	97	100	93	97.6
Highway Lighting	100	100	100	100	100
Element Total					**96.0**

8.0 Conclusion

This report presents the 2022 fourth 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 fourth quarter 2022 overall rating was **97.5** and the rolling rating was **96.7**, both ratings met the target rating of 90.

All element ratings were above the target ratings for the quarter. Only one characteristic, Turf, failed to meet the target rolling rating. During the fourth quarter assessment, all characteristics met or exceeded the target rating of 80.

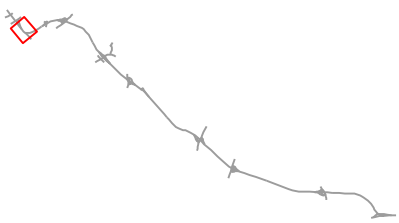
The maintenance provider is encouraged to continue using asset management principles and a performance management approach to work planning.

Appendix A: Monroe Expressway MRP Q4 2022 Assessment Locations

Legend

Failing Asset

Passing Asset



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B1

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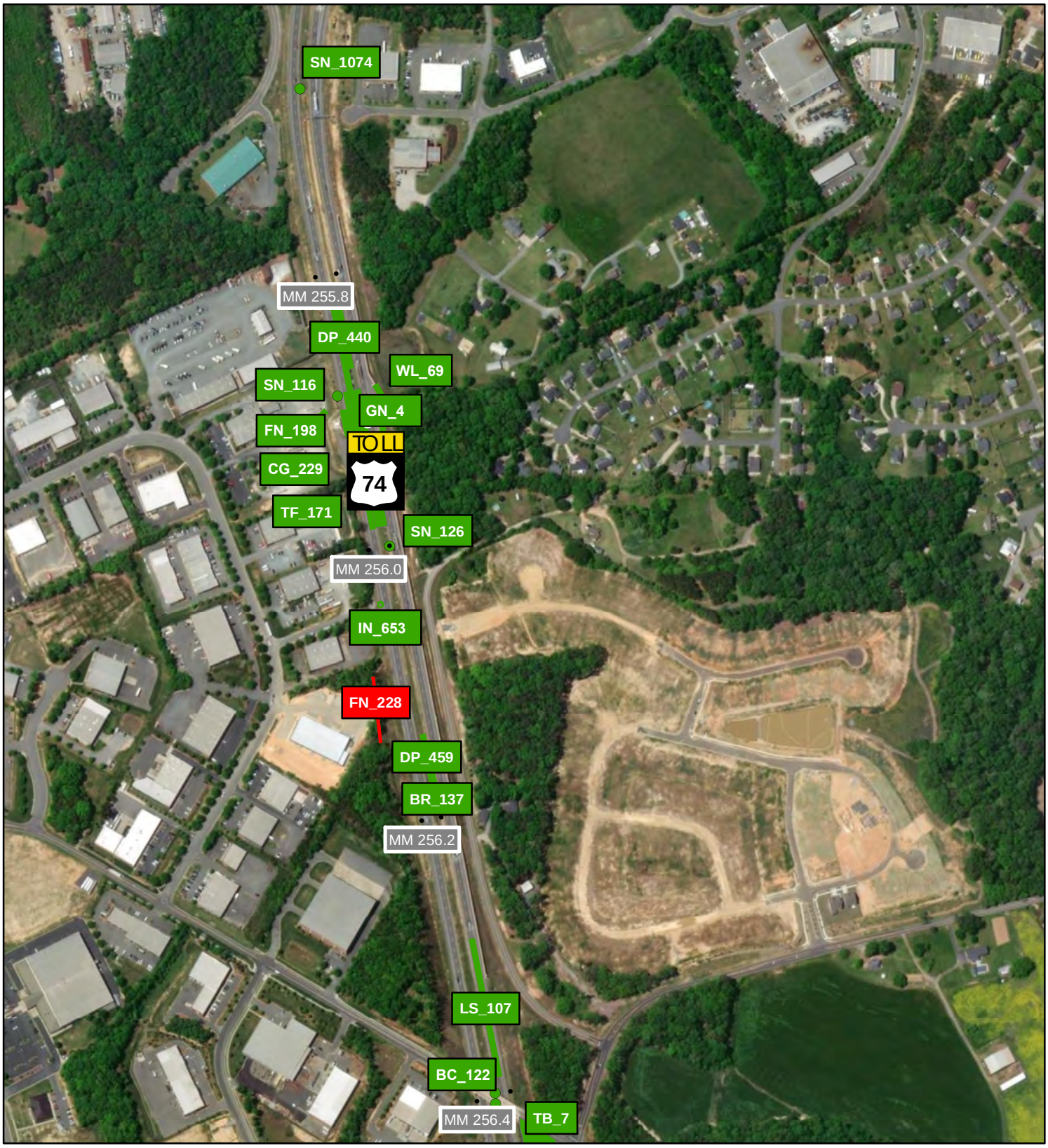

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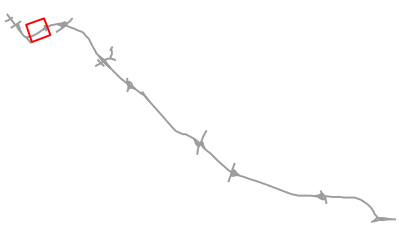

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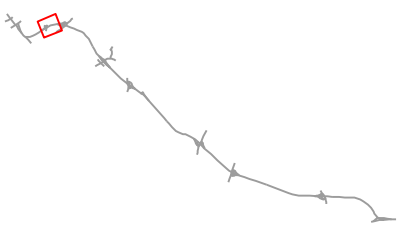

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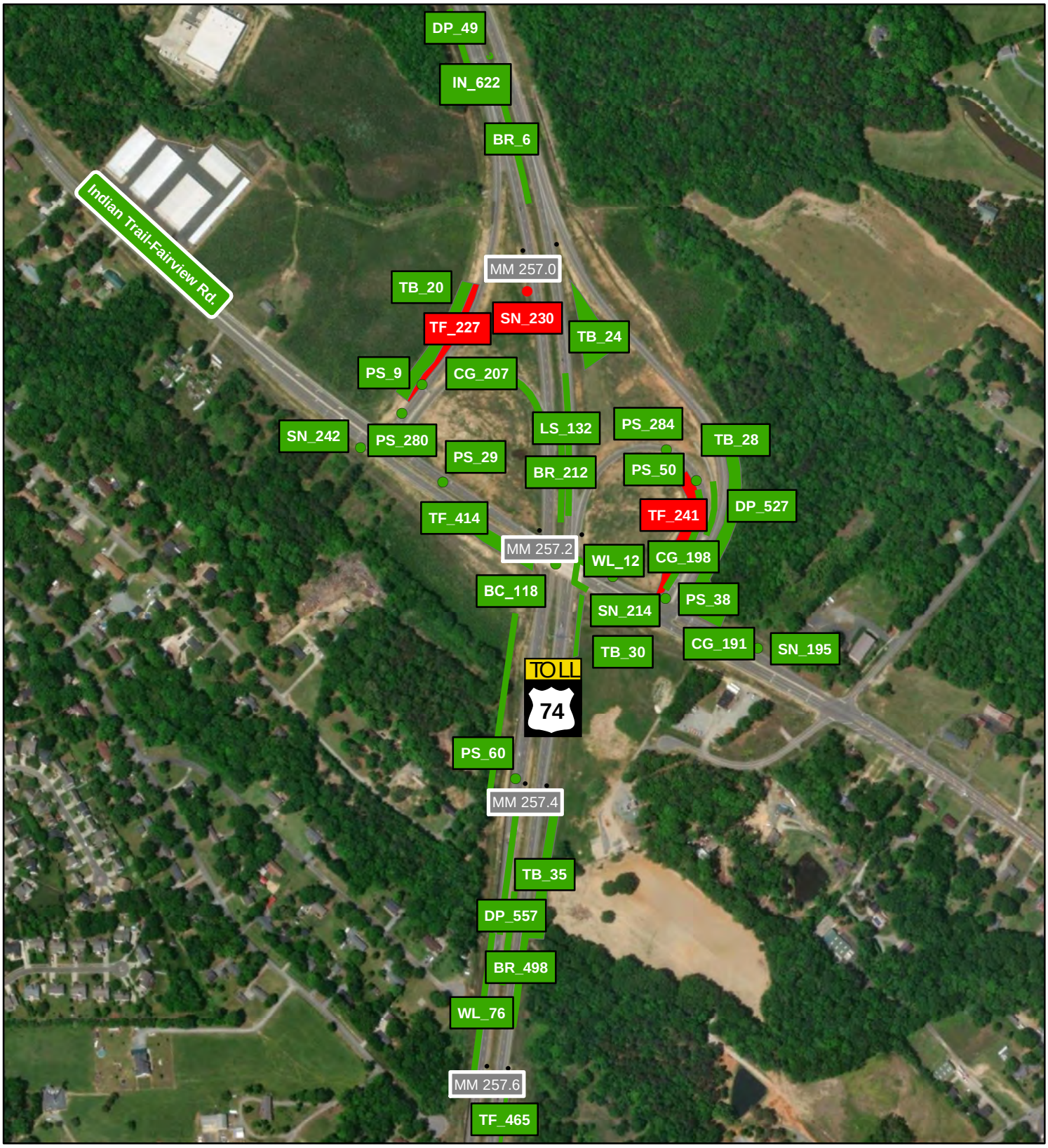

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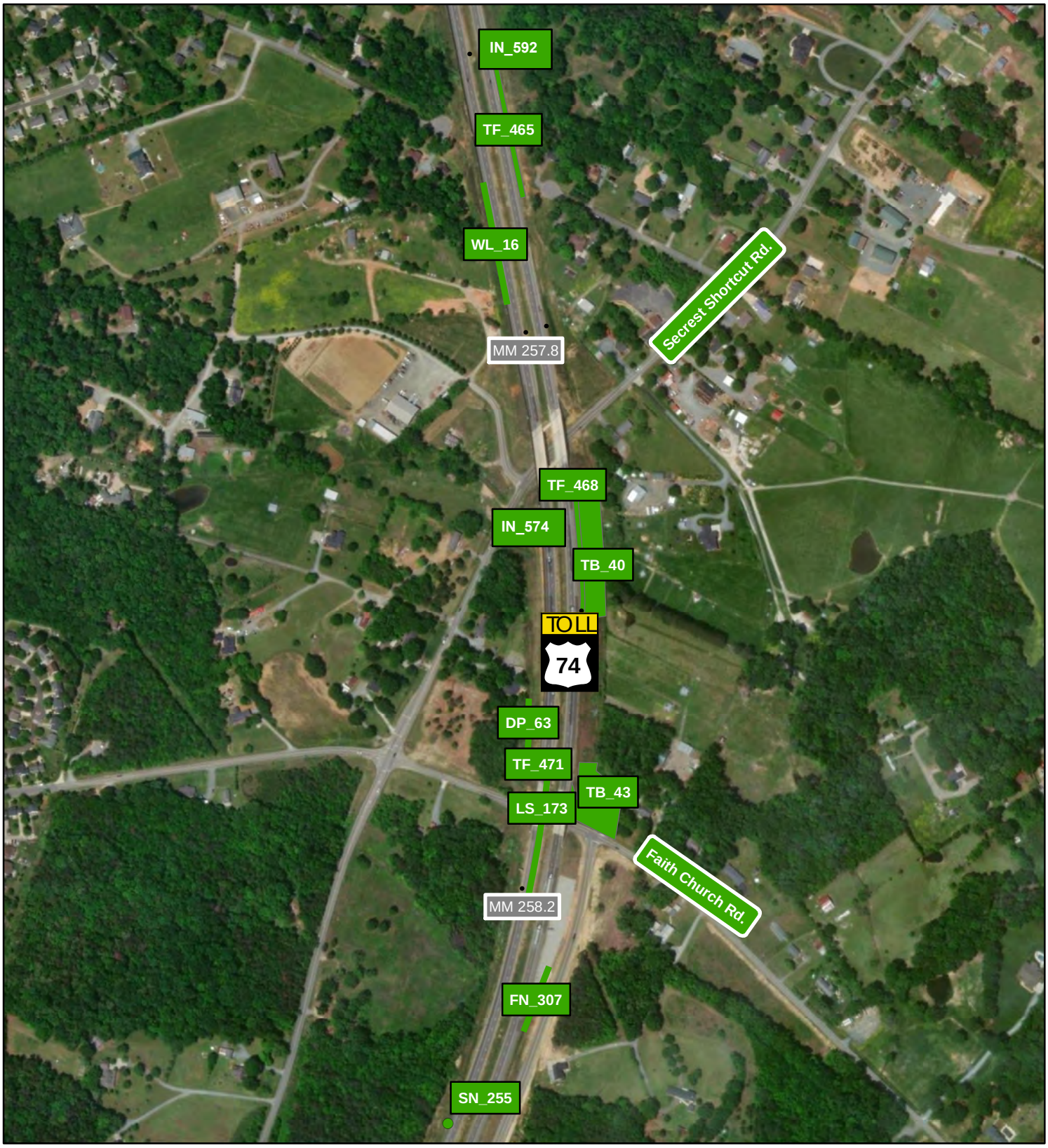

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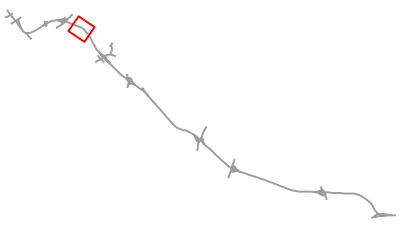

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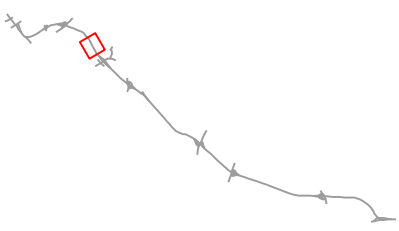

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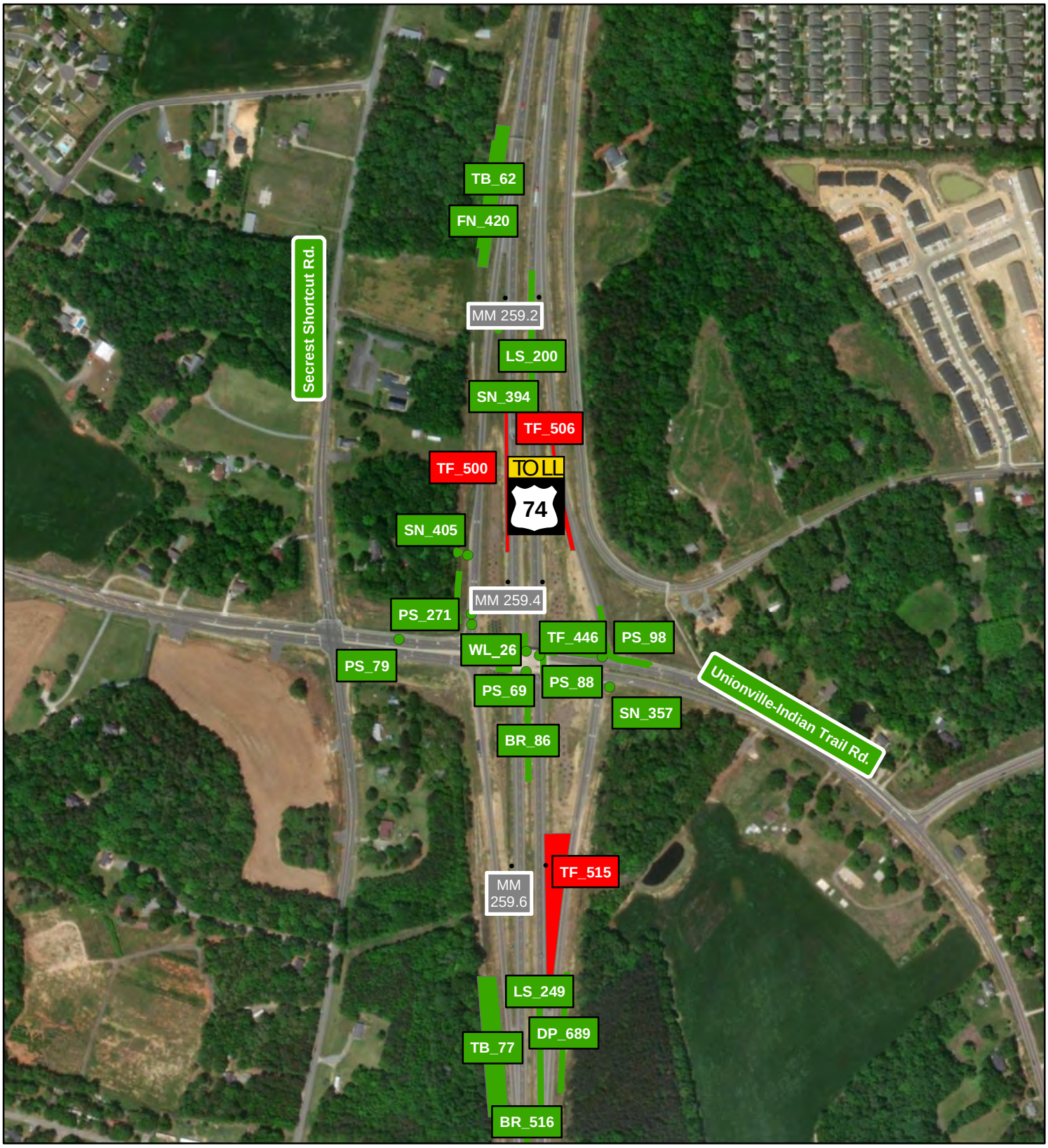

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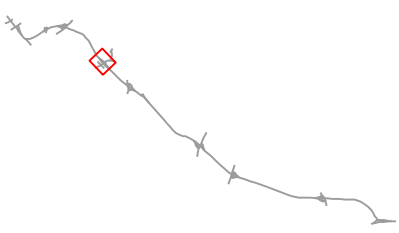

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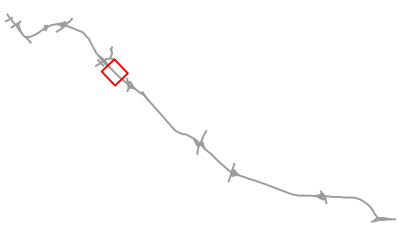

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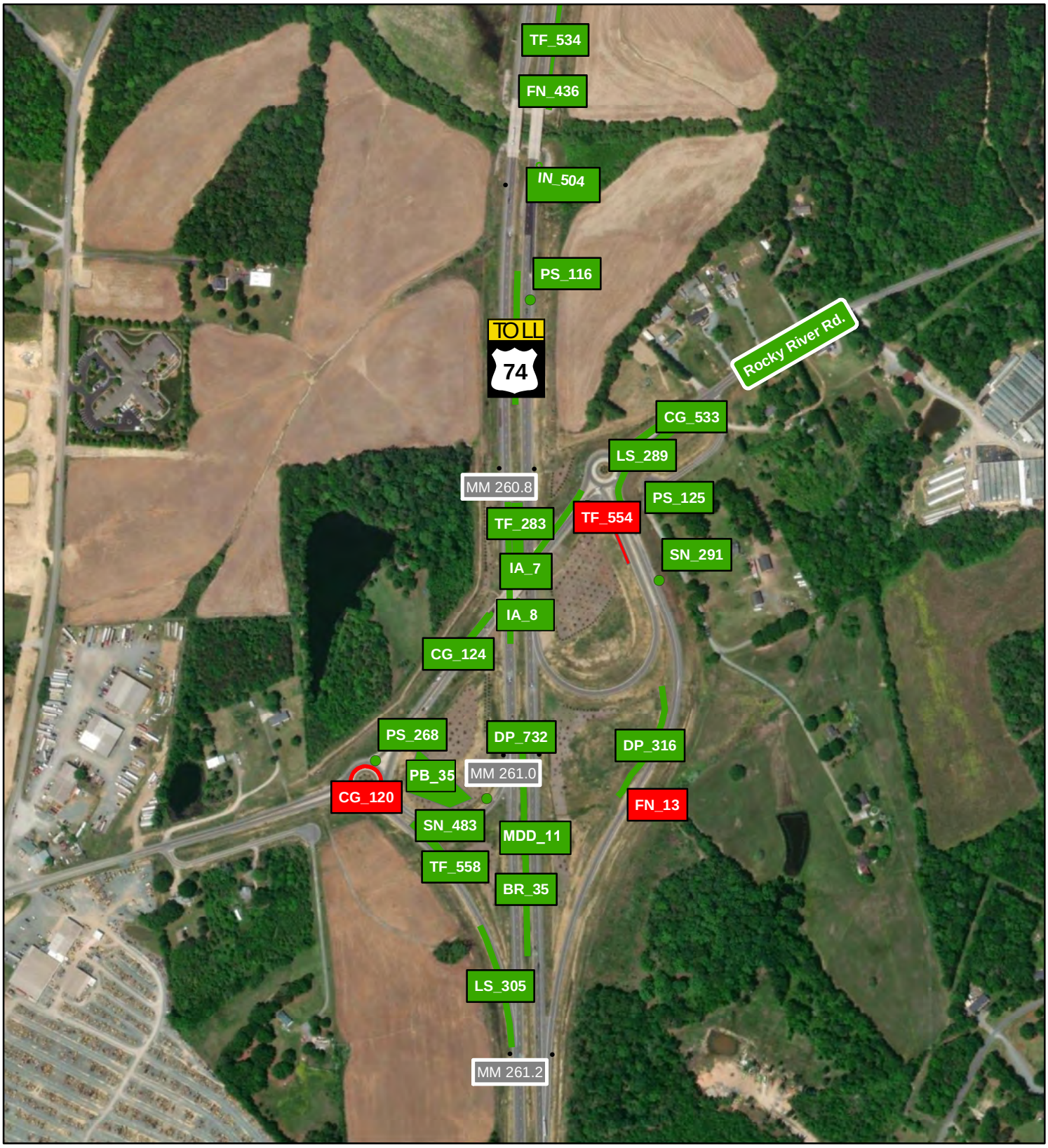

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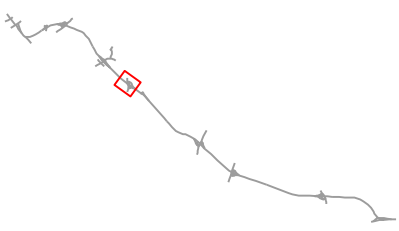

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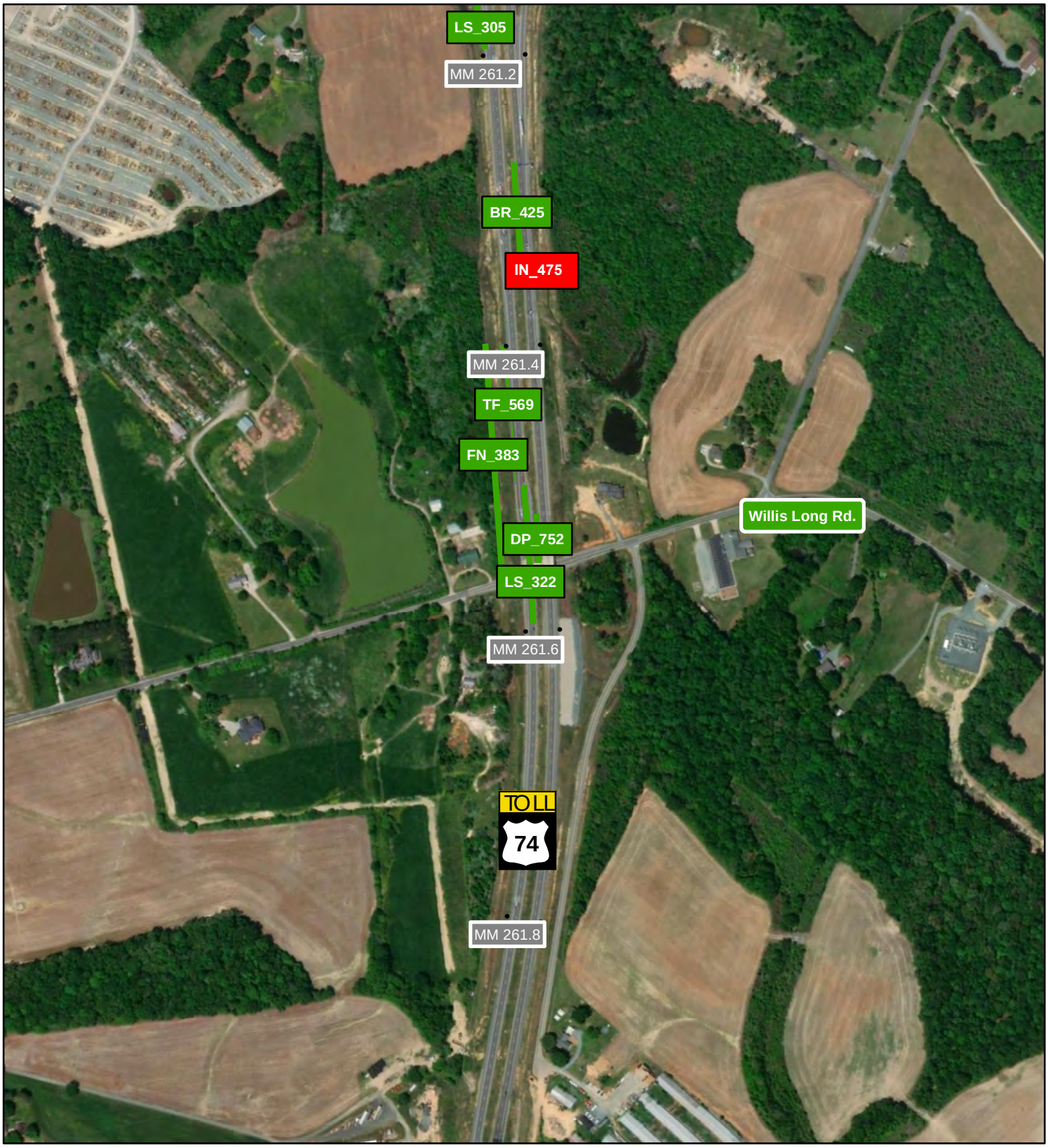

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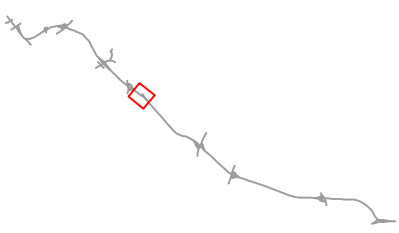

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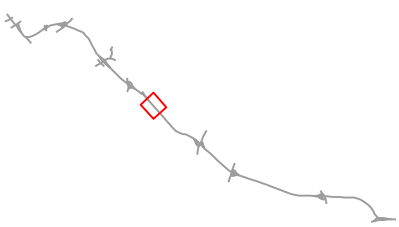

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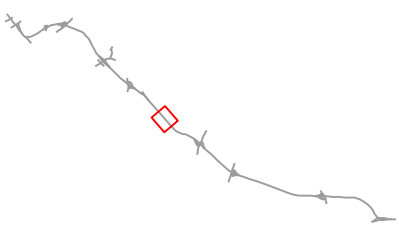

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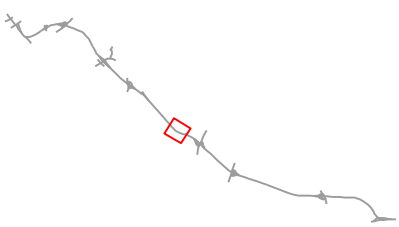

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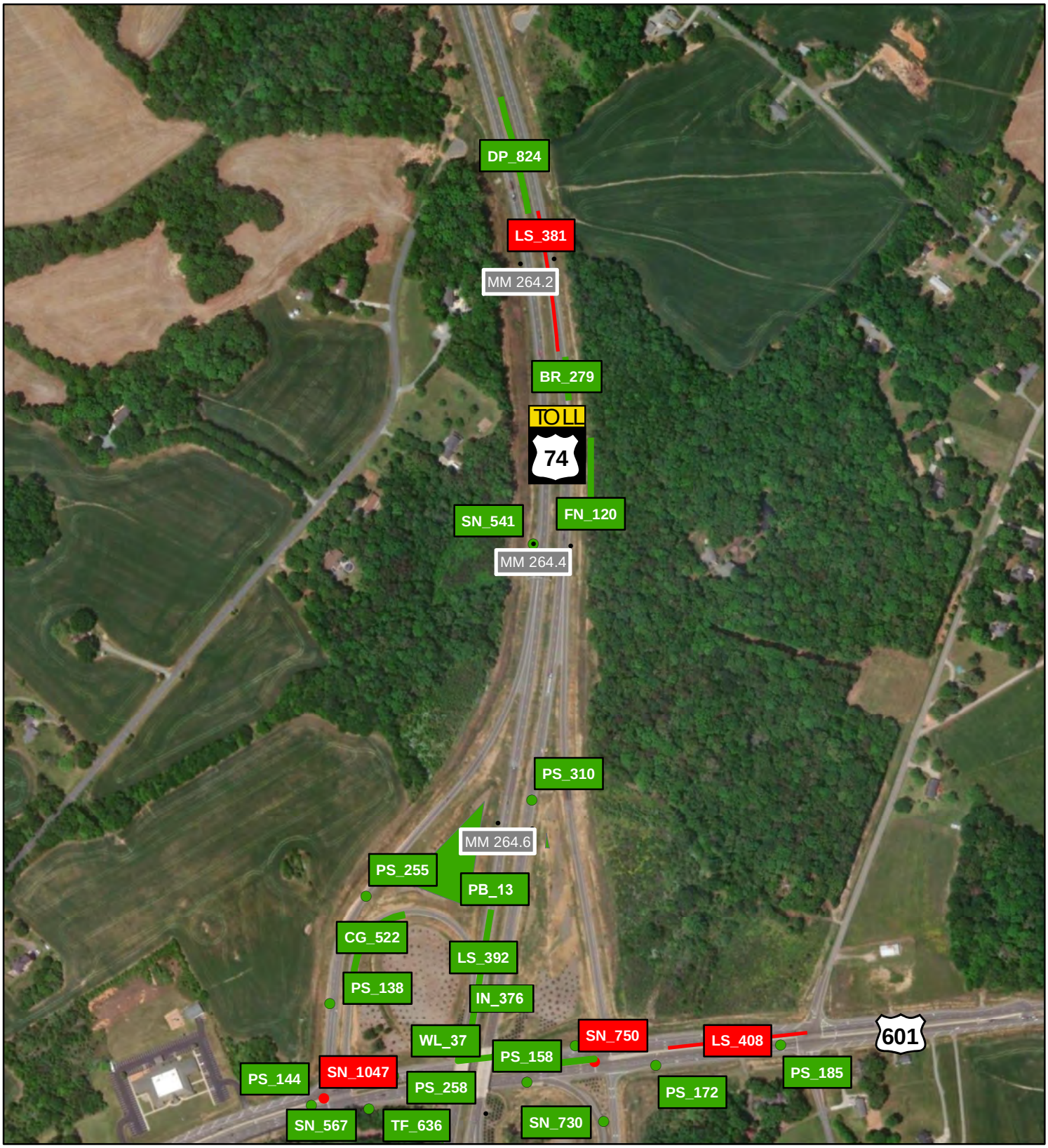

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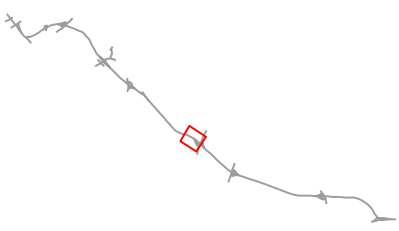

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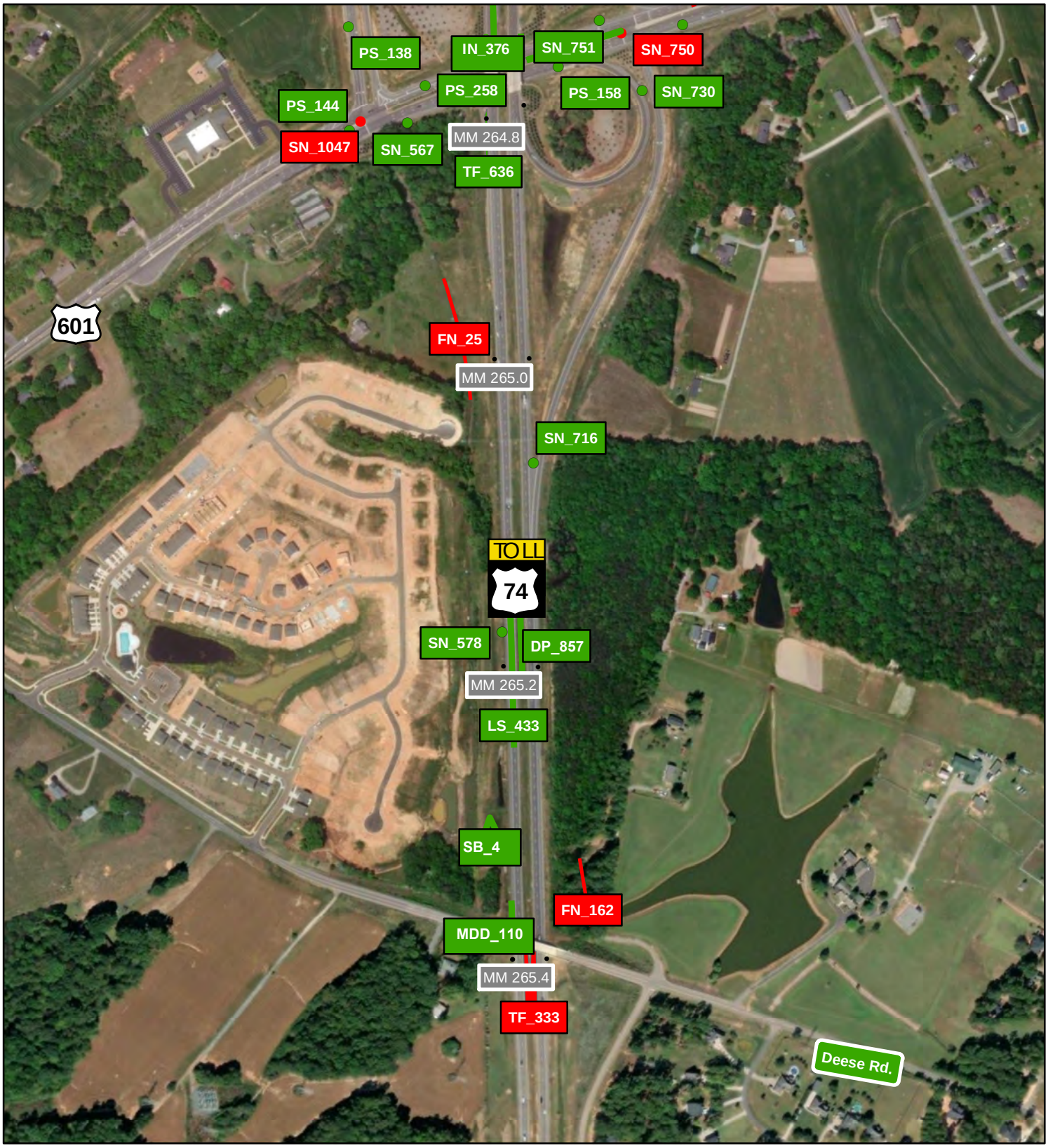
Appendix A: Monroe Expressway MRP Q4 2022 Assessment Locations



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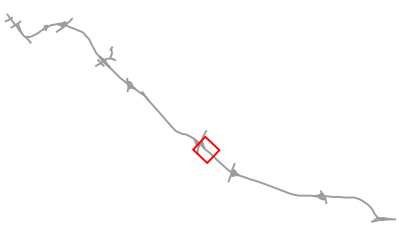
Failing Asset

Passing Asset



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Legend

Failing Asset

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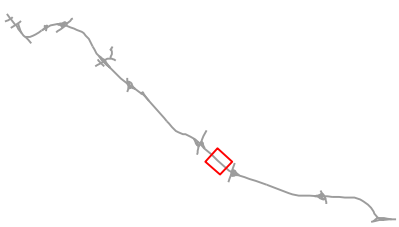

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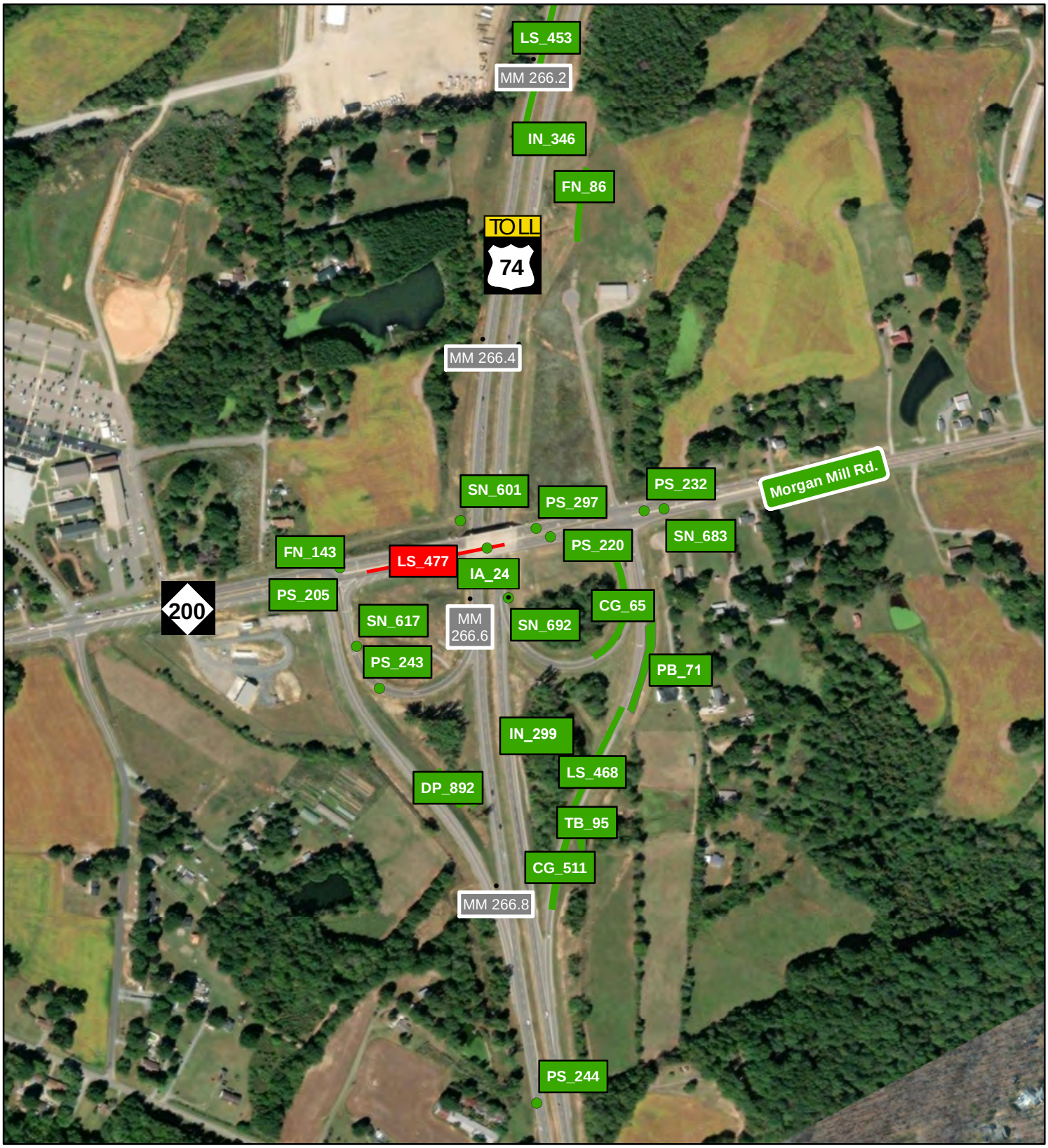

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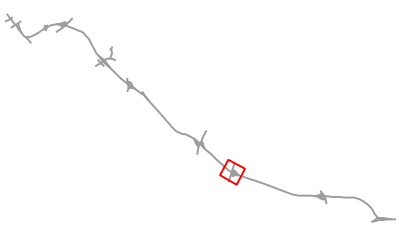

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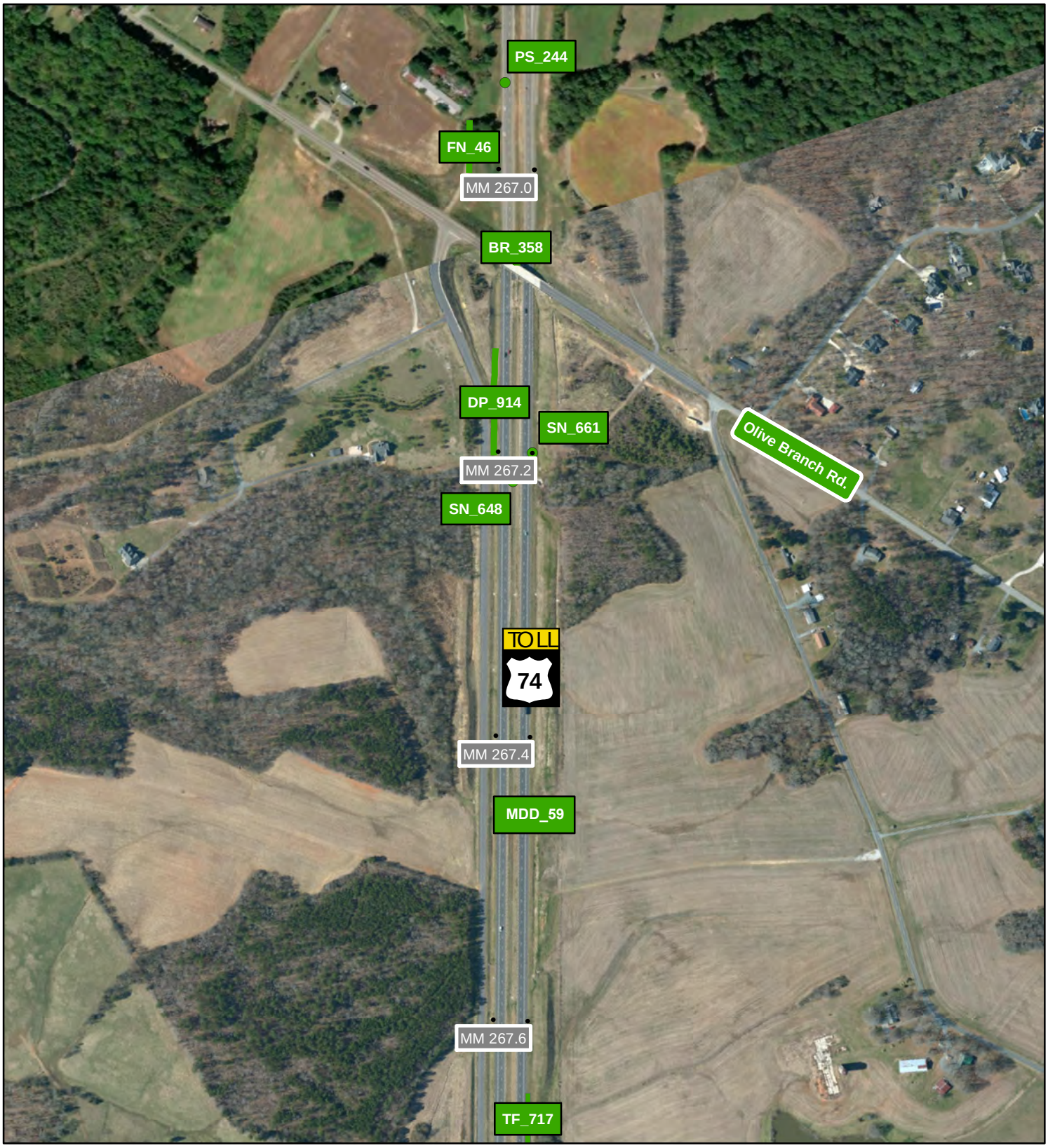

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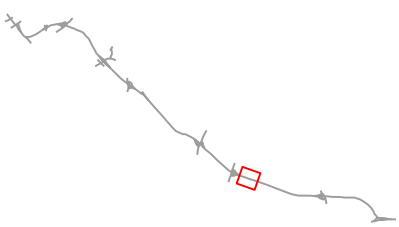

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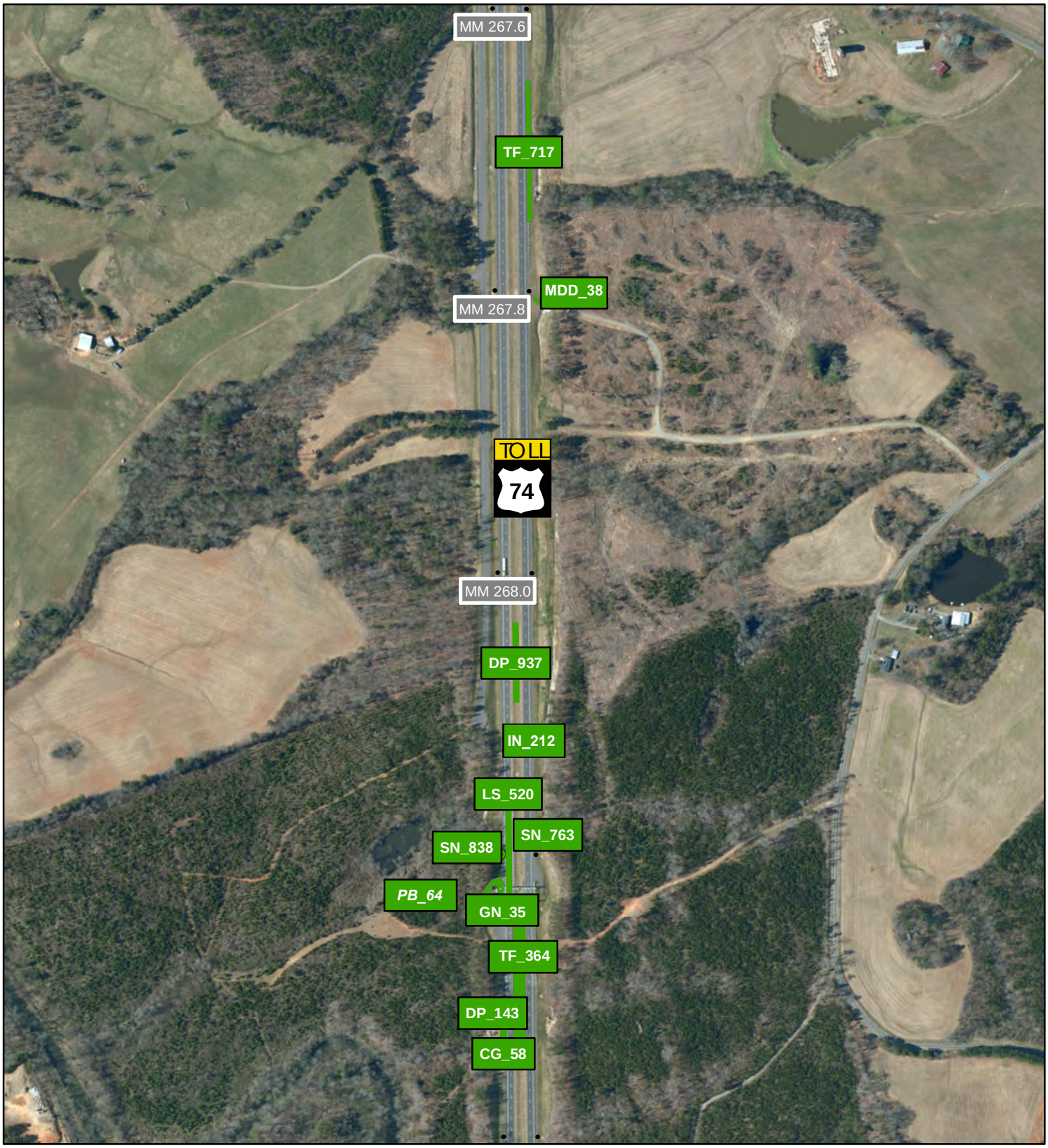

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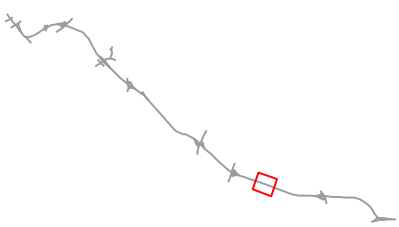

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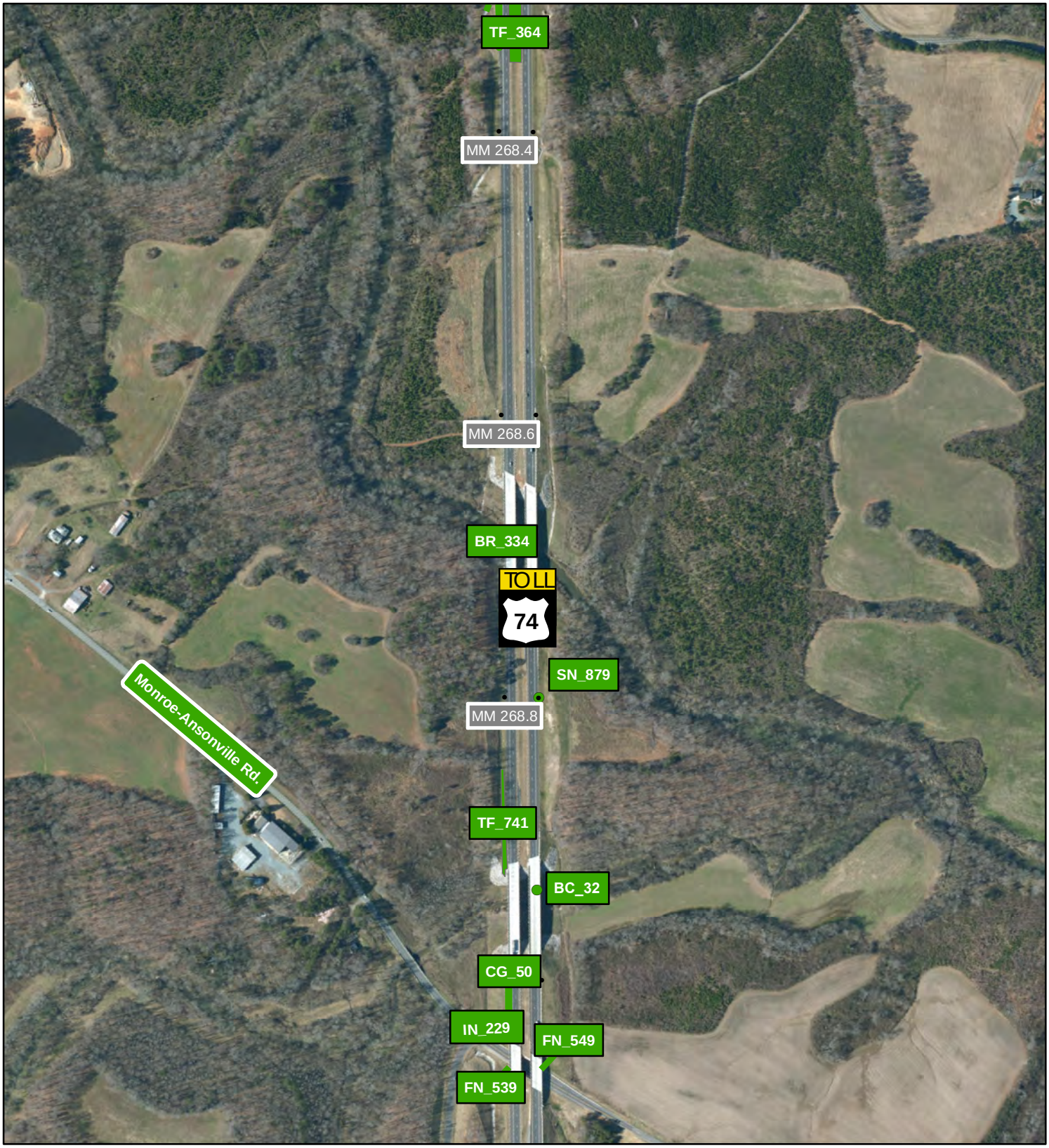

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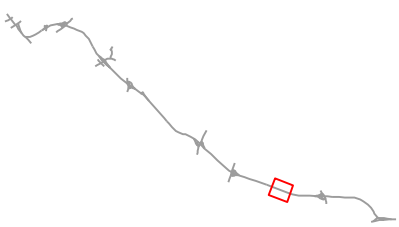

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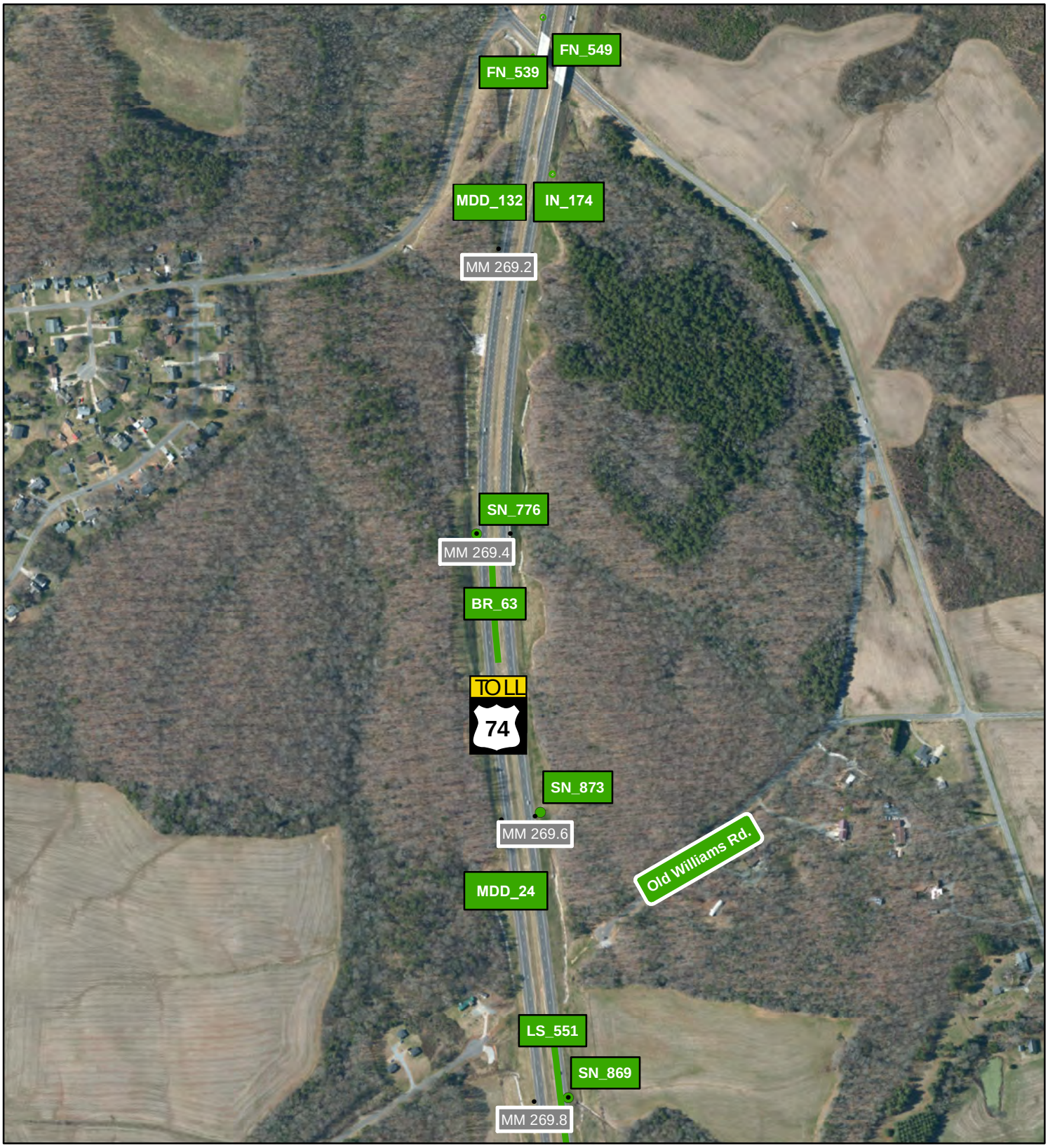

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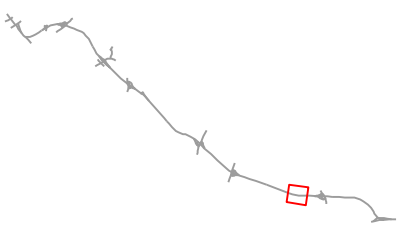

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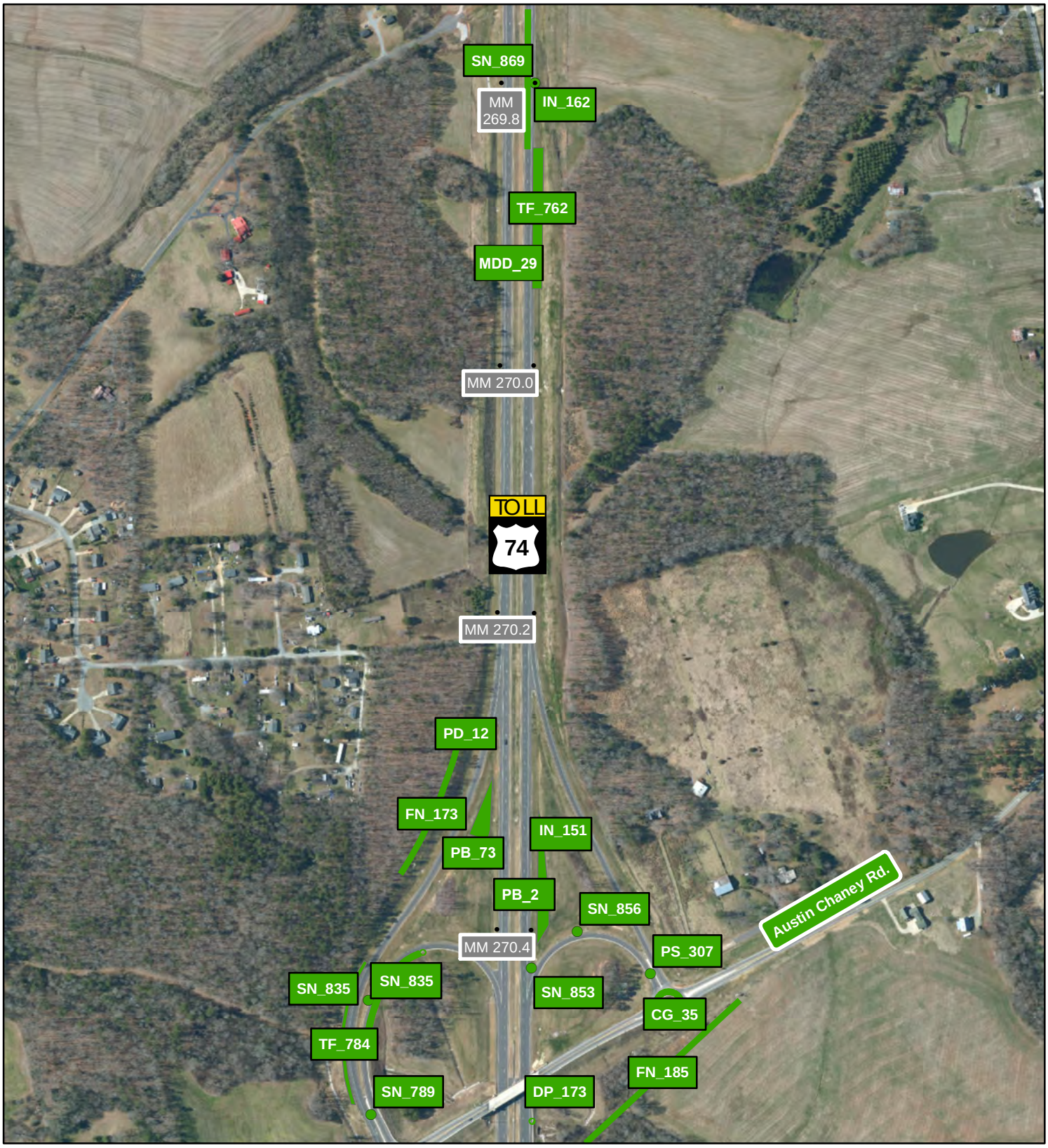

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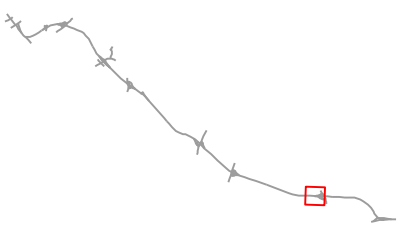

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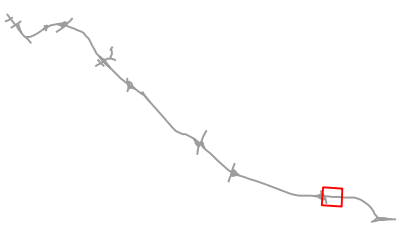
Appendix A: Monroe Expressway MRP Q4 2022 Assessment Locations

Legend

Failing Asset

Passing Asset



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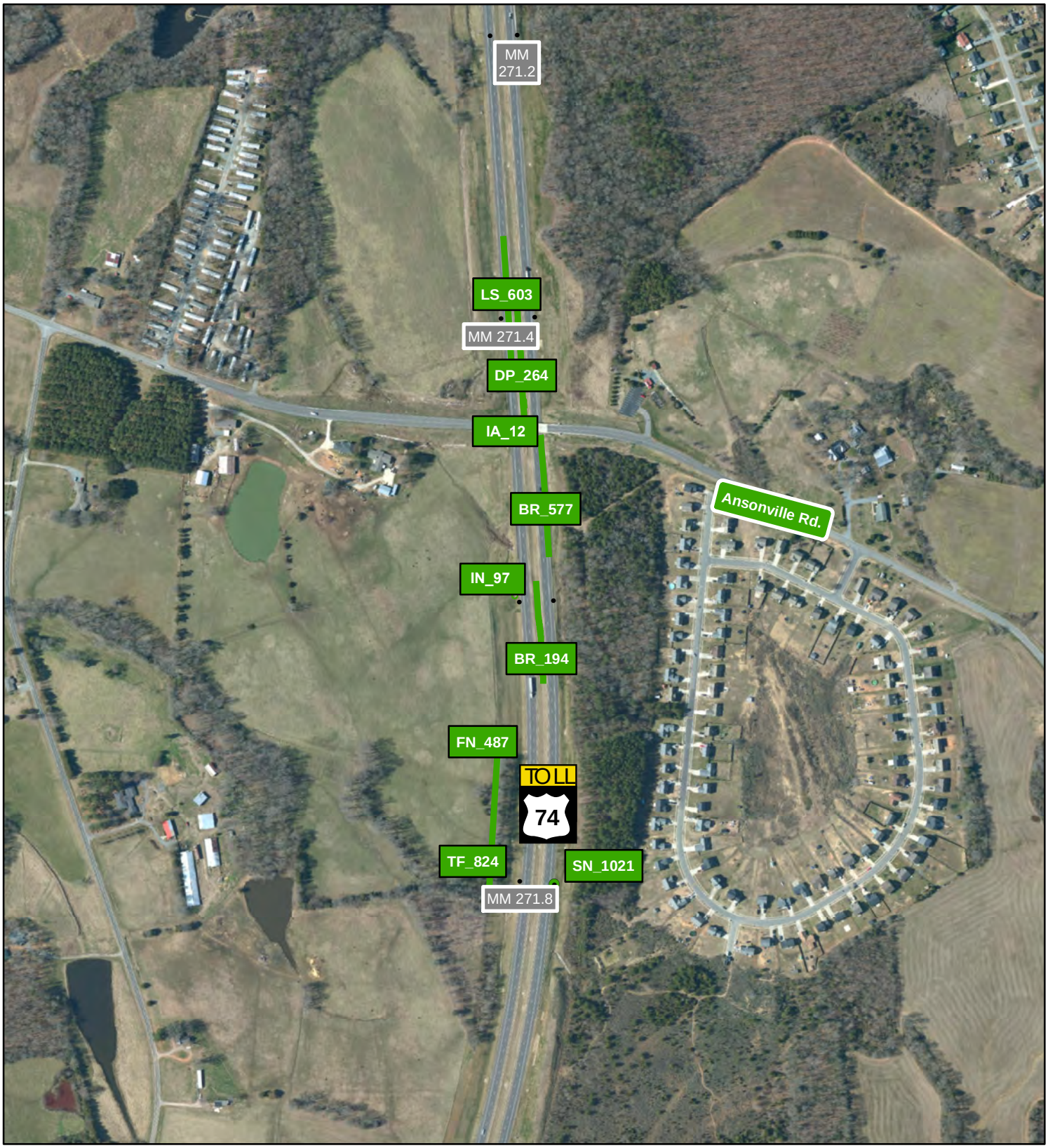
Appendix A: Monroe Expressway MRP Q4 2022 Assessment Locations



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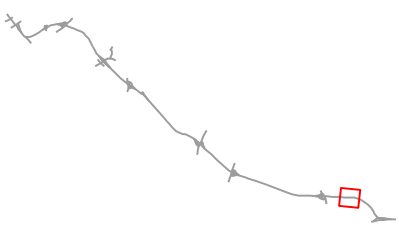

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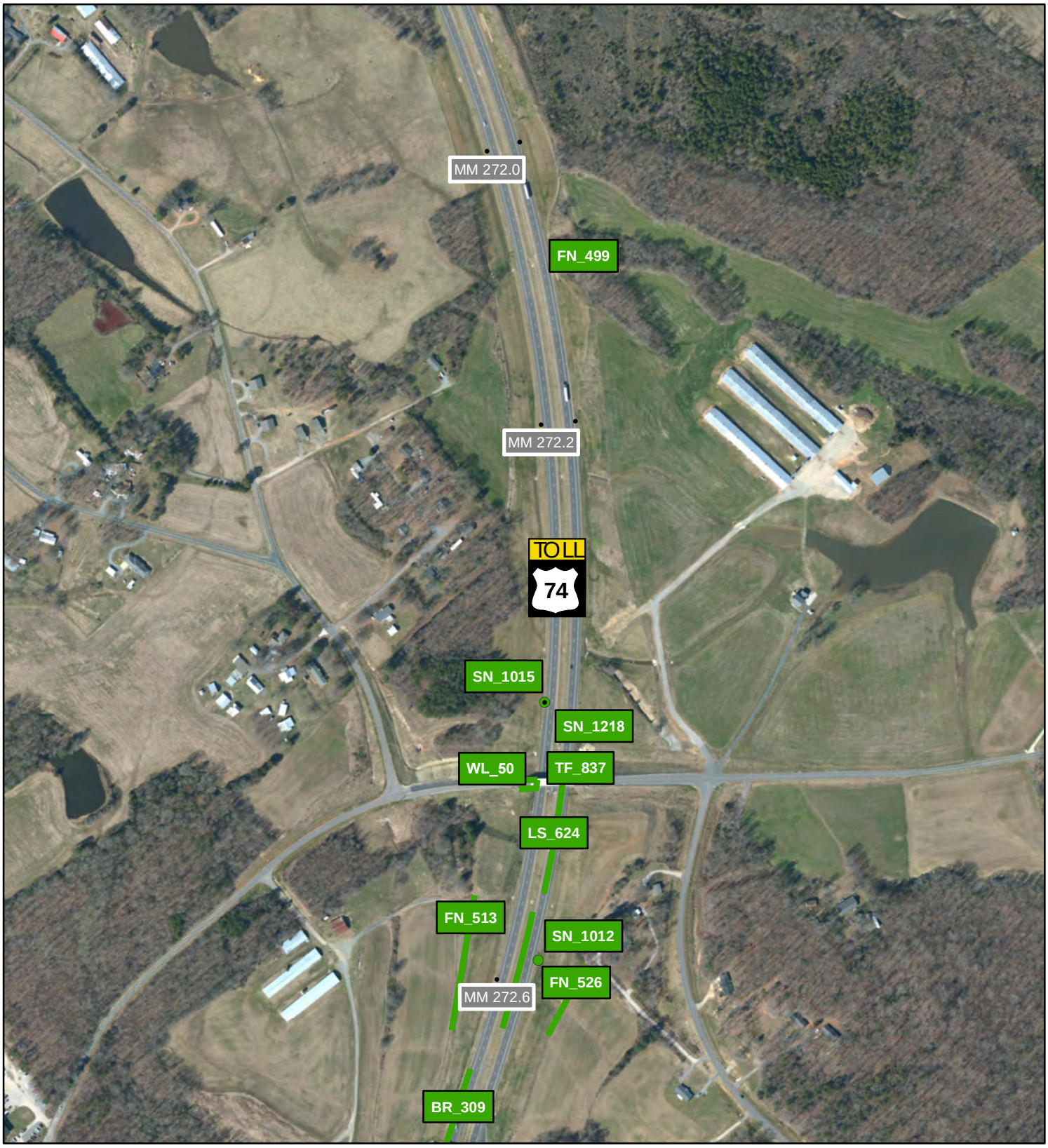

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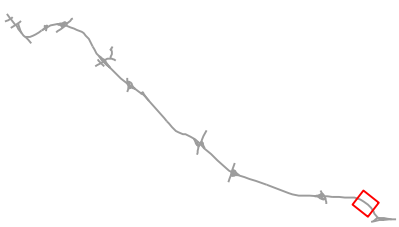

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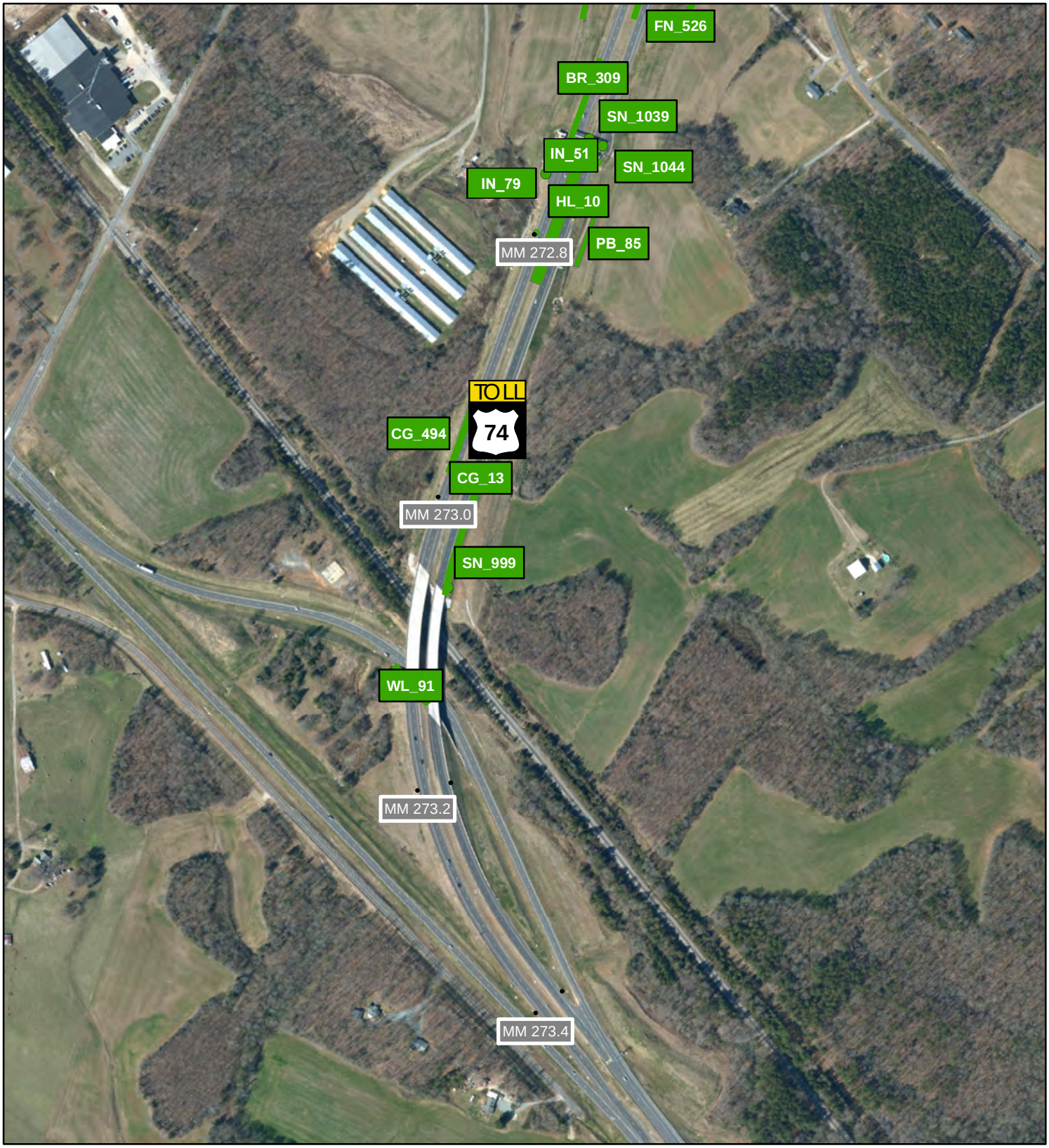

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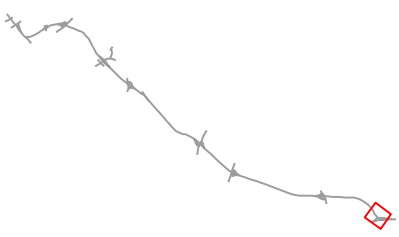

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Appendix B

Monroe Expressway 2022 Fourth Quarter Table Results of Assets Failing MRP

Appendix B: Monroe Expressway 2022 Fourth Quarter Table Results of Assets Failing MRP

Provided below are a series of tables outlining the existing failures that occurred throughout the facility. Assets are defined by an Inventory ID, which is a unique identifier given to each individual asset. The components 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.

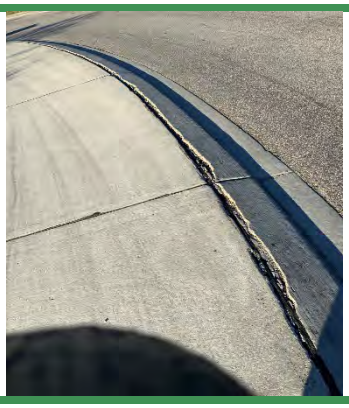
All assets and their respective prefixes are listed below:

Guardrail, Concrete Barrier and End Anchors (BR)

#	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
1	Concrete	CG_120	Cracking		A9

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Toll Gantry Supports (GN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Drainage Pipes (DP)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Misc. Drainage Structure (MDD)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Concrete	MDD_65	Obstruction		A13

Fence and Control of Access (FN)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Woven	FN_13	Hole		A9
2	Woven	FN_25	Hole		A15
3	Woven	FN_162	Hole		A15
4	Woven	FN_228	Hole		A2

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

This asset did not produce any failures.

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	Concrete	IN_475	Erosion		A10

Landscaping (PB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

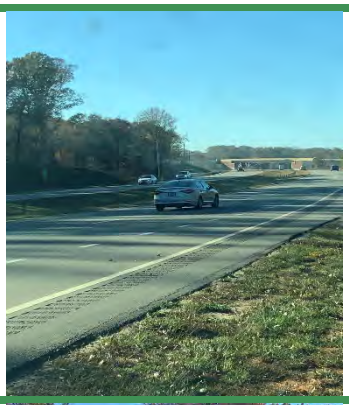
This asset did not produce any failures.

Paved Lanes – Asphalt (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_381	Cracking		A14
2	Asphalt	LS_408	Markers		A14

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

This asset did not produce any failures.

Roadway Sweeping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

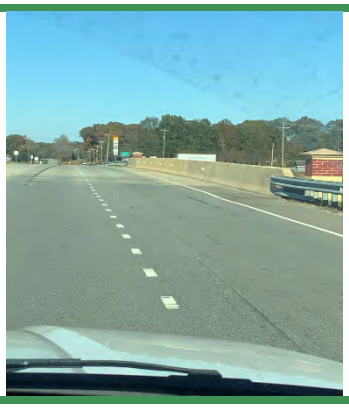
This asset did not produce any failures.

Pavement Striping (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Pavement Markers (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Asphalt	LS_477	Missing Markers		A17

Delineators (LS)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Paved Ditches (PD)

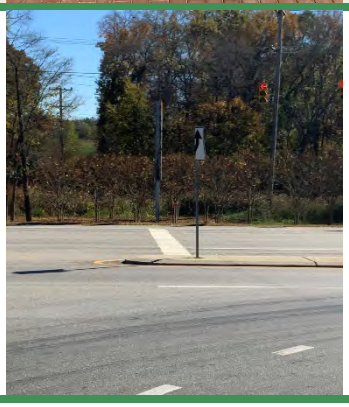
#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

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
1	Yield	SN_230	Sign Support		A4
2	Road Sign	SN_750	Sign Height		A14 & A15
3	Road Sign	SN_1047	Sign Damage		A14 & A15

Tree and Brush (TB)

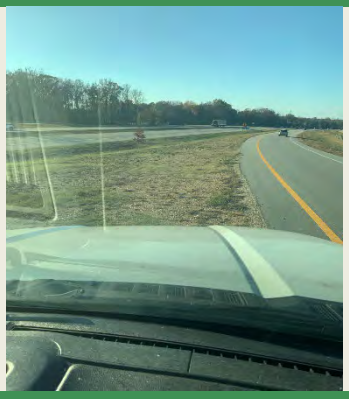
#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
1	Turf	TF_133	Bare Ground		A1
2	Turf	TF_227	Bare Ground		A4
3	Turf	TF_241	Bare Ground		A4

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
4	Turf	TF_333	Bare Ground		A15 & A16
5	Turf	TF_500	Bare Ground		A7
6	Turf	TF_506	Bare Ground		A7

Turf Condition (TF)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page
7	Turf	TF_515	Bare Ground		A7
8	Turf	TF_554	Bare Ground		A9

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

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.

Sediment Basins(SB)

#	Material Type	Object ID	Failure Type	Photo	GIS Reference Page

This asset did not produce any failures.