

US 521 Corridor Study

Lancaster County
South Carolina

Prepared for



Prepared by



434 Fayetteville Street, Suite 1500
Raleigh, NC 27601
License #: F-0165

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EXECUTIVE SUMMARY

The Rock Hill-Fort Mill Area Transportation Study (RFATS), in collaboration with Lancaster County, has prepared a corridor study for US 521 from the North Carolina state line to the intersection of SC-75 (Waxhaw Highway). The purpose of this corridor study is to identify alternatives for US 521 that improve safety, mobility, and operations; are feasible considering right-of-way constraints; and are capable of handling anticipated future growth along the corridor. A total of 18 intersections - 15 signalized and 3 unsignalized were included in this study. The study area map with corridor limits of approximately 8.5-miles is shown in **Figure ES-1**.

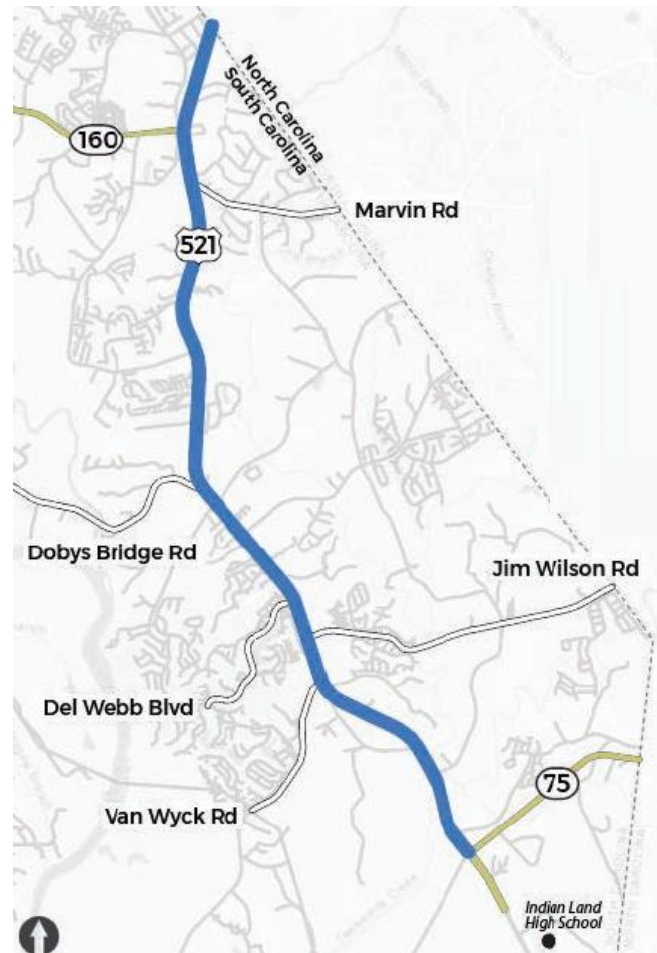
The base year and future year for the study are determined to be 2022 and 2045. The project team collected the relevant data to evaluate the existing and future year no-build conditions along the corridor. Any background projects that affect the roadway geometry or signal operations in the study area are included in the future year no-build conditions.

Alternatives were identified to further evaluate and analyze the traffic operations along the study intersections on US 521. The evaluation criteria are shown in **Figure ES-2**.

Figure ES-2 – Evaluation Criteria



Figure ES-1 - Study Area 1



A review of the most current 3-year (2019-2021) crash data in the study limits showed that:

- A total of 965 crashes occurred in the study area during the review period including three (3) fatal crashes, five (5) fatal injury crashes, three (3) serious injury crashes, and other 111 injury crashes.
- 51% of the crashes occurred at signalized intersections.
- Rear end and angle crashes include 57% and 24% respectively.
- “Driving too fast for conditions” (37%) and “Failure to yield right-of-way” (17%) were reported as the major possible causes.

Based on the crash analysis, the project team identifies the following as the potential safety issues in the study corridor:

- Driver behavior characteristics
- Congestion and stop-go conditions

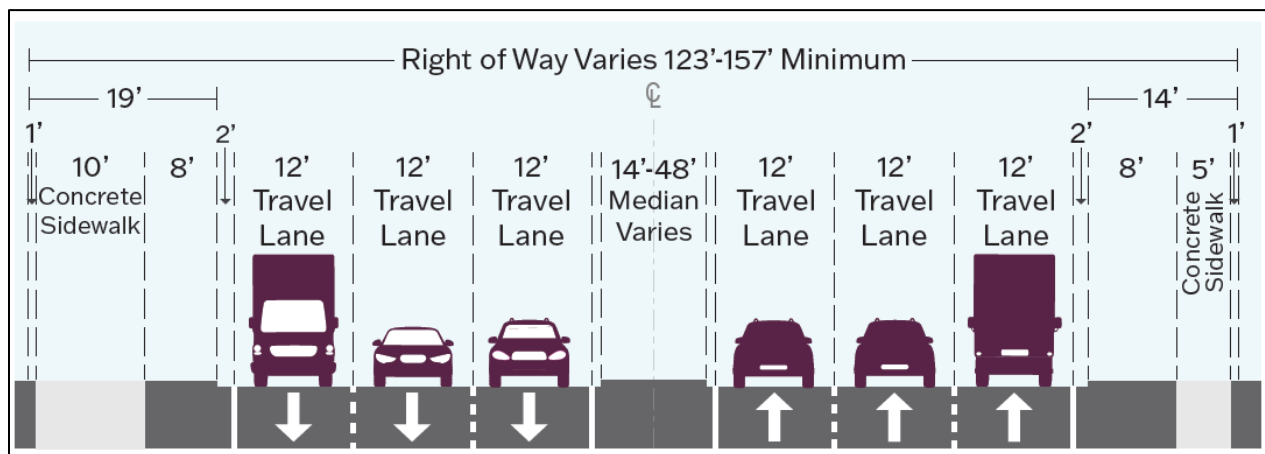
- Queue spillbacks to adjacent intersections
- Inadequate gap times and gaps for the TWSC traffic, especially left turns
- Inadequate gap times and gaps for the permissive left turn phases at signalized intersections

The Metrolina Regional Model (MRM) estimated the 2045 daily volume along four-lane US 521 to be up to approximately 54,000 vehicles per day (vpd). Demand is expected to exceed capacity at multiple intersections along the study corridor by 2045. Per the MRM, widening US 521 to six-lanes within the study corridor is expected to increase the demand to up to approximately 68,000 vpd. To accommodate this anticipated future growth while striving to improve safety, mobility, and operations, three Build Alternatives were identified in coordination with RFATS and Lancaster County to further evaluate and analyze the traffic operations along the study intersections on US 521. These include:

1. Alternative 1 - Traditional widening to six-lane median divided with conventional intersections.
2. Alternative 2 - Reduced Conflict Intersection (RCI) widening to six-lane median divided with RCIs.
3. Alternative 3 - Hybrid widening to six-lane median divided with conventional, RCI, and/or innovative intersections.

Figure ES-3 shows the typical section of the six-lane US 521 corridor.

Figure ES-3 – Typical Section of 6-lane US 521



The high-level cost estimate for the build alternatives is shown in **Table ES-1**. These are developed based on a review of similar local project costs, high-level order-of-magnitude estimates from other agencies, and coordination with project stakeholders. Cost estimates include construction of roadway cross-section, intersections, structures right-of-way, and utilities. Additional evaluation and design will need to be conducted to develop a more refined cost of improvements.

Table ES-1 High-Level Cost Estimates

	Alternative 1	Alternative 2	Alternative 3
Total Cost Estimate (2022 Year of Expenditure)	\$102,691,470	\$142,648,770	\$114,568,770

Capacity analysis results for study area intersections for the four future year (2045) scenarios listed below are shown in **Table ES-2**.

1. 2045 No-Build: 4-lane US 521; traffic volumes for 4-lane US 521
2. 2045 Alternative 1: 6-lane US 521; traffic volumes for 6-lane US 521; traditional intersections
3. 2045 Alternative 2: 6-lane US 521; traffic volumes for 6-lane US 521; RCI intersections
4. 2045 Alternative 3: 6-lane US 521; traffic volumes for 6-lane US 521; traditional/RCI intersections

Table ES-2 Capacity Analysis Results

Intersection	Level of Service (LOS)			
	2045 No-Build AM (PM)	2045 Alternative 1 AM (PM)	2045 Alternative 2 AM (PM)	2045 Alternative 3 AM (PM)
US 521 & Sandra Ln/Walmart	C (D)	B (D)	A (C)	B (C)
US 521 & Red Venture Dr	C (B)	B (B)	A (A)	B (B)
US 521 & SC-160/Opportunity Dr	D (F)	C (E)	C (E)	C (C)
US 521 & Edgewater Parkway	C (C)	B (B)	A (B)	B (C)
US 521 & SC-29-54 (Marvin Road)	C (D)	C (D)	C (B)	C (C)
US 521 & Medical University of South Carolina	B (B)	B (B)	B (B)	B (B)
US 521 & Bridgemill Drive/Mason Creek Circle	B (A)	B (B)	B (A)	B (B)
US 521 & Possum Hollow Rd	F (F)	A (A)	B (B)	A (A)
US 521 & Sandal Brook Rd/Corporate Center Way	B (C)	A (B)	A (A)	A (B)
US 521 & Dobys Bridge Rd/Worldreach Dr	D (F)	C (D)	C (D)	C (D)
US 521 & River Rd/Collins Rd	F (D)	E (D)	C (B)	E (D)
US 521 & Ridgeline Ln/Shelley Mullis Rd	C (D)	C (D)	B (B)	C (D)
US 521 & Jenkins Dr/Shelley Mullis Dwy	B (A)	A (B)	B (A)	A (B)
US 521 & Del Webb Blvd	B (C)	C (C)	A (B)	C (C)
US 521 & Jim Wilson Rd	C (E)	C (D)	B (C)	C (D)
US 521 & Van Wyck Rd	C (C)	B (B)	B (B)	B (B)
US 521 & SC 75	B (C)	B (D)	B (C)	B (D)
US 521 & Witherspoon Dr	C (B)	C (B)	D (C)	C (B)

A comparison of the peak hour (PM) US 521 corridor performance for study alternatives is shown in **Table ES-3**.

Table ES-3 Peak Hour (PM) Corridor Performance

Measure of Effectiveness	Direction	2045 No-Build	2045 Alternative 1	2045 Alternative 2	2045 Alternative 3
Delay (seconds/vehicle)	Northbound	508	558	283	542
	Southbound	753	689	1053	653
Travel Time (minutes)	Northbound	18.3	19.1	14.4	17.0
	Southbound	23.0	21.6	29	22.2
Arterial Speed (mph)	Northbound	27	26	35	30
	Southbound	23	24	18	24

Note: All the above performance measures are for the section between SC state line to SC 75

For 2045 No-Build, US 521 ADT estimates range from 53,600 to 40,900 vpd.

For 2045 Build, US 521 ADT estimates range from 67,200 to 45,800 vpd.

Based on the capacity analysis results, four-lane US 521 is projected to experience traffic operational issues including failing level of service (LOS) and heavy queuing at multiple intersections. Widening US 521 to six lanes is projected to improve traffic operations and address queuing issues while serving approximately 26% additional traffic demand.

The lower-cost traditional widening alternative includes traditional intersections along US 521. The traditional configuration includes no restriction to the existing intersection movements. Traditional widening alternative is projected to address the operational issues at most intersections except the US 521

intersections at SC 160 and River Road/Collins Road. Additionally, significant queuing is projected at the intersection of US 521 and SC 160.

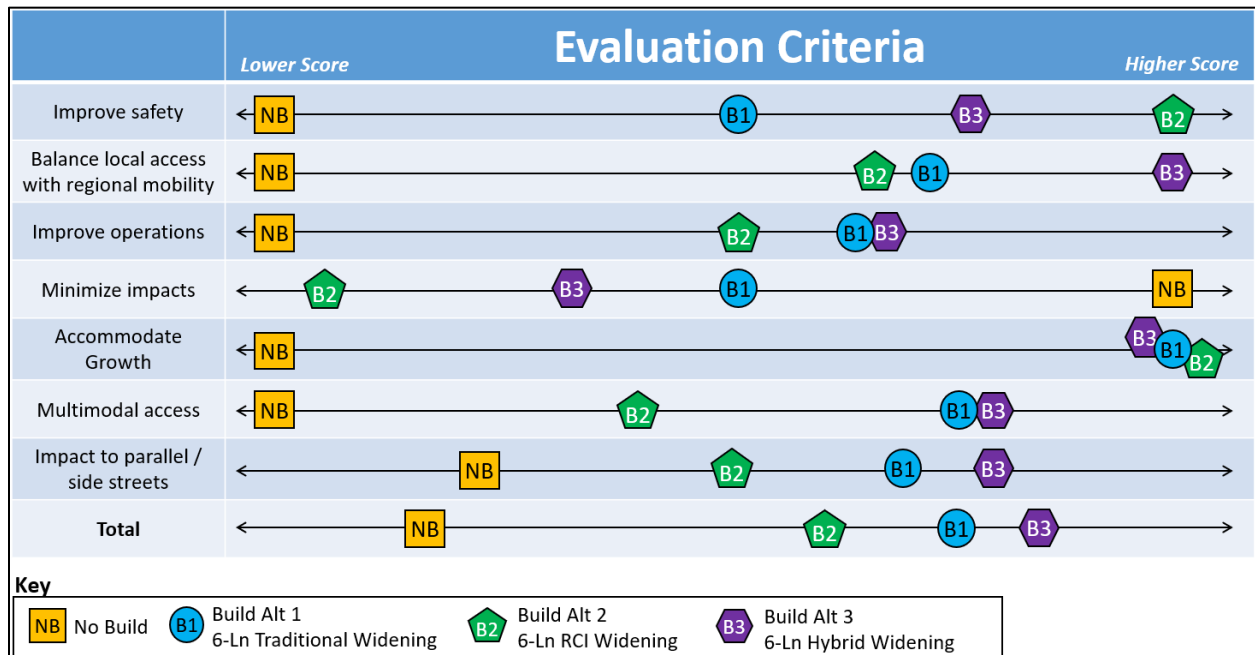
The higher-cost RCI widening alternative includes RCI intersections along US 521. Under the RCI configuration, cross street left turns and through movements are rerouted to make a right-turn and downstream U-turn. RCI widening alternative is projected to address the operational issues at all the intersections except the intersection at SC 160. However, in addition to the access restrictions/modifications along the corridor, this alternative presents design feasibility and intersection spacing challenges like inability to provide adequate storage length for specific turn lanes on US 521. Due to this, significant queuing is projected at the US 521 intersections at SC 160, Dobys Bridge Road, and River Road/Collins Road.

The medium-cost hybrid widening alternative includes traditional widening from the state line to north of Jim Wilson Road, with an exception at the intersection of US 521 and SC 160, and RCI widening from Jim Wilson Road to SC 75. At the US 521 and SC 160 intersection, an innovative design concept of Reverse RCI is incorporated to better accommodate the largest traffic movements north-south along US 521 and SC 160 to/from US 521 towards the state line. While similar to the RCI concept, the reverse RCI concept reroutes US 521 major street left turns and SC 160 cross street through movements to make U-turns downstream. The hybrid widening alternative is projected to address the operational issues at all the intersections except the intersection of US 521 and River Road/Collins Road.

The three US 521 widening alternatives support the project evaluation criteria in varying degrees to improve safety, balance local access with regional mobility, improve operations, minimize impacts to the corridor, accommodate future growth, accommodate multimodal access, and minimize impacts to parallel/side streets. An overall assessment of the No-Build and Build alternatives evaluation criteria is presented in **Figure ES-4**. The US 521 corridor study alternatives, designs and cost estimate information presented in this study can be used to advance local transportation planning, funding discussions, future engagement, corridor preservation, and SCDOT’s project development process.

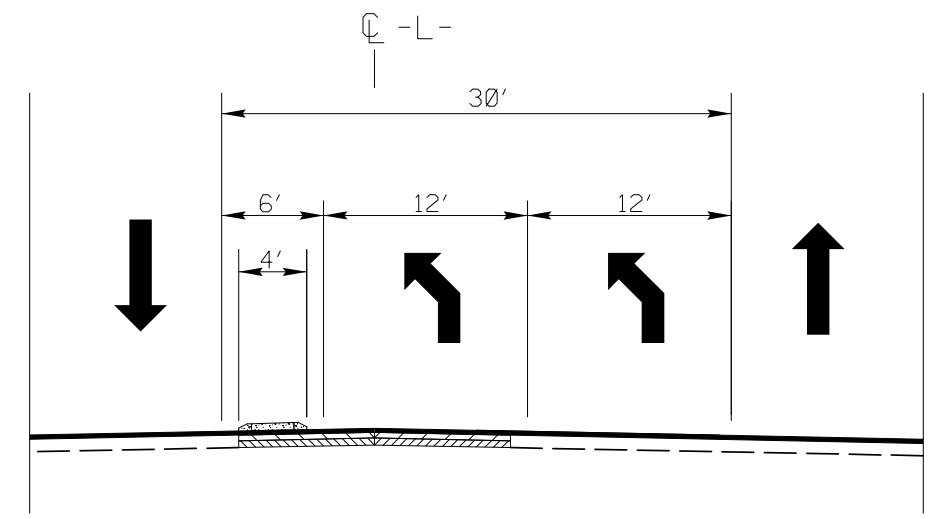
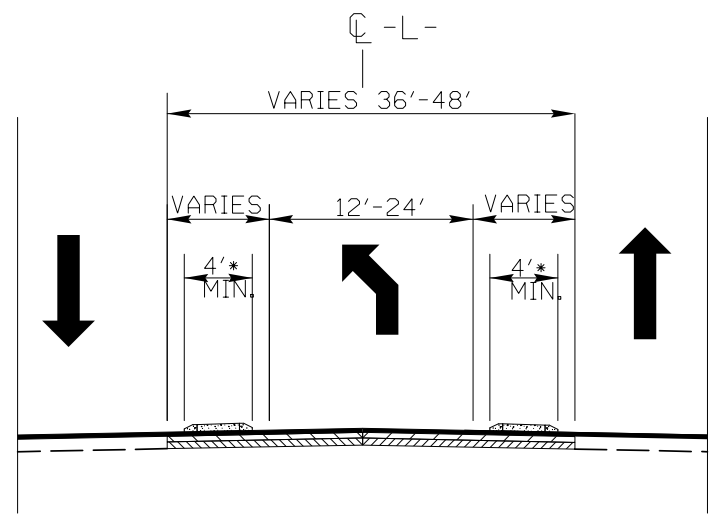
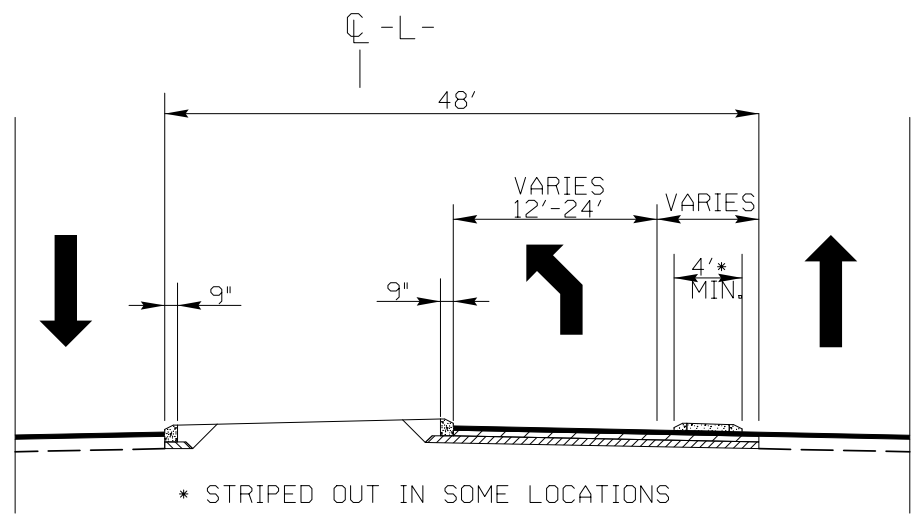
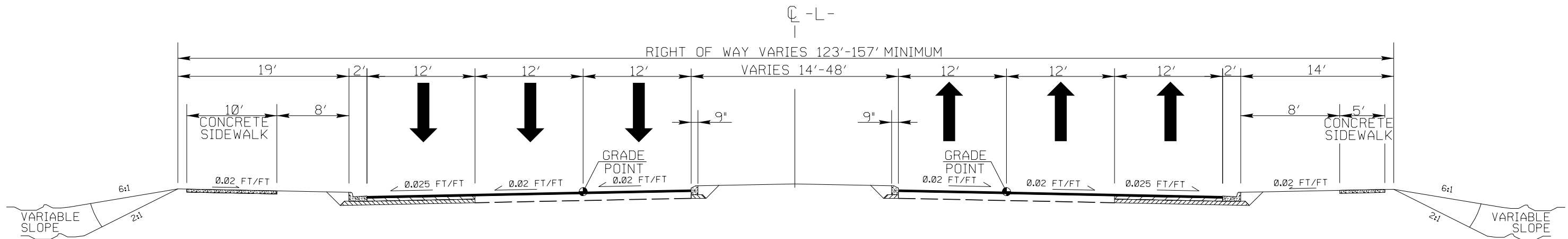
The concept layouts for all the build alternatives are included in **Appendix ES-A**.

Figure ES-4 – Alternative Assessment



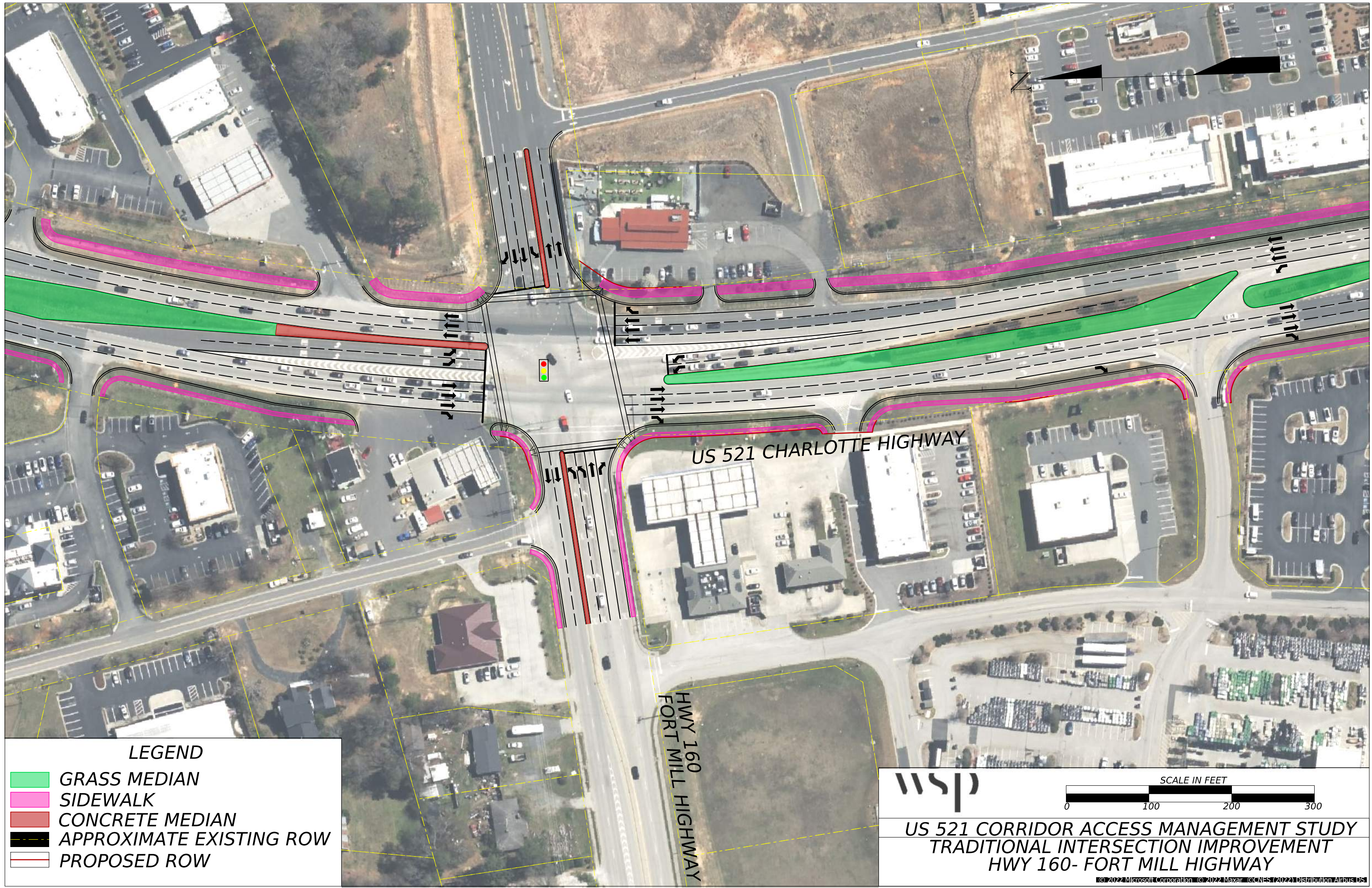
Appendix ES-A

Concept Layouts



Appendix **ES-A.1**

Alternative 1

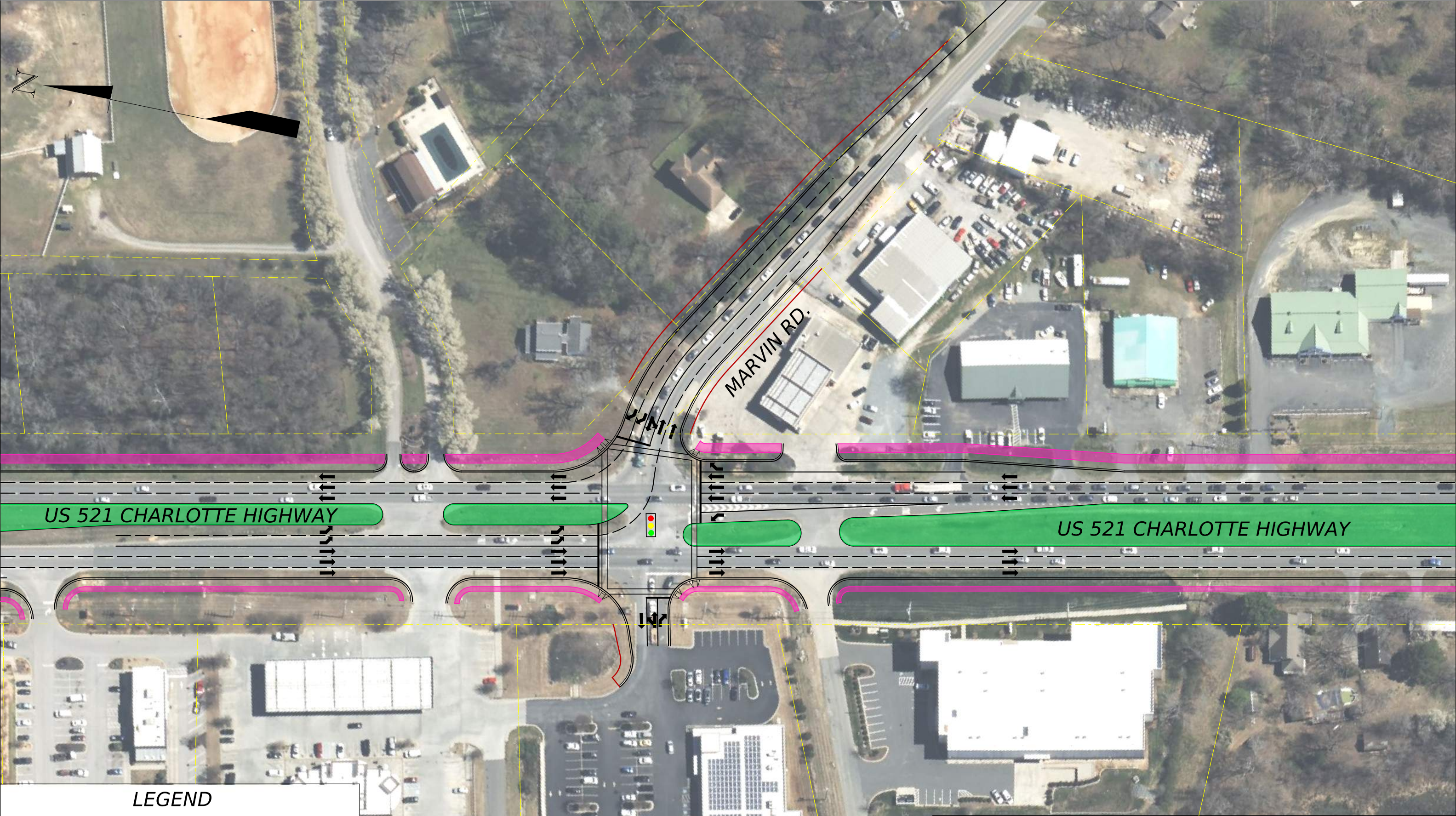


LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW



**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
TRADITIONAL INTERSECTION IMPROVEMENT
HWY 160- FORT MILL HIGHWAY**



LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW

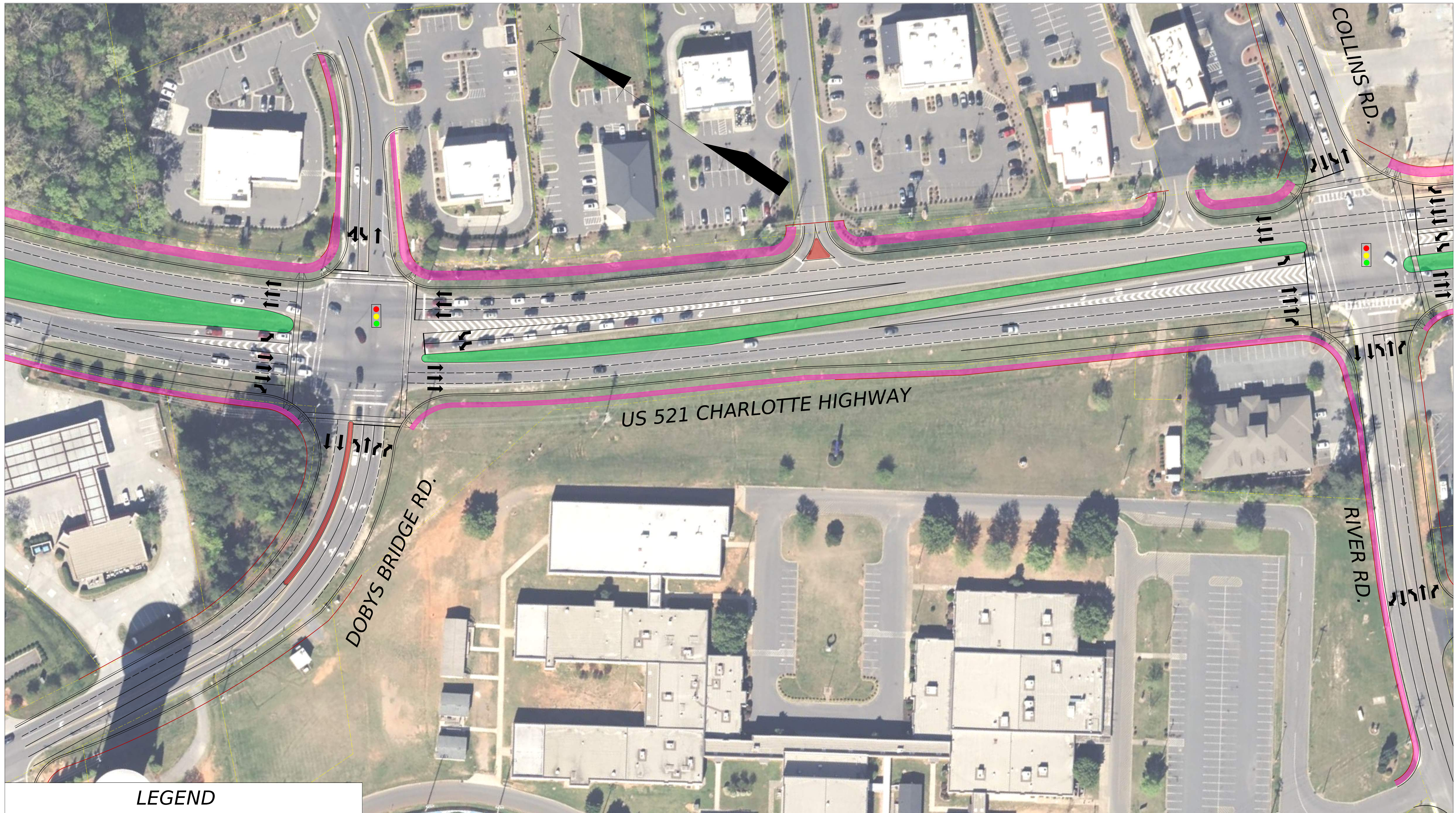
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**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
TRADITIONAL INTERSECTION IMPROVEMENT
MARVIN RD.**

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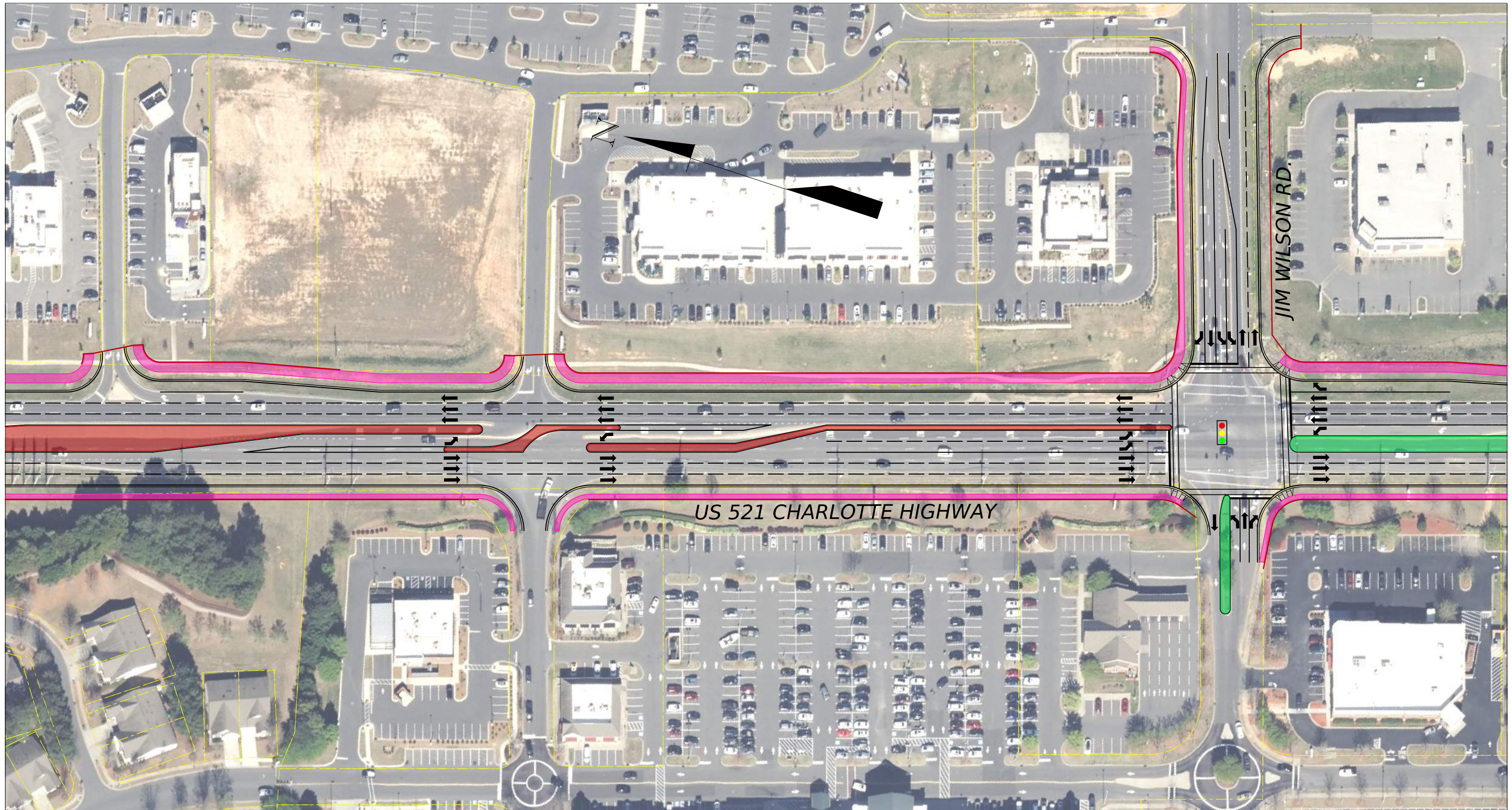
LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW

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SCALE IN FEET

**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
TRADITIONAL INTERSECTION IMPROVEMENT
DOBYS BRIDGE RD. & RIVERS RD.**



LEGEND

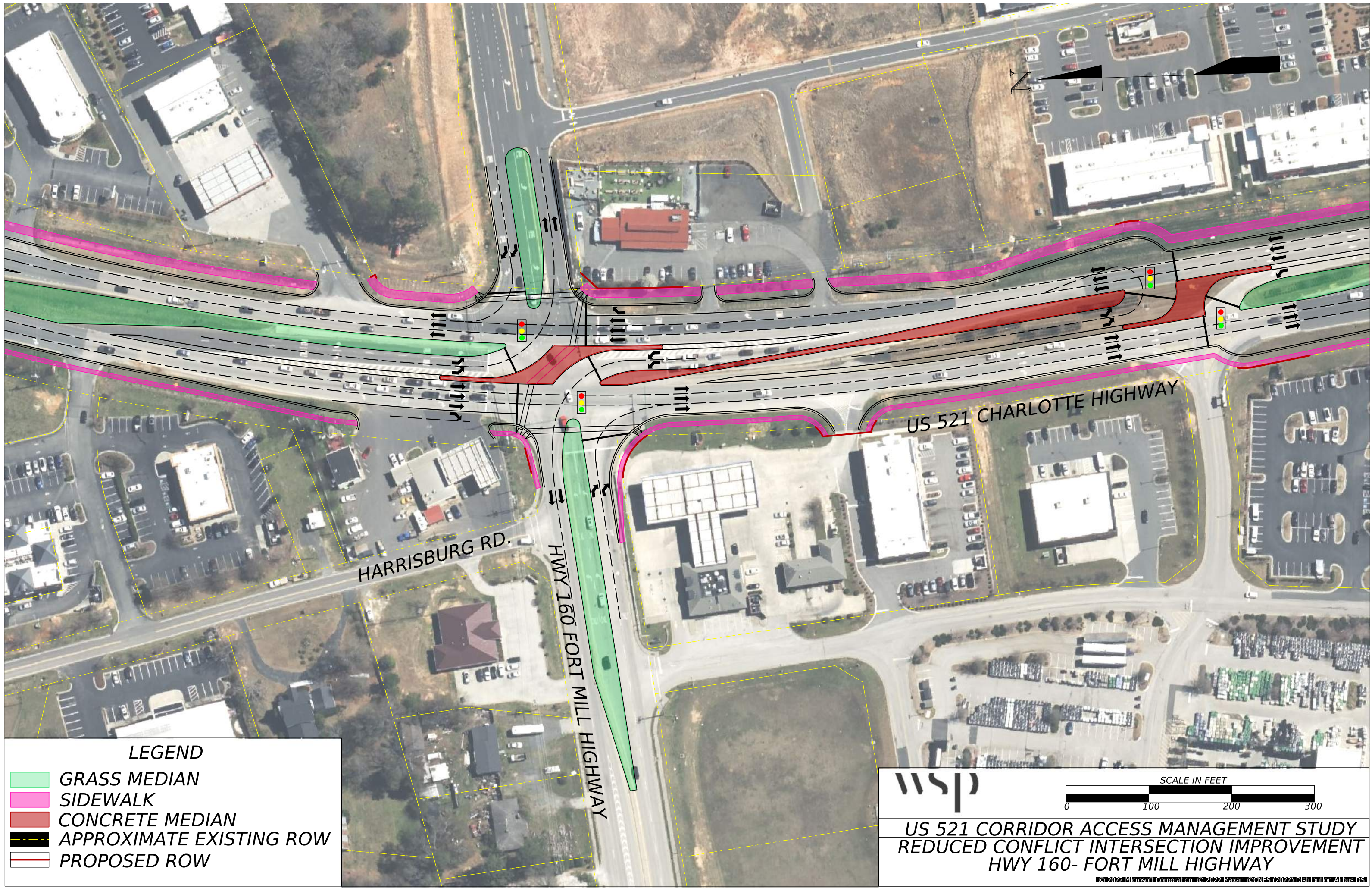
- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW



**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
TRADITIONAL INTERSECTION IMPROVEMENT
JIM WILSON RD.**

Appendix **ES-A.2**

Alternative 2

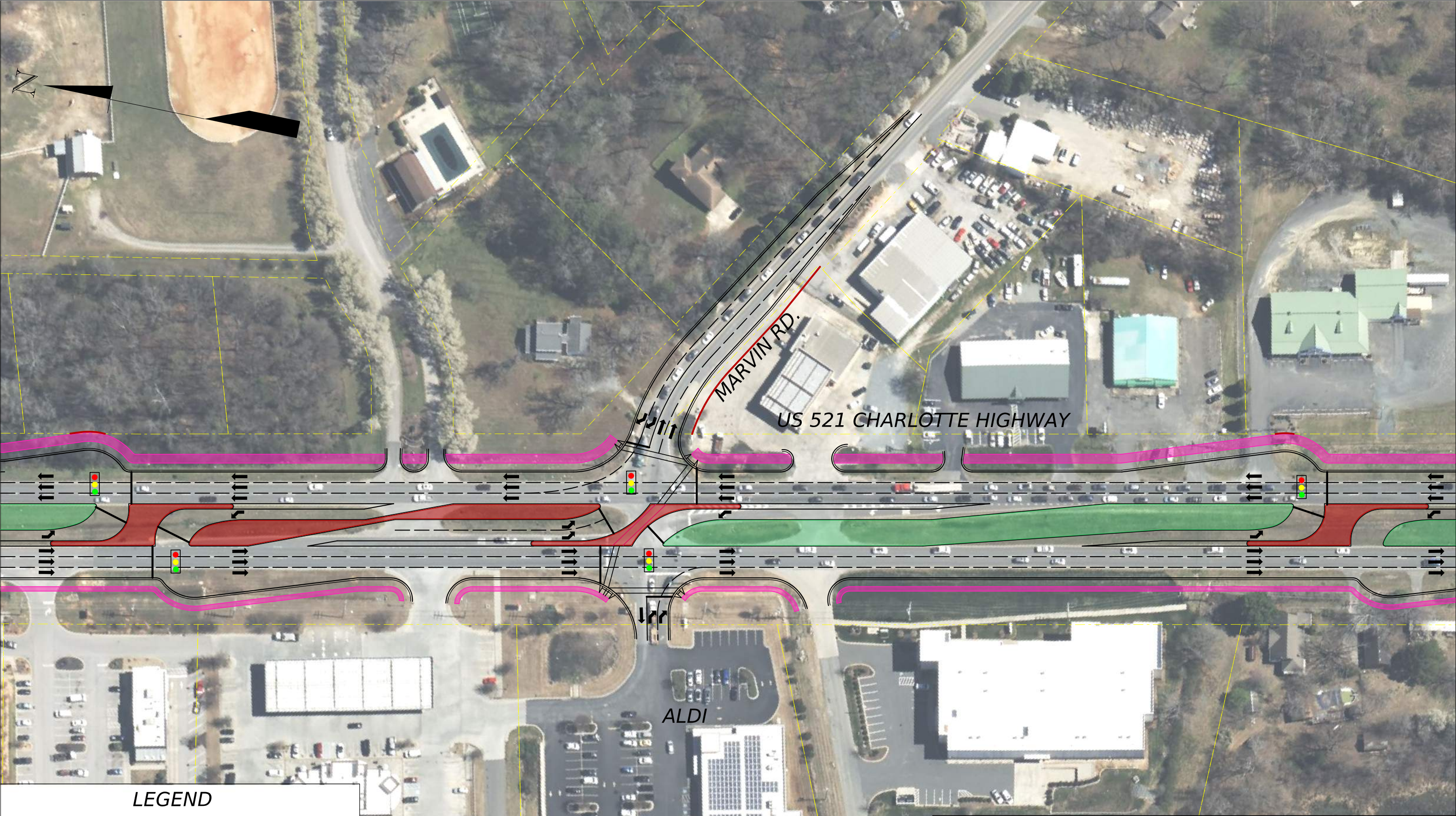


LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW



**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
 REDUCED CONFLICT INTERSECTION IMPROVEMENT
 HWY 160- FORT MILL HIGHWAY**



LEGEND

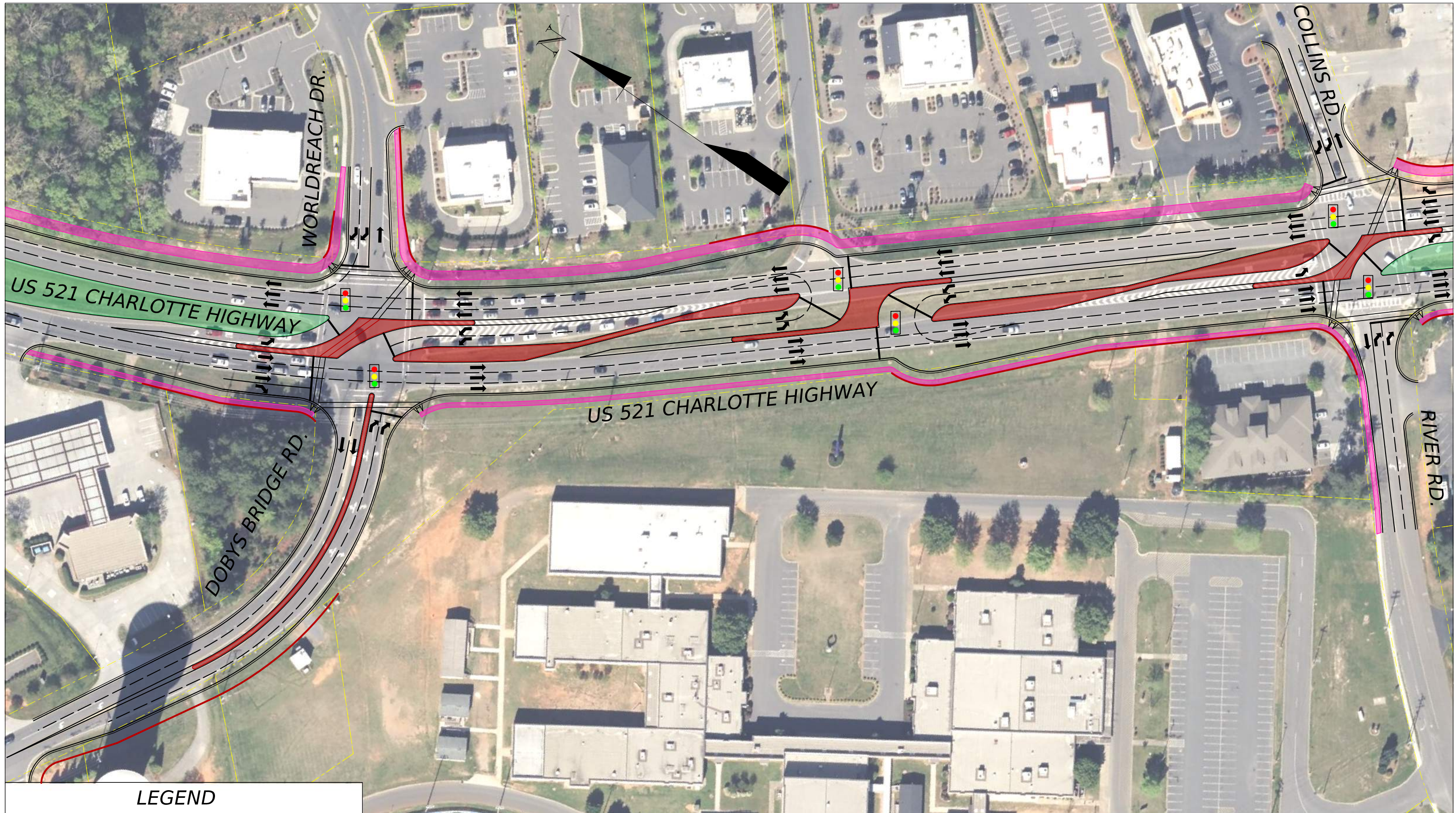
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- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW

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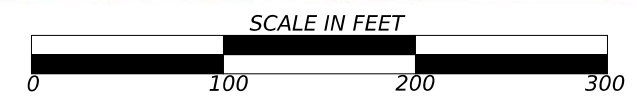
**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
 REDUCED CONFLICT INTERSECTION IMPROVEMENT
 MARVIN RD.**

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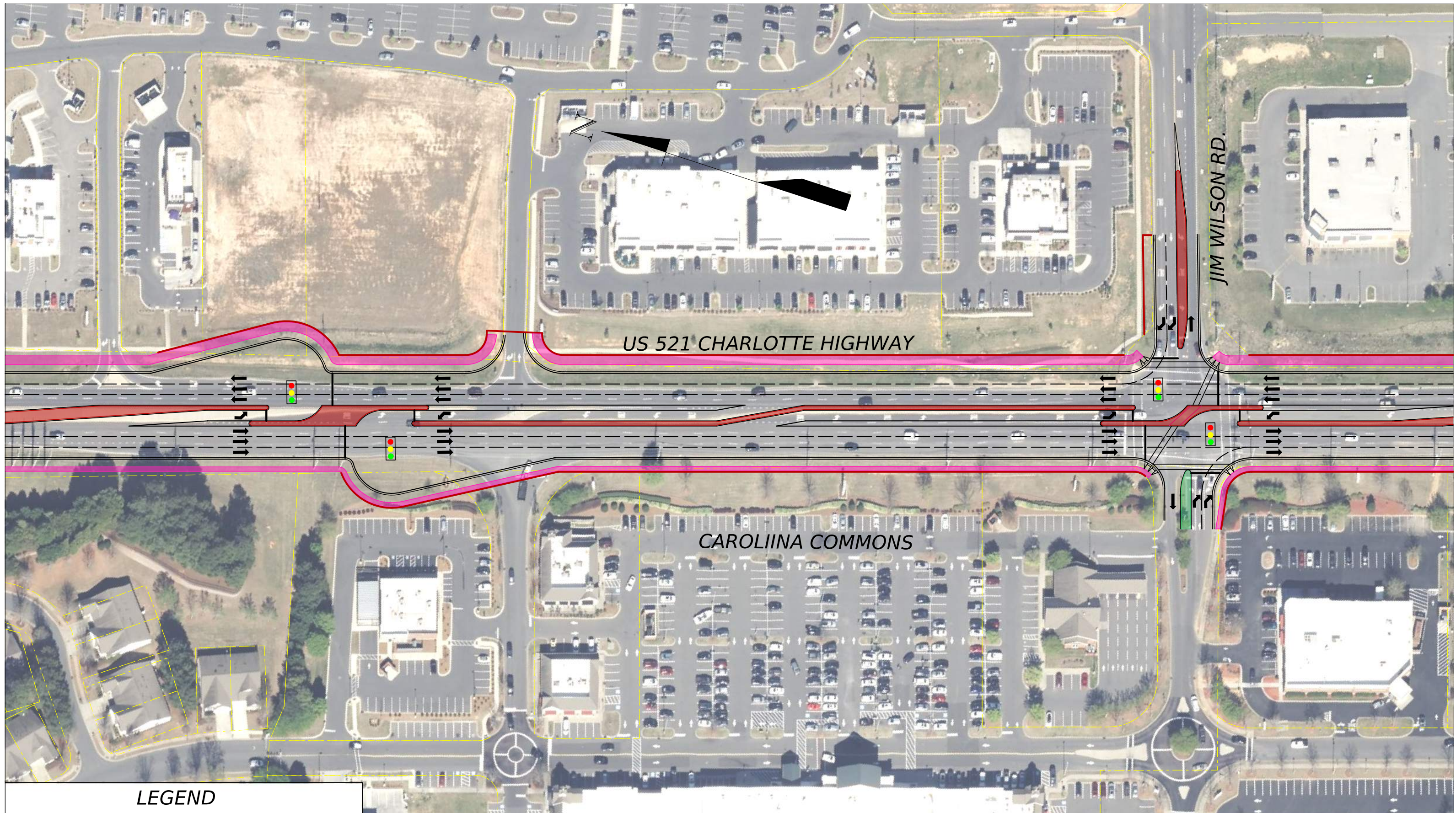


LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW



**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
REDUCED CONFLICT INTERSECTION IMPROVEMENT
DOBYS BRIDGE RD. & RIVERS RD.**



LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW

wsp

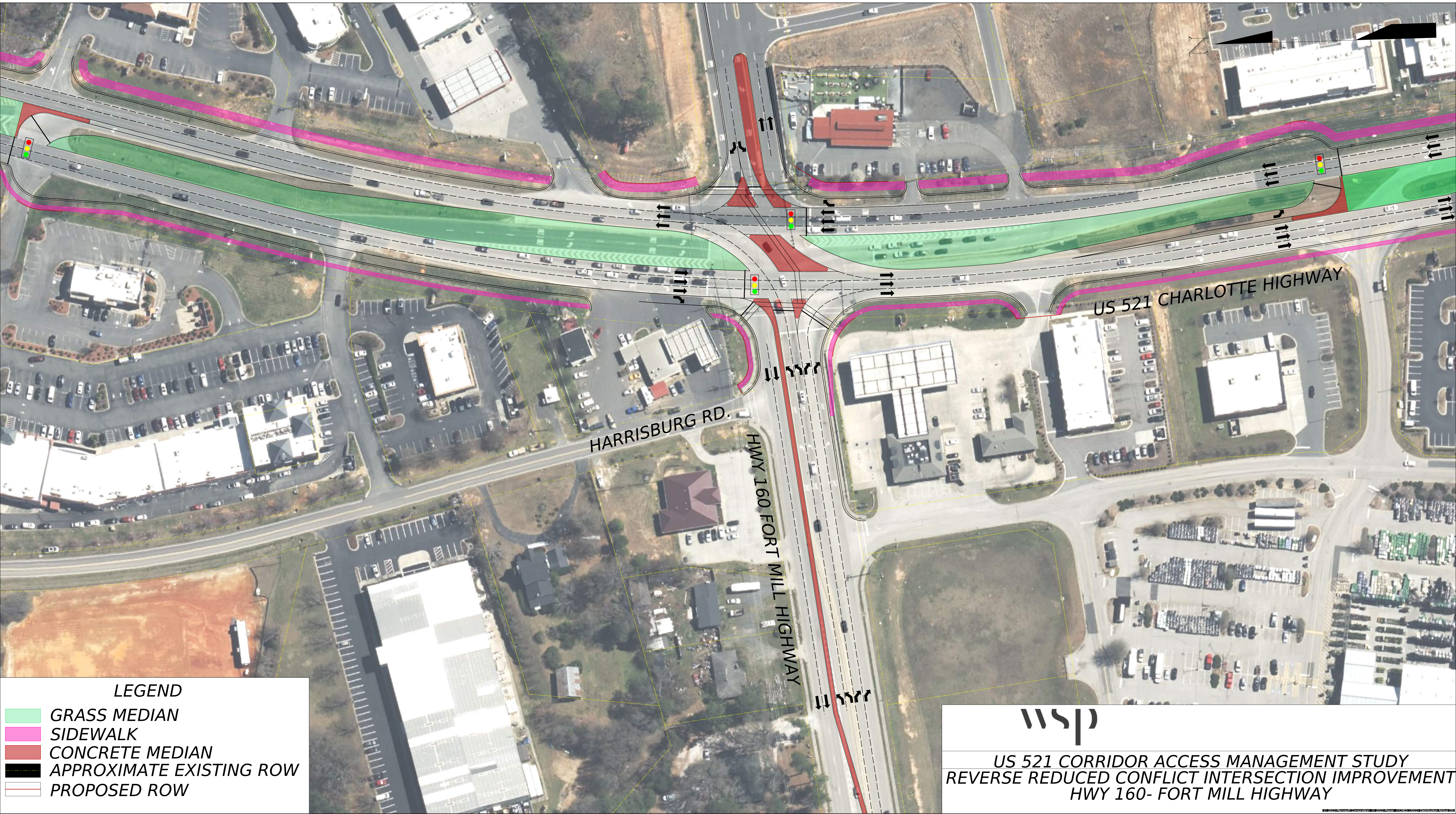
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**US 521 CORRIDOR ACCESS MANAGEMENT STUDY
 REDUCED CONFLICT INTERSECTION IMPROVEMENT
 JIM WILSON RD.**

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Appendix **ES-A.3**

Alternative 3



US 521 CHARLOTTE HIGHWAY

HARRISBURG RD.

HWY 160 FORT MILL HIGHWAY

LEGEND

- GRASS MEDIAN
- SIDEWALK
- CONCRETE MEDIAN
- APPROXIMATE EXISTING ROW
- PROPOSED ROW

wsp

US 521 CORRIDOR ACCESS MANAGEMENT STUDY
REVERSE REDUCED CONFLICT INTERSECTION IMPROVEMENT
HWY 160- FORT MILL HIGHWAY

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Appendix C	2022 ADT Counts
Appendix D	Signal Plans
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Appendix F	Synchro and SimTraffic Reports
Appendix G	Concept Layouts

INTRODUCTION

The Rock Hill-Fort Mill Area Transportation Study (RFATS), in collaboration with Lancaster County, has prepared a corridor study for US 521 from the North Carolina state line to the intersection of SC-75 (Waxhaw Highway). The purpose of this corridor study is to identify alternatives for US 521 that improve safety, mobility, and operations; are feasible considering right-of-way constraints; and are capable of handling anticipated future growth along the corridor.

The corridor has seen a large amount of growth over the last few years and is the main highway throughout the “Panhandle” providing access to health and education, residential, and commercial/employment sites. The corridor also serves as a main access to points north in Mecklenburg County, such as high employment areas in Ballantyne, and providing regional access to I-485. Expected future growth along the corridor, as well as in neighboring counties, will continue to add traffic to this corridor that will increase congestion and decrease travel time reliability.

The project team coordinated with RFATS and Lancaster County to identify the following three (3) corridor alternatives for evaluation and comparison for project identification and development:

- Alternative 1 – Traditional widening to six-lane median divided with conventional intersections.
- Alternative 2 – Reduced Conflict Intersection (RCI) widening to six-lane median divided with RCIs.
- Alternative 2 – Hybrid widening to six-lane median divided with conventional, RCI, and/or innovative intersections.

The base year and future year for the study are 2022 and 2045. This report discusses the following:

- Study area
- Data collection
- Existing conditions assessment
- Project alternatives
- Crash and safety analysis
- Traffic analysis
 - Existing conditions
 - Future year no-build conditions (US 521 as 4-lane roadway)
 - Future year build conditions (US 521 as 6-lane roadway)
- Conclusion

1.0 STUDY AREA

The study included a total of 17 intersections along an approximately 8.5-mile corridor. This includes 14 signalized and 3 unsignalized intersections under existing conditions. Additionally, the new Indian Land High School and signalized intersection at Witherspoon Drive, located approximately 0.9 miles south of the corridor study area limits, is a major traffic generator for the corridor and is included in the study. All study intersections and control type are listed below:

1. US 521 & Sandra Lane / Walmart – existing signal control
2. US 521 & Red Venture Drive – existing signal control
3. US 521 & SC-160 (Fort Mill Hwy) / Opportunity Drive – existing signal control
4. US 521 & Edgewater Parkway – existing signal control
5. US 521 & SC-29-54 (Marvin Road) – existing signal control
6. US 521 & Planned Medical University of South Carolina – existing TWSC.
7. US 521 & Bridgemill Drive / Mason Creek Circle – existing signal control
8. US 521 & Possum Hollow Road – existing TWSC.
9. US 521 & Sandal Brook Road / Corporate Center Way – existing signal control

10. US 521 & Dobys Bridge Road / Worldreach Drive – existing signal control
11. US 521 & River Road / Collins Road – existing signal control
12. US 521 & Ridgeline Lane / Shelley Mullis Road – existing signal control
13. US 521 & Jenkins Drive / Planned Shelley Mullis Residential Driveway – existing TWSC.
14. US 521 & Del Webb Boulevard – existing signal control
15. US 521 & Jim Wilson Road – existing signal control
16. US 521 & Van Wyck Road – existing signal control
17. US 521 & SC-75 (Waxhaw Highway) – existing signal control

Additional Intersection

18. US 521 & Witherspoon Drive – existing signal control

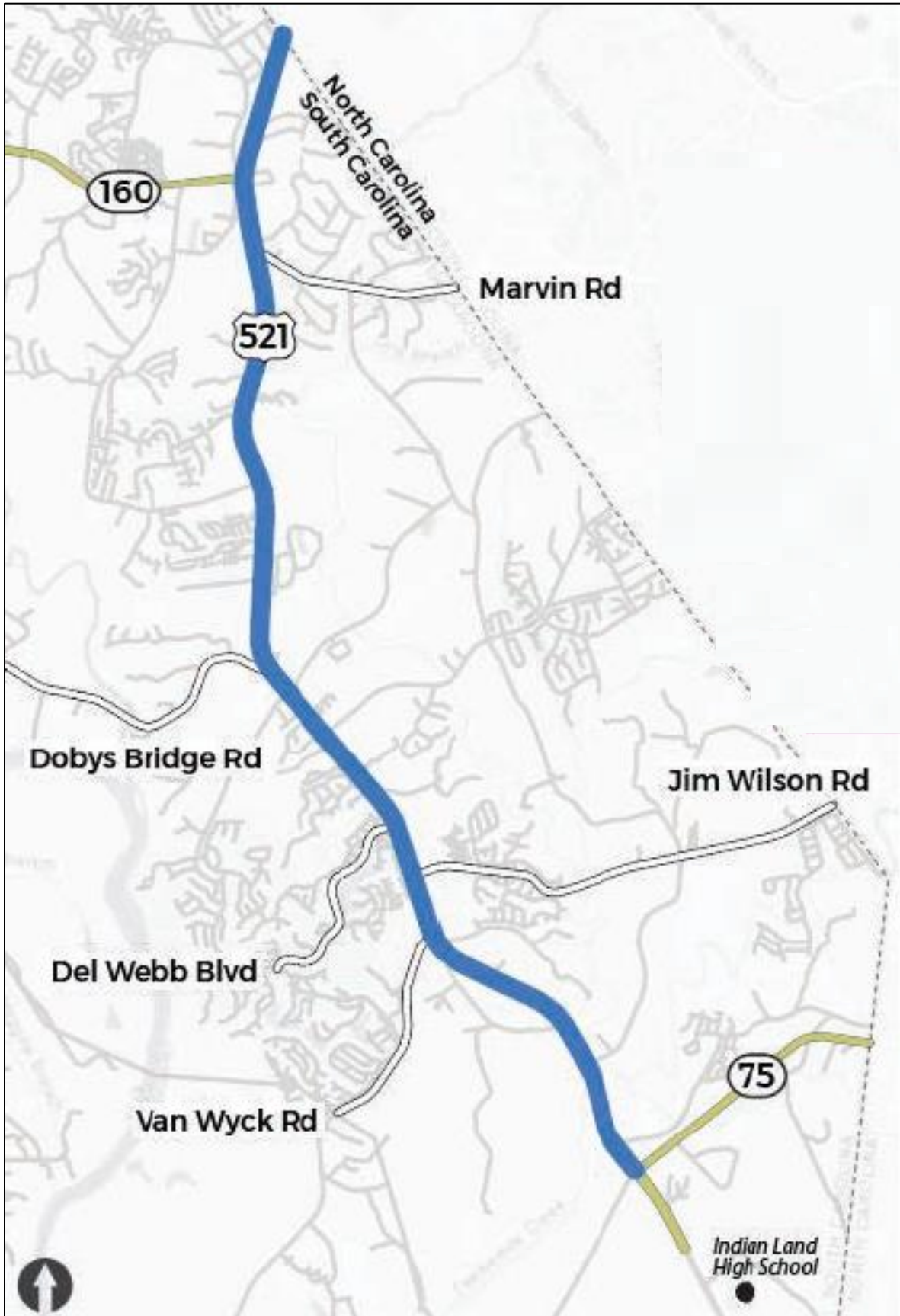
Figure 1 shows the study corridor limits and study intersections. The existing lane configuration at the study intersections, traffic control, and posted speed limits are shown in **Figure 2** included in **Appendix A**.

US 521, in the study area is a north-south four-lane divided principal arterial. The posted speed limit in this area varies between 45 mph and 55 mph. The US 521 section between Dobys Bridge Road/Worldreach Drive and River Road/Collins Road has a speed limit of 35 mph. The area is identified to be transitioning from an urban type on the north to a rural type towards the south (Waxhaw Highway) with a mixed land use including several residential, retail, recreational, and commercial stores. Indian Land Elementary School and Indian Land Middle School are located just west of US 521 between Dobys Bridge Road and River Road. Indian Land High School is located just east of US 521 on the southern end of the study area. A summary of the side street characteristics in the study area is shown in **Table 1**.

Table 1 Side Street Characteristics

Side Street	Classification	Speed Limit	Other
Sandra Ln / Walmart	NA	15 mph	2-lane road
Red Venture Dr	NA	25 mph	2-lane road
SC-160	Urban - Principal Arterial - Other	45 mph	4-lane road
Edgewater Parkway	NA	25 mph	2-lane road
SC-29-54 (Marvin Road)	Urban - Major Collector	35 mph	2-lane road
Medical University of South Carolina	NA	25 mph	2-lane road
Bridgemill Drive / Mason Creek Circle	NA	25 mph	2-lane road
Possum Hollow Rd	Urban - Major Collector	35 mph	2-lane road
Sandal Brook Rd / Corporate Center Way	NA	35 mph	2-lane road
Dobys Bridge Rd	Urban - Major Collector	35 mph	2-lane road
River Rd / Collins Rd	Rural - Major Collector	35 mph	2-lane road
Shelley Mullis Rd	Rural - Major Collector	45 mph	2-lane road
Jenkins Dr	NA	15 mph	2-lane road
Del Webb Blvd	NA	25 mph	2-lane road
Jim Wilson Rd	Urban - Major Collector	35 mph	2-lane road
Van Wyck Rd	Urban - Major Collector	35 mph	2-lane road
SC 75	Rural - Minor Arterial	55 mph	2-lane road
Witherspoon Dr	NA	10 mph	2-lane road

Figure 1 - Study Area Map



2.0 DATA COLLECTION

As a part of this corridor study, the project team gathered the following information for review and evaluation to assist in developing improvement recommendations:

- Historic Annual Average Daily Traffic (AADT)
- Existing Traffic Counts
 - 2022 AM and PM peak hour turning movement counts.
 - 2022 mainline 48-hour vehicle classification counts.
- Traffic signal plans and timing plans
- Background roadway projects and developments
- Previous studies in the study area
- Planning data
 - Existing and future transportation plans, land use plans, small area plans,
 - Metrolina Regional Model (MRM)

2.1 Historic AADT

Using the SCDOT traffic counts data portal, historic AADT in the study area was collected to review the growth trend in traffic and identify a suitable growth rate for the area. **Table 2** summarizes the historic AADT collected in this study.

Table 2 Historic AADT

Station ID	Location Description	AADT						
		2015	2016	2017	2018	2019	2020	2021
128	US 521 between State Line & SC 160	37,700	37,700	37,800	38,900	39,700	36,800	38,900
126	US 521 between SC 160 & Shelly Mullis Rd	25,700	26,100	26,900	27,700	32,000	29,700	32,100
124	US 521 between Shelly Mullis Rd & SC 75	14,400	14,300	15,900	16,300	19,500	18,100	21,400

2.2 2021 Traffic counts

Peak Hour Turning Movement Counts

The project team collected the AM (7-9 AM) and PM (4-6 PM) peak period TMC on a typical weekday at all the study intersections on May 10, 2022. The peak hour counts included all the vehicles as well as the pedestrians crossing at the study intersections. **Figure 3** in **Appendix A** shows the 2020 Base Year existing volumes for the AM and PM peak hours. The 4-hour raw counts are provided in **Appendix B**.

48-hour Classification Counts

The project team collected the 48-hour counts at 3 locations on US 521 and 6 locations on major side streets in the study area during typical weekdays in May 2022. These counts included vehicle classification by direction. A summary of this data is shown in **Table 3**. The 48-hour counts are included in **Appendix C**.

Table 3 ADT Data Summary

ID	Location Description	2022 ADT (vpd)	2022 ADT (vpd)	
			Direction 1	Direction 2
1	US 521 north of Red Ventures Dr	42,564	21,596	20,968
2	US 521 south of Fisher Ln	34,577	17,176	17,401
3	US 521 north of Harris Rd	23,114	11,516	11,598
4	SC 160	21,472	11,091	10,381
5	Marvin Rd	12,846	6,282	6,564
6	Dobys Bridge Rd	12,618	6,618	6,000
7	Shelly Mullis Rd	7,214	3,602	3,612
8	Jim Wilson Rd	11,172	5,626	5,546
9	SC 75 (Waxhaw Hwy)	6,531	3,258	3,273

Note: For IDs 1 through 3, Direction 1 is northbound, and Direction 2 is southbound.
For IDs 4 through 9, Direction 1 is eastbound, and Direction 2 is westbound.

2.3 Traffic Signal and Timing Plans

SCDOT provided the latest traffic signal and timing plans for all the signalized intersections in the study area. These plans are included in **Appendix D**.

2.4 Background Roadway Projects and Developments

The background projects include any funded roadway projects and approved developments in the study influence area. RFATS provided this information including the design plans and site plans as available. All the associated changes to the lane configuration at the study intersections are applied from all the background projects.

The following are the planned roadway projects in the study area:

Project ID: P027277

- Intersection of US 521 & Marvin Road
 - Addition of southbound left turn lane to provide dual lefts.
 - Addition of 2 westbound right turn lanes.
 - Extension of westbound shared left/through lane.
 - Extension of northbound left turn lane.
- Intersection of US 521 & Bridgemill Drive
 - Addition of 1 northbound right turn lane.

The following planned developments were reviewed and incorporated in this study:

- Goodwill Discount Store
 - Located east of US 521, approximately 1000' north of Ridgeline Lane / Shelly Mullis Rd
 - 2022 build-out year
 - 2.8% annual growth rate was used for the future year background traffic projections.
 - No proposed improvements in the TIA
- Tadlock Residential (Apartments) Development
 - Located west of US 521, near Tadlock Drive, north of Dobys Bridge Road
 - 2024 build-out year
 - 238 multi-family housing mid-rise (apartments)
 - 4% annual growth rate was used for the future year background traffic projections.

- Proposed improvements in the TIA are included in the study (at US 521 / Dobys Bridge Road intersection)
- Ansley Tract Commercial and Townhouses
 - Located east of US 521, near Six Mile Creek Apartments access.
 - 2023 build-out year
 - 2% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA are included in the study (at US 521 / Bridgemill Drive intersection)
- Medical University of South Carolina – Phases 1, 2, and 3
 - Located east of US 521 between Thousand Oaks Road and Bridgemill Drive
 - 2022 build-out (Phase 1); 2024 build-out (Phase 2); and 2027 build-out (Phase 3)
 - 2% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA are included in the study (at US 521 / proposed Site Driveway, US 521 / SC 160, US 521 / Marvin Road, and US 521 / Possum Hollow Road intersections)
- Pedcor Residential (Multi-family)
 - Located west of US 521 just north of Thousand Oaks Road
 - 2025 build-out year
 - 3% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA do not affect the current study intersections.
- Harris Mill Residential
 - Located east of US 521 in the northeast and northwest quadrants of Jim Wilson Road and Marvin Road intersection.
 - 2023 build-out year
 - 3.5% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA are included in the study (at US 521 / Jim Wilson Road intersection)
- Widewaters Mixed Use
 - Located east of US 521 just south of Shelley Mullis Road
 - 2026 build-out year
 - 3.5% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA are included in the study (at US 521 / Ridgeline Lane / Shelley Mullis Road and US 521 / Jenkins Drive intersections)
- Wilson Creek Residential
 - Located east of US 521 just west of Henry Harris Road
 - Recreational vehicle sales and service
 - 2% annual growth rate was used for the future year background traffic projections.
 - Proposed improvements in the TIA do not affect the current study intersections.
- CrossRidge Center
 - Located east of US 521 just north of Worldreach Drive
 - 2023 build-out year
 - 3-acres of development to include YMCA, business hotel, retail, and office
 - Proposed improvements are included in the study (at Dobys Bridge Road/Worldreach Drive intersection)

Other roadway improvements in the study area as provided by SCDOT District 4 Office include:

- Intersection of US 521 & Van Wyck Road
 - Addition of 1 southbound right turn lane
 - Reconfiguration of the eastbound approach to provide 1 exclusive left, 1 shared left-through, and 1 exclusive right turn lane.
- Intersection of US 521 & Shelly Mullis Road

- Reconfiguration of the eastbound approach to provide 1 exclusive left and 1 shared through-right lane.
- Reconfiguration of the westbound approach to provide 1 exclusive left, 1 through, and 1 exclusive right turn lane.
- Intersection of US 521 & Dell Webb Road
 - Provide dual eastbound left turn lanes.

All the roadway improvements as part of the background developments are shown in **Figure 4** included in **Appendix A**.

2.5 Planning data

RFATS provided the future transportation plans, land use plans, small area plans, and regional planning model – Metrolina Regional Model (MRM). The following plans and data were reviewed by the project team to assess the existing and future conditions of the study corridor:

- 2050 Long Range Transportation Plan
- RFATS Collector Street Network Plan
- RFATS Bike & Pedestrian Connectivity Plan
- Lancaster County 2014 Comprehensive Plan
- Lancaster County 2040 Comprehensive Plan
- Lancaster County Unified Development Ordinance
- Southern Panhandle Small Area Plan
- Carolina Thread Trail Master Plan for Lancaster County Communities
- Metrolina Regional Model

3.0 EXISTING CONDITIONS ASSESSMENT

The existing conditions assessment is essential to understand the nature and extent of traffic congestion (i.e., its intensity, duration, and recurring / non-recurring causes, etc.) along the corridor. This study evaluated the basic physical layout of this area by looking at the existing land use as well as the socio-economic growth that has occurred in the past 10 and 20-year periods. The study utilized the MRM to outline the volume-to-capacity ratios and AADT projections along the corridor. This MRM analysis informs the transportation analysis relative to capacity and network design including areas of potential land use change. The study also reviewed the current Lancaster County Comprehensive Plan and development plans along the corridor for evaluating growth and potential new connections (intersections and driveways) along US 521.

The following study area assessment figures / maps were prepared:

- Adjacent Developments
 - **Figure 5** shows the residential developments in the study area.
 - **Figure 6** shows the commercial developments in the study area.
- 2018 Employment per TAZ
 - **Figure 7** shows the employment growth in the study area.
- 2018 Population per TAZ
 - **Figure 8** shows the population growth in the study area.
- Daily Traffic projections from MRM
 - **Figure 9** shows the 2045 AADT in the study area.
- Volume to capacity (v/c) ratios from MRM
 - **Figure 10** shows the 2045 v/c in the study area.

Additionally, the following data was reviewed as a part of the existing conditions assessment:

- Southern Panhandle Small Area Plan
 - Existing Land Use Map
 - Future Land Use Map
- RFATS Collector Street Plan

Figure 5 – Existing Residential Developments

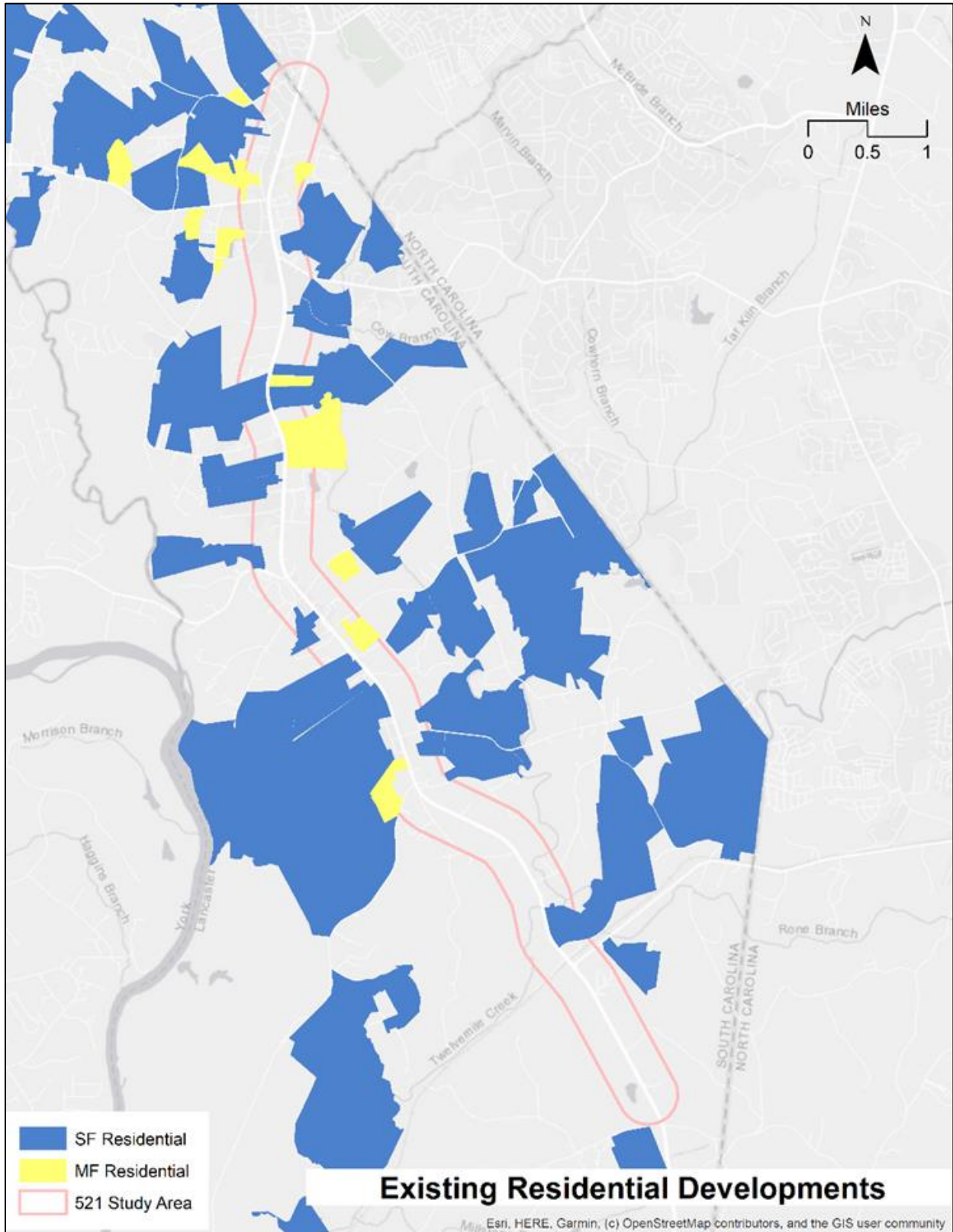


Figure 6 – Existing Commercial Developments

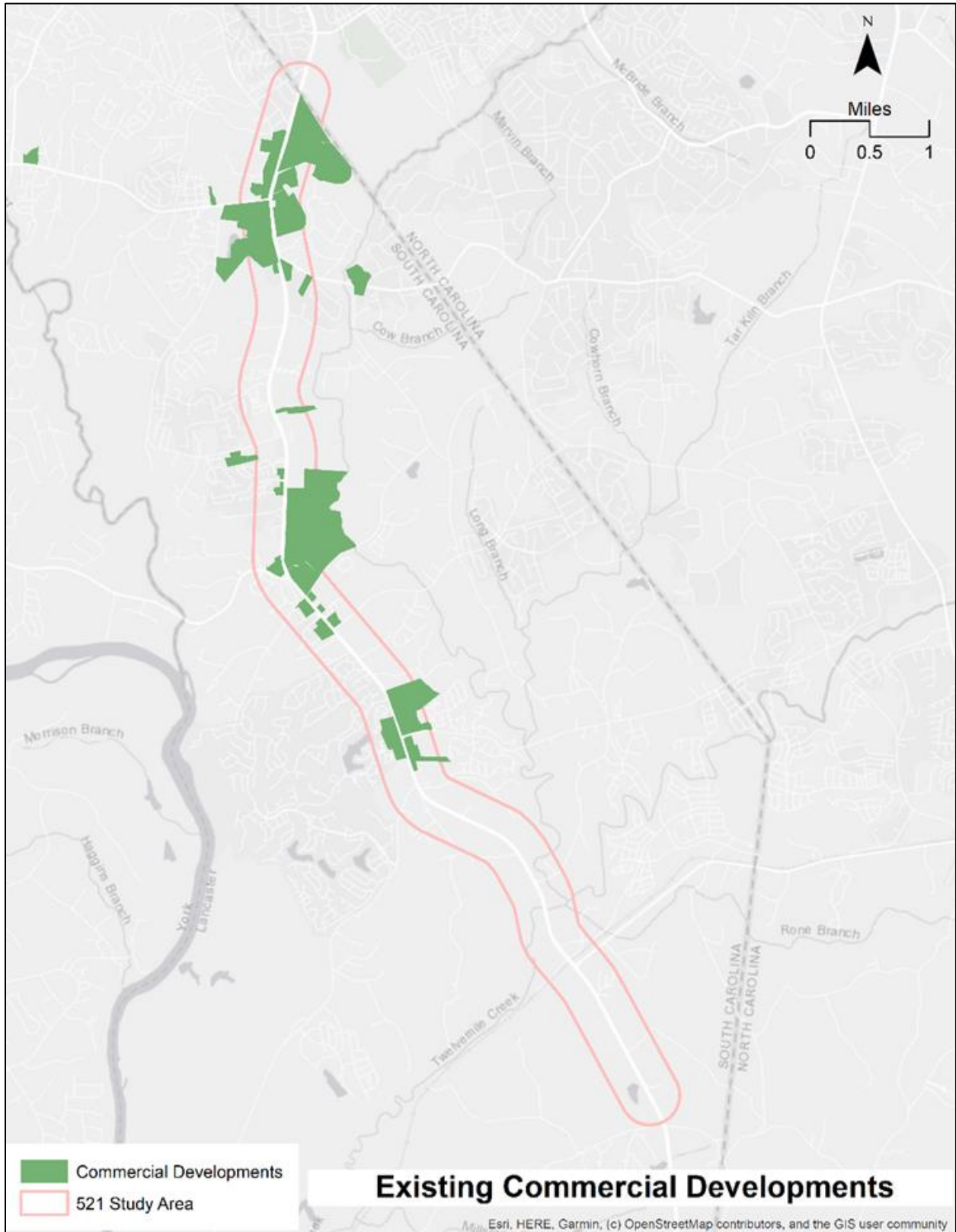


Figure 7 – Population Growth

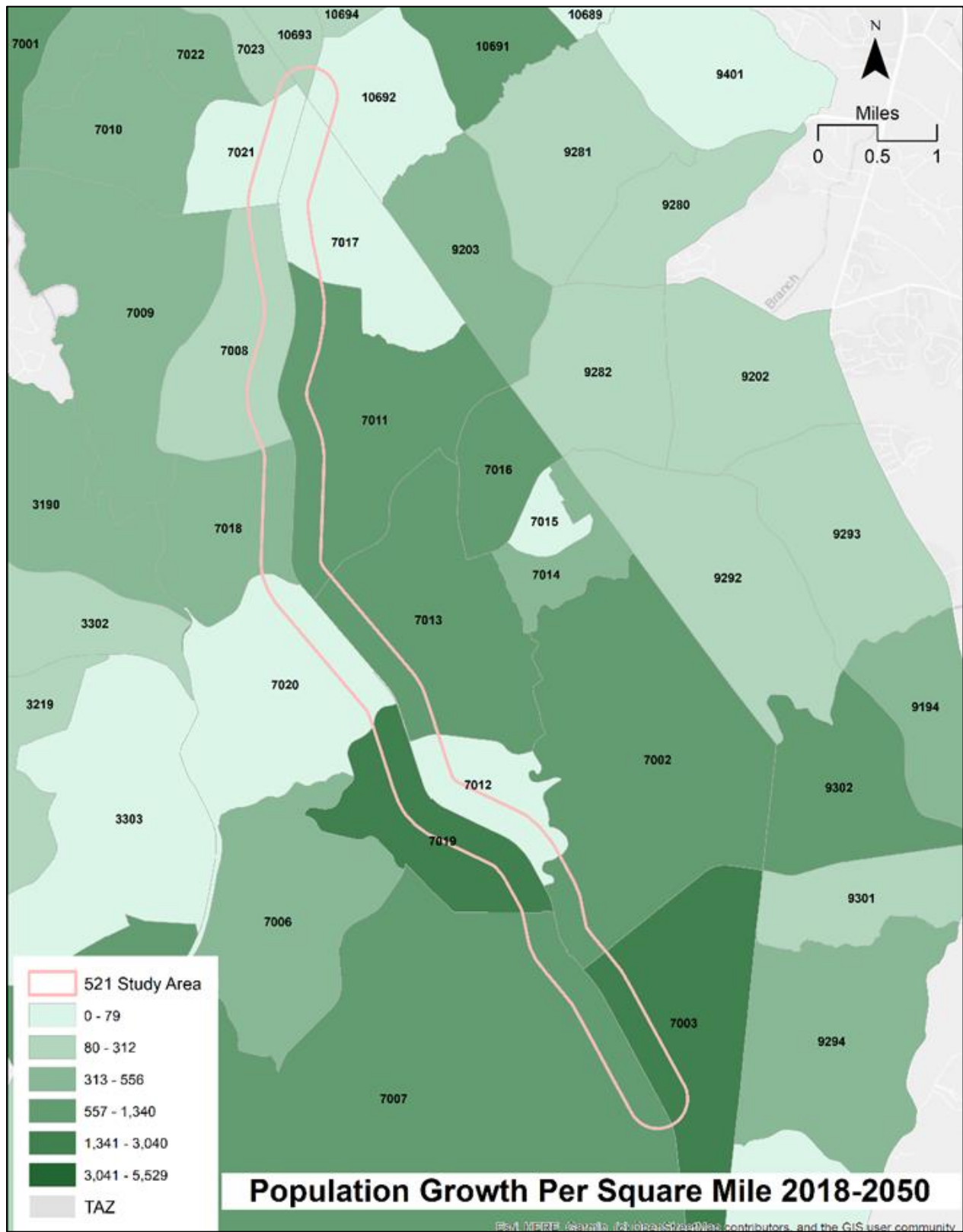


Figure 8 – Employment Growth

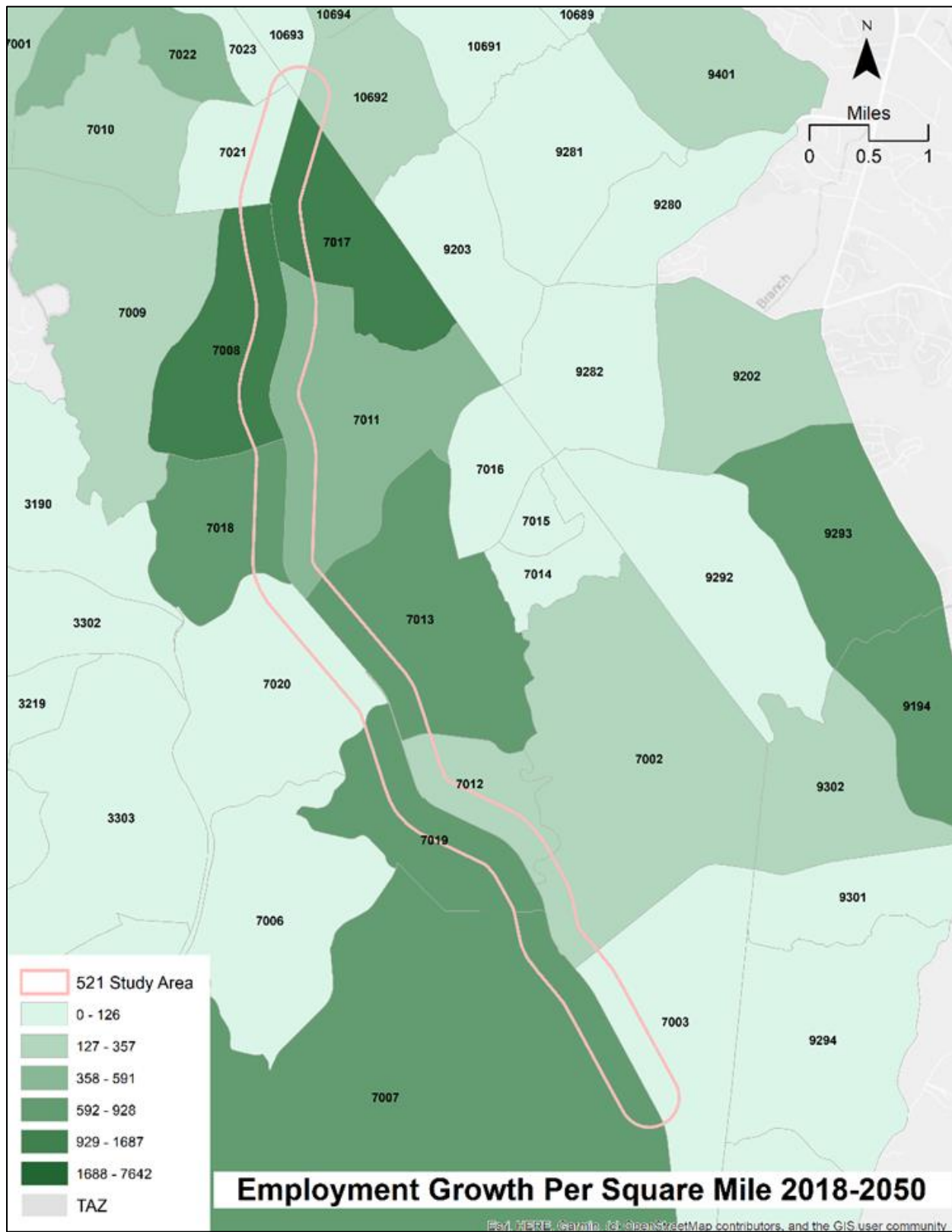


Figure 9 – MRM 2045 AADT

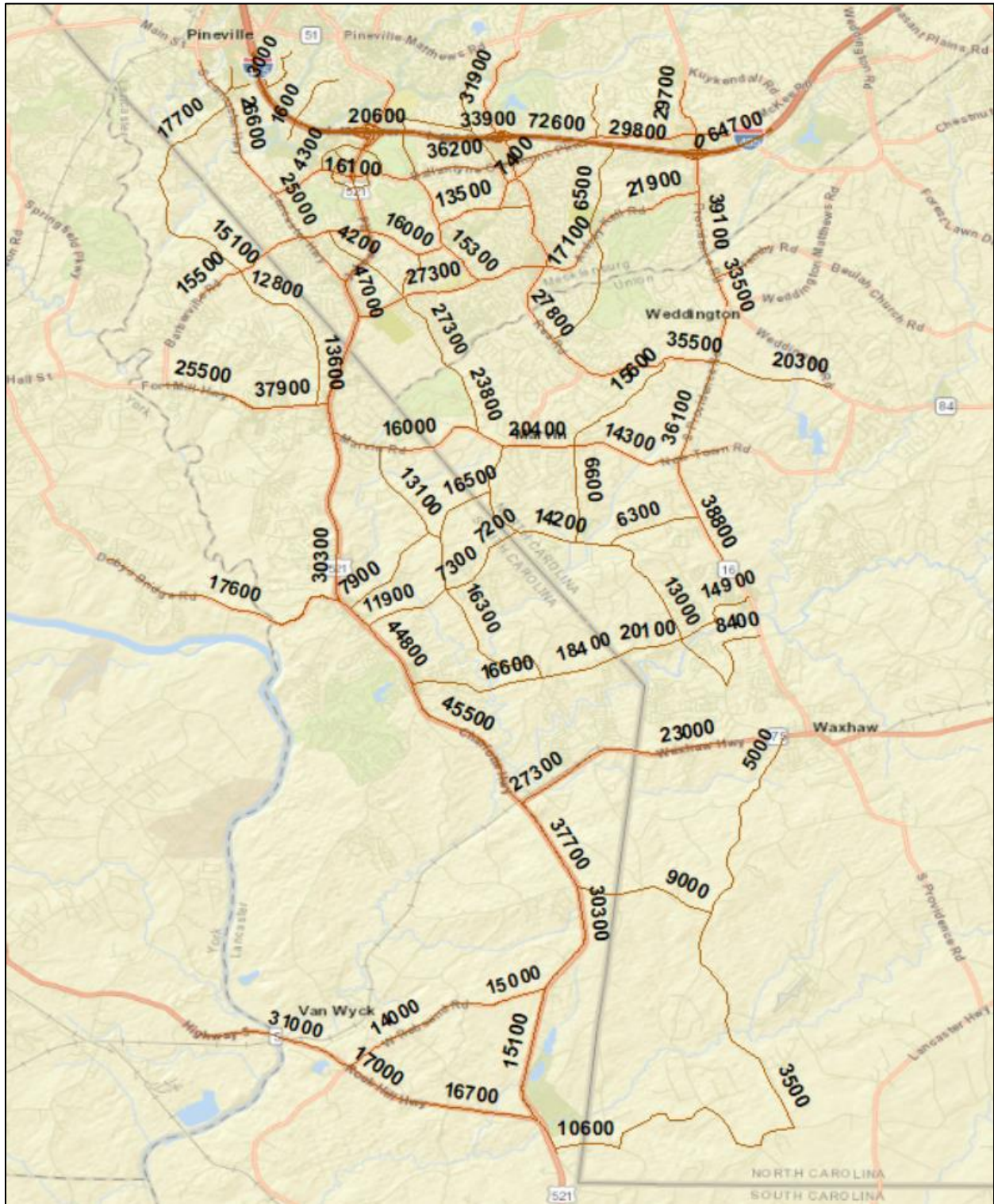
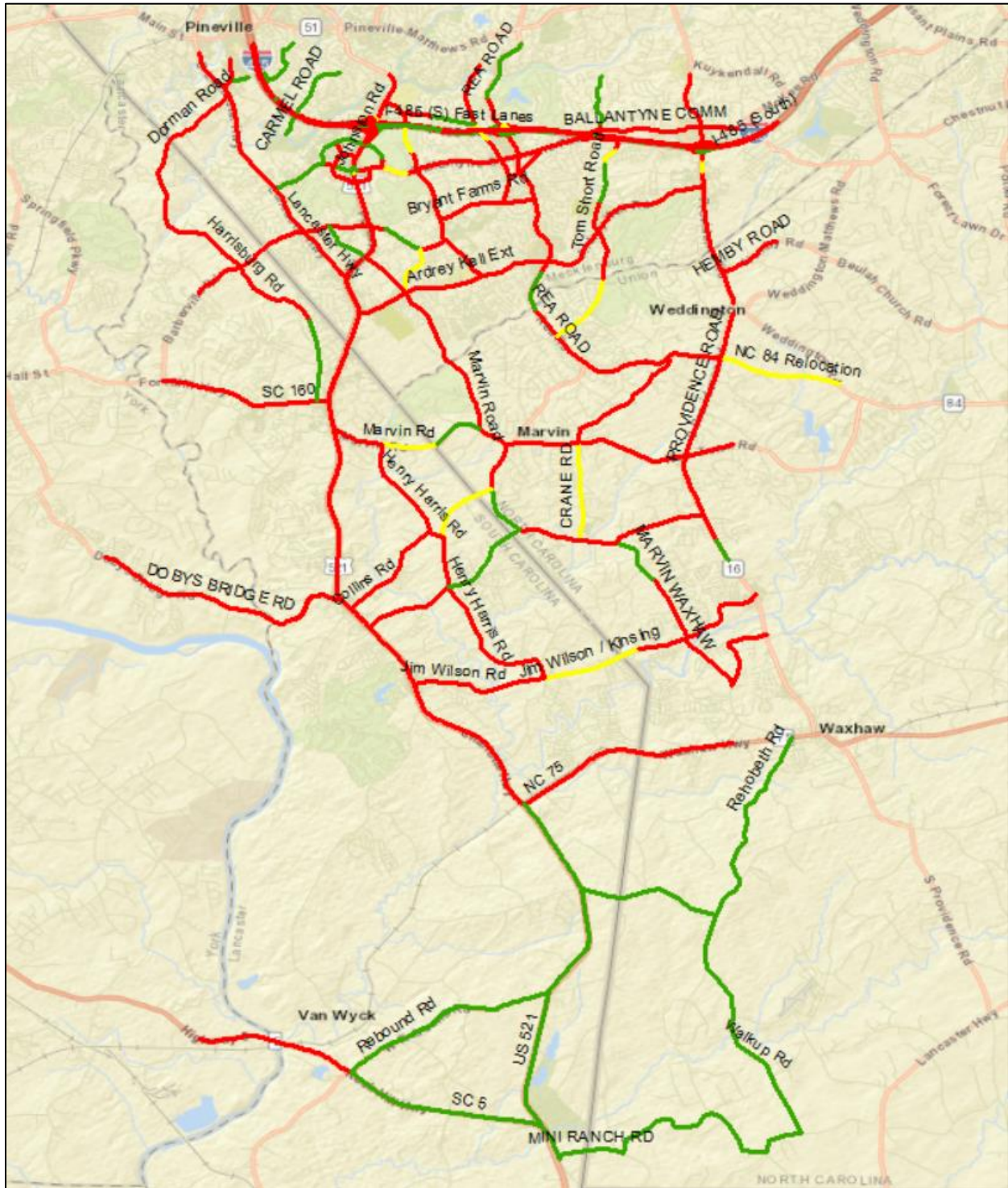


Figure 10 – MRM 2045 V/C with 4-lane US 521



4.0 CRASH AND SAFETY ANALYSIS

SCDOT provided the most current 3-year (2019-2021) crash data within the study area. This data was reviewed, geo-processed, and analyzed to identify the crash patterns and potential safety issues within the study area. Intersection crash summaries were developed using the “Base Street Name” attribute that identifies the nearest cross street for every crash.

Key observations from crash analysis include:

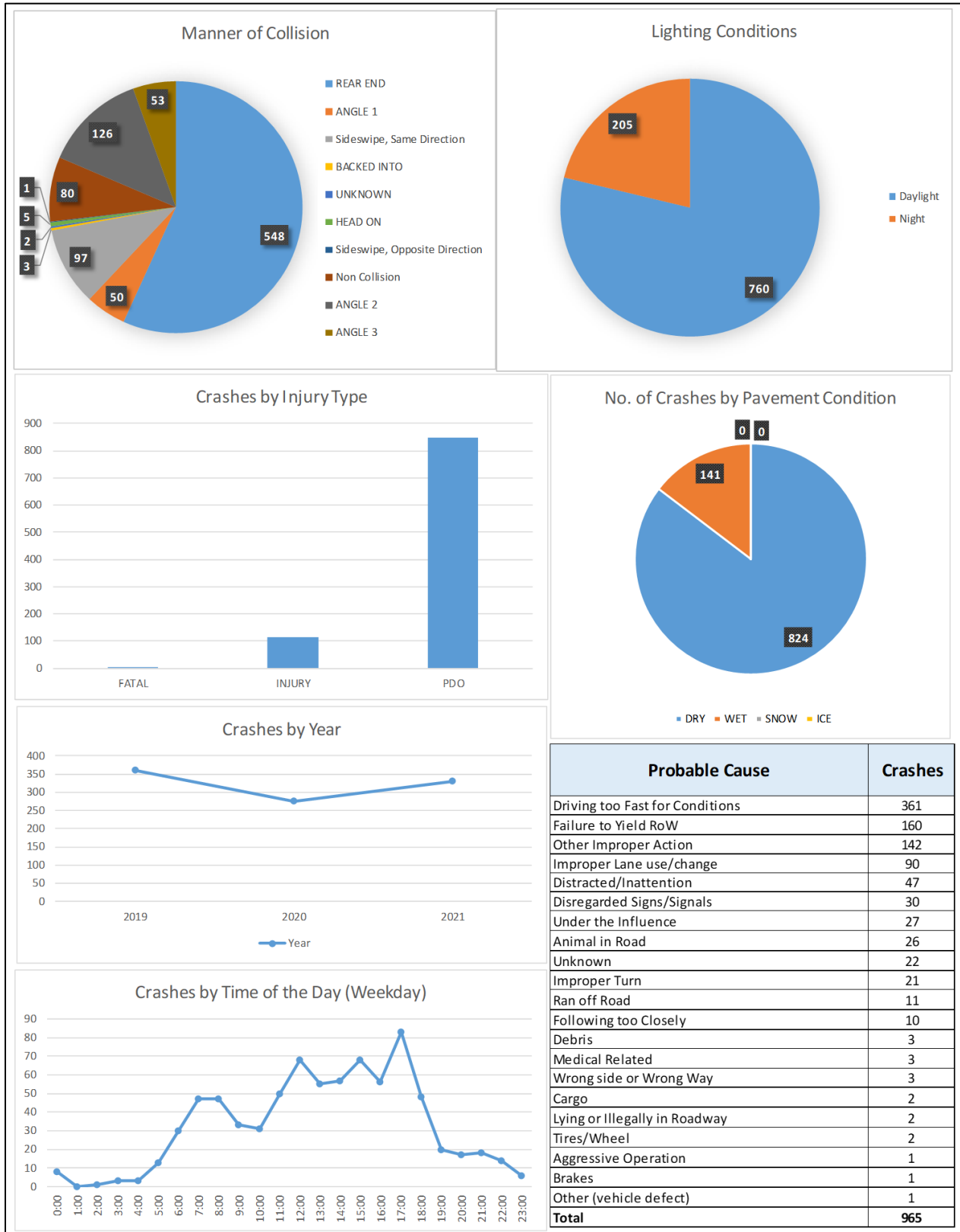
- A total of 965 crashes occurred in the study area during the review period including three (3) fatal crashes, five (5) fatal injury crashes, three (3) serious injury crashes, and other 111 injury crashes.
- Of the three (3) fatal crashes, two (2) occurred near Possum Hollow Road and one (1) occurred near Edgewater Parkway
 - Driving “under the influence” was reported as the probable cause for two (2) of the fatal crashes.
 - “Disregarded sign/signal” was reported as the probable cause for one (1) of the fatal crash.
- 70% of the crashes occurred at intersections and 30% occurred at midblock locations.
- 51% of the crashes occurred at signalized intersections.
- 80% of crashes occurred during weekdays of which:
 - 10% occurred during the AM peak (6-8 AM)
 - 17% during PM peak (5-7 PM)
 - 30% of crashes occurred between 1-5 PM
- Rear end and angle crashes include 57% and 24% respectively.
- 56% of the angle crashes occurred at signalized intersections.
- “Driving too fast for conditions” (37%) and “Failure to yield right-of-way” (17%) were reported as the major possible causes.

Based on the crash analysis, the project team identifies the following as the potential safety issues in the study corridor:

- Driver Behavior Characteristics
- Congestion and stop-go conditions
- Queue spillbacks to adjacent intersections
- Inadequate gap times and gaps for the TWSC traffic, especially left turns.
- Inadequate gap times and gaps for the permissive left turn phases at signalized intersections

Figure 11 shows the summary of the 965 crashes that occurred in the study area during the review period. Detailed crash summaries for each study intersection are provided in **Appendix E**.

Figure 11 – Crash Summary



5.0 VOLUME DEVELOPMENT

Traffic volume data collected in May 2022 were used for the base year (2022) analysis. The future year (2045) volumes were developed by applying appropriate growth rate to the base year volumes. The annual growth rate in the study area was developed using the historic AADT data and growth rate derived from the MRM base year and future year AADT projections. Additionally, all the previous studies (TIA) conducted in the study area were reviewed to identify the various growth rates used. The following sections discuss the growth rate determination and volume development process for this study.

It is to be noted that the growth rates were determined for the future year No-Build (4-lane US 521) and Build scenarios (6-lane US 521) separately due to the potential difference in US 521 corridor volumes as a result of added capacity under the build conditions.

5.1 Annual Traffic Growth Rate

Based on the review of SCDOT historic AADT and MRM data, it was determined that the study corridor be broken down into three (3) sections due to the varied AADT levels and growth rates. The corridor sections and their corresponding growth rates listed below:

1. Northern study limits to Marvin Road
 - An annual growth rate of 1.0% was used for the future year (2045) No-Build scenario.
 - An annual growth rate of 2.0% was used for the future year (2045) Build scenarios.
2. Marvin Road to Jim Wilson Road
 - An annual growth rate of 1.0% was used for the future year (2045) No-Build scenario.
 - An annual growth rate of 2.5% was used for the future year (2045) Build scenarios.
3. Jim Wilson Road to Southern study limits
 - An annual growth rate of 2.5% was used for the future year (2045) No-Build scenario.
 - An annual growth rate of 3.0% was used for the future year (2045) Build scenarios.

Table 4 shows the summary of the growth rate calculations.

5.2 2045 Future Year

2045 future year AM and PM peak hour volumes were developed by applying the annual growth rates to the 2022 Base Year volumes. Volumes are redistributed as necessary to account for planned geometric or access management changes. Additionally, adjustments were made to account for volume imbalances at the intersections of Marvin Road, and Jim Wilson Road due to different growth rates on US 521 on either side of the intersection.

The 2045 No-Build and Build volumes are shown in **Figure 12** and **Figure 13** included in **Appendix A**.

5.3 2045 No-Build Lane Configuration

The geometry for 2045 No-Build conditions includes all the approved background roadway projects and improvements mentioned in Section 2.4. This includes signalization of the access to the Medical University, signalization of Jenkins Drive/Driveway. **Figure 14** in **Appendix A** shows the lane configuration for the 2045 No-Build scenario.

Table 4 Growth Rate Summary

ROUTE	LOCATION	Historic AADT		Historic AADT Growth Rate	ADT Traffic Counts	MRM Daily Volume No Build (US 521 4-Lane)			Proposed CAGR No Build (US 521 4-Lane)	MRM Daily Volume Build (US 521 6-Lane)		Proposed CAGR Build (US 521 6-Lane)	No Build Estimate	Build Estimate
		2015	2021	2015 - 2021	2022	2025	2045	CAGR	(US 521 4-Lane)	2045	CAGR	(US 521 6-Lane)	2045	2045
US 521														
US 521	North of Sandra Ln	-	-	-	-	38,116	47,343	1.1%	1.0%	53,300	1.7%	2.0%		
US 521	Sandra Ln to Red Ventures Dr	37,700	38,900	1%	42,600	38,116	47,343	1.1%		53,300	1.7%		53,600	67,200
US 521	Red Ventures Dr to Fort Mill Hwy (SC 160)	-	-	-	-	34,400	38,800	0.6%		47,100	1.6%			
US 521	Fort Mill Hwy (SC 160) to Edgewater Pkwy	-	-	-	-	40,159	47,651	0.9%		60,600	2.1%			
US 521	Edgewater Pkwy to Marvin Rd	-	-	-	-	40,159	47,651	0.9%		60,600	2.1%			
US 521	Marvin Rd to Proposed Medical University	-	-	-	-	24,452	30,251	1.1%	1.0%	42,200	2.8%	2.5%		
US 521	Proposed Medical University to Bridgemill Dr	-	-	-	-	24,452	30,251	1.1%		42,200	2.8%			
US 521	Bridgemill Dr to Possum Hollow Rd	-	-	-	-	24,452	30,251	1.1%		42,200	2.8%			
US 521	Possum Hollow Rd to Sandal Brook Rd	-	-	-	-	24,452	30,251	1.1%		42,200	2.8%			
US 521	Sandal Brook Rd to Dobys Bridge Rd	25,700	32,100	4%	34,600	30,875	37,763	1.0%		50,500	2.5%		43,500	61,100
US 521	Dobys Bridge Rd to River Rd	-	-	-	-	38,045	44,656	0.8%		56,200	2.0%			
US 521	River Rd to Shelley Mullis Rd	-	-	-	-	37,647	42,738	0.6%		55,700	2.0%			
US 521	Shelley Mullis Rd to Jenkins Dr	-	-	-	-	35,687	44,806	1.1%		58,500	2.5%			
US 521	Jenkins Dr to Del Webb Blvd	-	-	-	-	35,687	44,806	1.1%		58,500	2.5%			
US 521	Del Webb Blvd to Jim Wilson Rd	-	-	-	-	35,687	44,806	1.1%		58,500	2.5%			
US 521	Jim Wilson Rd to Van Wyck Rd	-	-	-	-	35,428	53,787	2.1%	2.5%	66,400	3.2%	3.0%		
US 521	Van Wyck Rd to Waxhaw Hwy (SC 75)	14,400	21,400	7%	23,200	22,034	45,489	3.7%		46,800	3.8%		40,900	45,800
US 521	Waxhaw Hwy to Witherspoon Dr	-	-	-	-	25,662	37,709	1.9%		43,000	2.6%			
US 521	South of Witherspoon Dr	-	-	-	-	25,662	37,709	1.9%		43,000	2.6%			
Side Streets														
Fort Mill Hwy (SC 160)	West of US 521	15,900	15,800	-0.1%	21,500	32,200	40,300	1.1%	1.0%	41,500	1.3%	1.5%	27,000	30,300
State Rd S-29-54/ Marvin Rd	East of US 521	9,800	10,400	1.0%	12,900	18,800	18,400	-0.1%	0.5%	19,500	0.2%	0.5%	14,500	14,500
Dobys Bridge Rd	West of US 521	5,300	11,300	13.4%	12,700	16,700	19,700	0.8%	1.0%	20,700	1.1%	1.0%	16,000	16,000
Shelley Mullis Rd	East of US 521	5,100	6,800	4.9%	7,300	8,800	11,900	1.5%	1.5%	10,000	0.6%	0.5%	10,300	8,200
Jim Wilson Rd	East of US 521	4,700	6,600	5.8%	11,200	12,900	16,600	1.3%	1.5%	16,600	1.3%	1.5%	15,800	15,800
Waxhaw Hwy (SC 75)	East of US 521	5,300	6,300	2.9%	6,600	16,900	27,300	2.4%	2.5%	26,500	2.3%	2.5%	11,600	11,600

1. "-" implies data not available

2. 2045 No Build & Build Estimates are based on applying the proposed growth rate on 2022 ADT (from counts)

6.0 CAPACITY ANALYSIS METHODOLOGY

6.1 Level of Service Concept

The performance of an intersection is measured by the level of service (LOS) that it provides, as described in the Highway Capacity Manual (HCM), 6th Edition. LOS is a measure that is used to describe the operating conditions of an intersection based on characteristics such as speed, traffic volumes, geometric/lane configuration, and delays. LOS ranges from “A” to “F”, with “A” describing smooth, free flow conditions where queues easily clear through each cycle length, and “F” describing heavily congested, over-saturated conditions, where queues are often forced to wait through potentially multiple cycle lengths prior to clearing an intersection, resulting in heavy delays.

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experience due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Two-way stop-controlled intersection LOS is defined in terms of the highest control delay between the minor-street movements and major-street left-turns. This is because major street through vehicles are assumed to experience zero delay, a weighted average of all movements results in very low overall average delay, and this calculated low delay could mask efficiencies of minor movements. It is not uncommon that Two-way stop-controlled intersections operate at LOS E or F and hence don’t require capacity improvements except when the stop-controlled approaches experience excessive queuing.

For this study, acceptable LOS is considered as LOS “D” or better. **Table 5** provides the LOS and delay criteria for signalized and unsignalized intersections provided in the HCM.

Table 5 Level of Service Criteria

LOS	Delay Per Vehicle (In Seconds)	
	Signalized Intersection	Unsignalized Approach
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

6.2 Capacity Analysis

The capacity analysis for the study corridor including the signalized and stop-controlled intersections in the study area was performed using Synchro 10 and SimTraffic. The existing roadway network was modeled in Synchro with the existing lane configuration and traffic control. Existing signal plans and timing plans provided by RFATS/SCDOT were used to code the timing, phasing, and detector settings for

the signalized intersections in the study. Additionally, SCDOT standards for Synchro v10 were adopted in the analysis.

Some of the key details and assumptions in the Synchro modeling are summarized below:

- A minimum of 4 vehicles per hour were assumed in the analysis at allowed movements.
- Speed limit of 25 mph was used for all the driveways where posted speed limit is not available.
- Sequence (lead-lag) optimization was applied for the future year No-Build conditions.

HCM 6 reports were extracted from Synchro for the unsignalized intersections and the Intersection Lane, Volumes, Timings reports were extracted for the signalized intersections. Queuing, network performance, and arterial level-of-service measures were extracted from the SimTraffic simulations. All the Synchro and SimTraffic outputs for the analyses performed are included in **Appendix F**.

7.0 NO-BUILD OPERATIONS ANALYSIS

7.1 2022 Existing

This scenario includes the 2022 existing lane configuration and 2022 Base Year volumes collected as a part of this study. Capacity analysis results for this scenario are discussed below.

Signalized Intersections

Based on the Synchro results, 14 of the 15 signalized intersections in the study area operate under acceptable overall LOS D or better. The intersection at Dobys Bridge Road / Worldreach Drive operates at LOS E during the PM peak hour.

Unsignalized Intersections

Based on the Synchro results, all three (3) unsignalized intersections operate under LOS E or worse during at least one of the peak hours.

7.2 2045 No-Build

This scenario includes the 2045 no-build lane configuration and 2045 No-Build volumes. This includes signalization of the access to the Medical University, signalization of Jenkins Drive/Driveway. Capacity analysis results for this scenario are discussed below.

Signalized Intersections

Based on the Synchro results, 13 of the 17 signalized intersections operate under acceptable overall LOS D or better. The intersections at Fort Mill Highway / Overhill Drive, Dobys Bridge Road / Worldreach Drive, River Road / Collins Road, and Jim Wilson Road are projected to operate at LOS E or worse during at least one of the peak hours.

Significant queuing is projected along US 521 at all the four signalized intersections that are projected to operate at LOS E or worse.

Unsignalized Intersections

Based on the Synchro results, the unsignalized intersection of US 521 at Possum Hollow Road is projected to operate under LOS E or worse during at least one of the peak hours.

Figures 15 and **Figure 16** show the LOS results for the Existing and No-Build conditions.

Figure 15 – 2022 Existing Conditions LOS Results

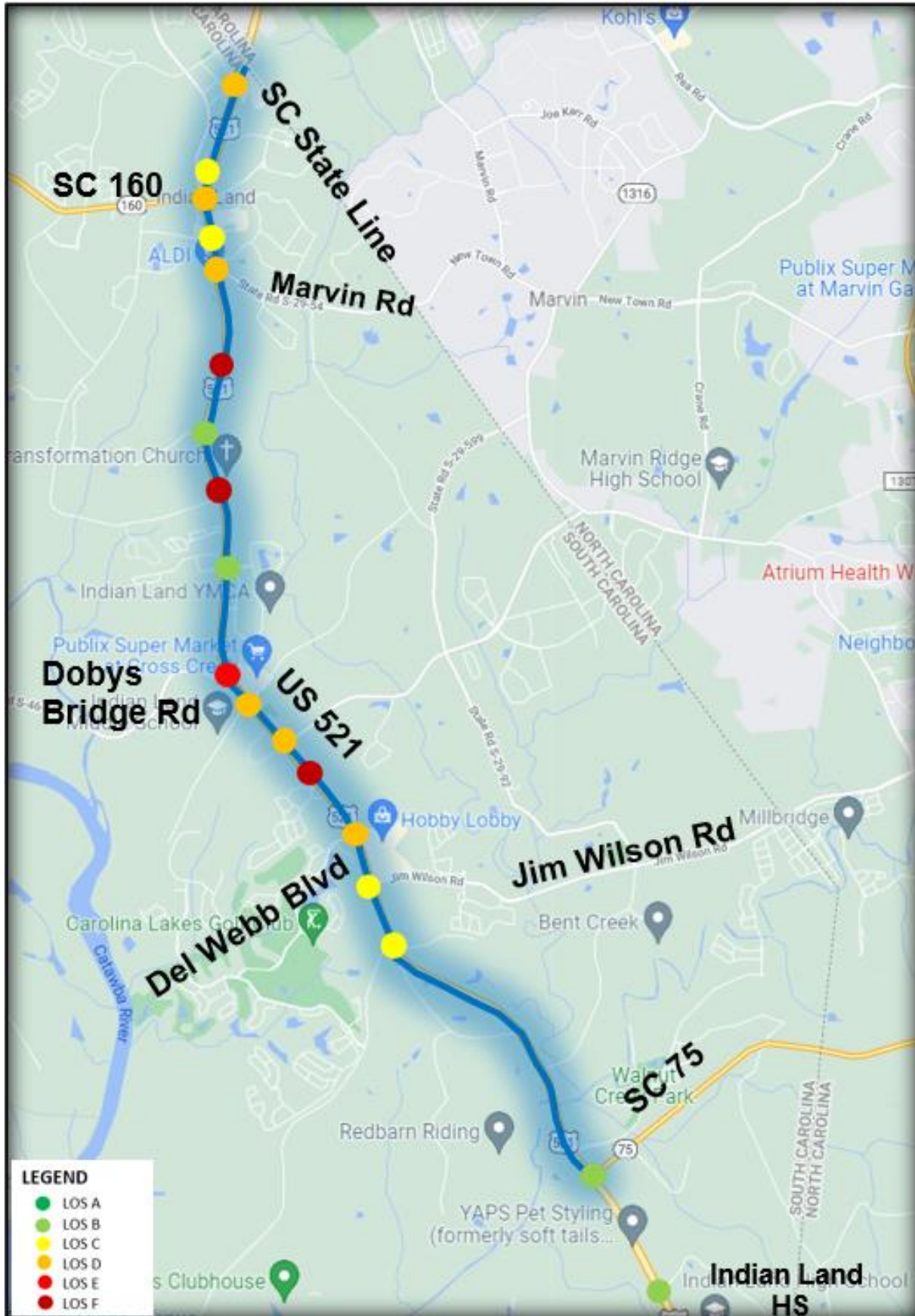
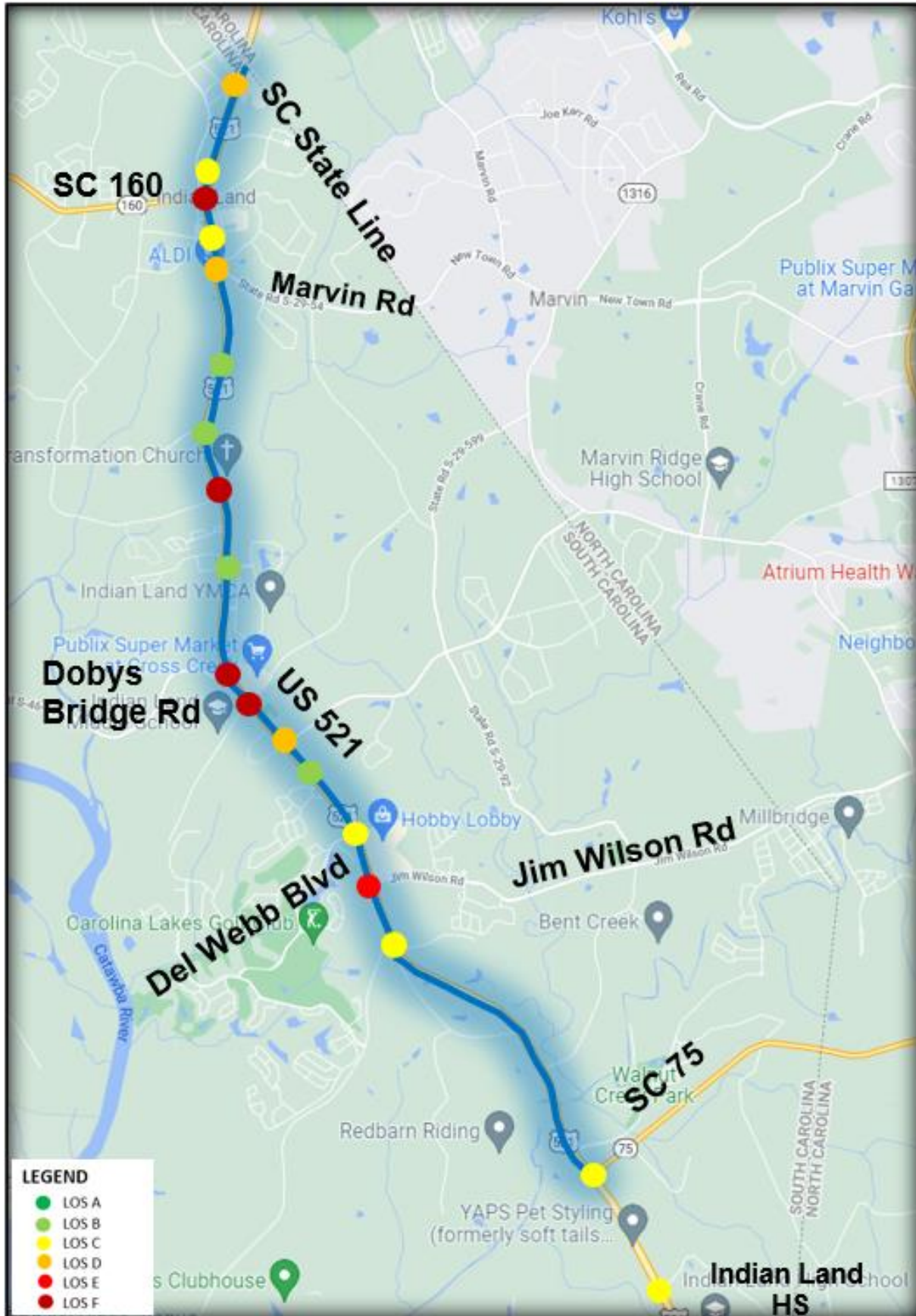


Figure 16 – 2045 No-Build Conditions LOS Results



8.0 BUILD ALTERNATIVES

As mentioned in the project background description, to improve the safety, mobility, operations, and handle the anticipated future growth, three Build Alternatives were identified to further evaluate and analyze the traffic operations along the study intersections on US 521. The evaluation criteria include:

- Improve safety
- Balance local access with regional mobility
- Improve operations
- Minimize impacts
- Accommodate future growth
- Accommodate multimodal access
- Impact to parallel/side streets



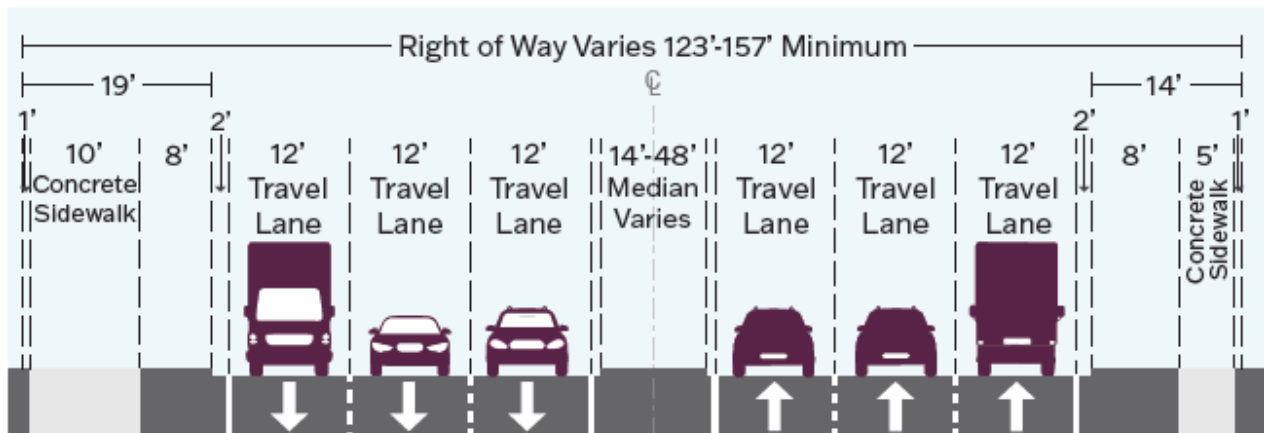
Details of each build alternative are discussed in the following sections.

8.1 Build Alternative 1 – Traditional Widening

This alternative includes widening of US 521 from NC/SC state line to Waxhaw Highway to a six-lane median divided roadway. Additionally, this alternative retains the traditional configuration and existing driveway access for all intersections along the study corridor.

A typical section of the widened corridor is shown **Figure 17** below:

Figure 17 – Typical Section



The concept layouts for Build Alternative 1 are included in **Appendix G.1**.

8.2 Build Alternative 2 – Reduced Conflict Intersection Widening

This alternative includes widening of US 521 from NC/SC state line to Waxhaw Highway to a six-lane median divided roadway. This includes reconfiguring all study intersections to a Reduced Conflict Intersection (RCI) design that improves safety and operations by changing how minor road traffic crosses or turns left at a major road. The RCI does not change any of the movements that are possible from the major road. At an RCI, minor road traffic wanting to cross or turn left make a right turn and then a U-turn on the major road to navigate through the intersection. This design reduces conflict points at the

intersections thus improving safety. Traffic capacity and operations are improved due to reduction in signal phases and better signal coordination.

Figure 18 shows an example of a possible RCI intersection layout, multimodal accommodations, and how to navigate the RCI. **Figure 19** shows the superstreet capacity chart as provided by FHWA. The concept layouts for Build Alternative 2 are included in **Appendix G.2**.

Figure 18 – RCI Intersection Example

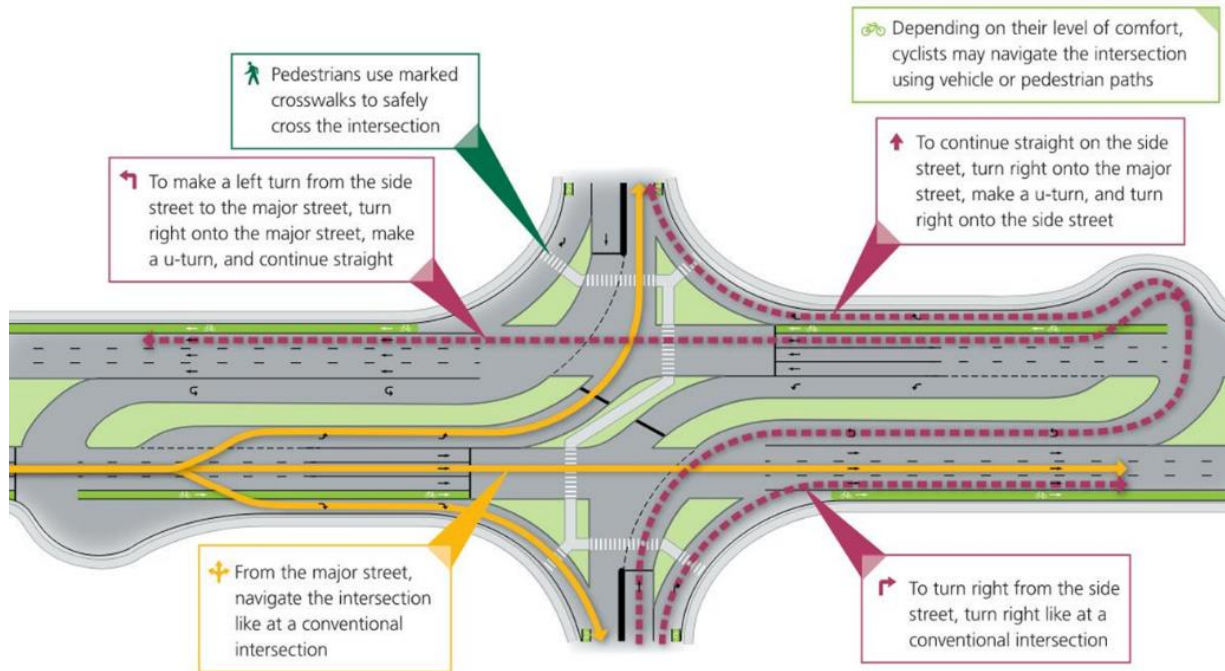
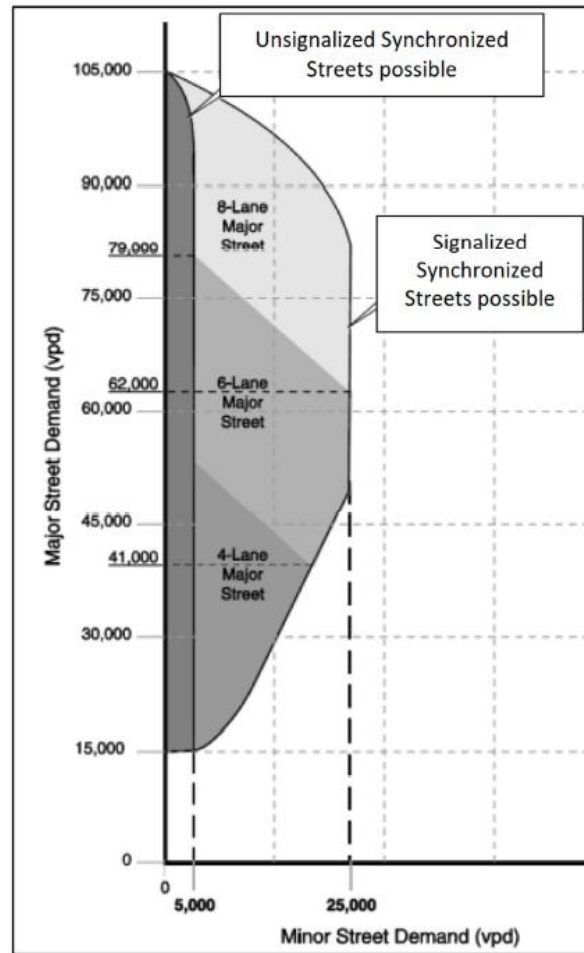


Image Source: VDOT

Figure 19 – Superstreet Capacity Chart



8.3 Build Alternative 3 – Hybrid Widening

This alternative includes widening of US 521 from NC/SC state line to Waxhaw Highway to a six-lane median divided roadway. This alternative includes a combination of intersection configuration from Alternative 1, Alternative 2, and other innovative configurations. The intersection configuration along the study corridor under this alternative is listed below:

- US 521 & SC 160 / Overhill Drive – Reverse RCI
- US 521 intersections south of Van Wyck Road – RCI configuration
- US 521 intersections north of Van Wyck Road (except at SC 160) – Traditional configuration

The Reverse RCI is similar to the RCI with changes to major road and minor road left turns. The Reverse RCI does not change any of the movements that are possible from the major road. At a Reverse RCI, major road traffic wanting to make a left turn continue through the intersection and make a U-turn and then a right turn on the major road. Minor road traffic wanting to cross make a right turn, then a U-turn, and then a right turn on the major road to navigate through the intersection.

The concept layouts for Build Alternative 3 are included in **Appendix G.3**.

Figures 20 through Figure 22 in Appendix A show the lane configuration for Build Alternatives 1, 2, and 3 respectively. The intersection of Possum Hollow Road was analyzed as a signalized intersection in all the build alternatives due to the significant delay at this intersection under the no-build conditions.

8.4 Planning-Level Cost Estimate of Improvements

The following high-level cost estimate ranges of improvements presented in **Table 6** were developed based on a review of similar local project costs, high-level order-of-magnitude estimates from other agencies, and coordination with project stakeholders. Additional evaluation and design will need to be conducted to develop a more refined cost of improvements.

Table 6 High-Level Cost Estimate of Improvements

Item	Value/Unit	Alternative 1	Alternative 2	Alternative 3
6 Lane Cross-Section	\$3,660,000/mile	\$31,110,000	-	\$21,960,000
6 Lane Cross-Section with RCI's	\$4,350,000/mile	-	\$44,370,000	\$13,050,000
Construction – Misc. & Mob. - Structures	25%	\$7,777,500	\$11,092,500	\$8,752,500
Construction – Misc. & Mob. - Roadway	55%	\$17,110,500	\$24,403,500	\$19,255,500
Construction – Misc. & Mob. - Intersection	40%	\$12,444,000	\$17,748,000	\$14,004,000
Construction – Eng. & Constr.	15%	\$4,666,500	\$6,655,500	\$5,251,500
Construction – Remove Bridge, New Bridge Structure	\$30/sft \$150/sft	\$9,361,470	\$9,538,770	\$9,538,770
Right-of-Way – Parcel, Partial/No Access Control	50%	\$15,555,000	\$22,185,000	\$17,505,000
Utilities	15%	\$4,666,500	\$6,655,500	\$5,251,000
Total Cost Estimate (2022 Year of Expenditure)		\$102,691,470	\$142,648,770	\$114,568,770

9.0 BUILD OPERATIONS ANALYSIS

9.1 2045 Build Volumes

The 2045 Build volumes discussed in the volume development section were used for the build analysis. As discussed in that section, the traffic growth on US 521 under build conditions is projected to be higher than the no-build conditions due to the added capacity. A comparison of the MRM volumes for the no-build and build conditions is shown in **Table 7**.

Table 7 US 521 Widening Volume Changes

US 521 Section / Parallel / Cross Street	MRM AADT (No-Build)	MRM AADT Change (Build)	MRM AADT % Change
US 521 (Lancaster Hwy to Andrey Kell Rd)	47,000	+3,600	+8%
US 521 (Andrey Kell Rd to SC 160)	39,000 – 47,000	+6,000 to +8,300	+13 to +21%
US 521 (SC 160 to Jim Wilson Rd)	30,000 – 54,000	+12,000 to +14,000	+30% to +40%
US 521 (Jim Wilson Rd to Rehobeth Rd)	38,000 – 54,000	+1,300 to +12,600	+3% to +25%
US 521 (South of Rehobeth Rd)	< 30,000	< +1,000	< +5%
SC 160	38,000	+800	+3.5%
Marvin Rd	13,000 – 28,000	-1,300 to - 2,500	-10% to -15%
Dobys Bridge Rd	20,000	+1,000	+5%
Shelly Mullis Rd	12,000	-1,900	-16%
Jim Wilson Rd	15,000 – 20,000	0 to +1,500	< +2%
Henry Harris Rd	17,000	-3,500	-20%
Stacy Howie Rd	17,000	-3,000	-17%

Peak hour volumes at the RCI intersections also include re-distribution of traffic due to the movement restrictions. The volumes at the U-turn locations include the re-routed traffic from the upstream RCI intersections. This study did not consider the traffic from other driveways or cross streets that may also be re-routed to the U-turn locations.

9.2 2045 Build Operations Analysis

Build Alternative 1 – Traditional Widening

Based on the Synchro results, all the 18 signalized intersections in the study are projected to operate under acceptable LOS except the following:

- US 521 & SC 160 / Overhill Drive
 - Projected to operate at LOS E during the PM peak hour.
- US 521 & River Road / Collins Road
 - Projected to operate at LOS E during the AM peak hour.

Build Alternative 2 – RCI Widening

Based on the Synchro results, all the 18 signalized intersections in the study are projected to operate under acceptable LOS except the following:

- US 521 & SC 160 / Overhill Drive
 - Projected to operate at LOS E during the PM peak hour.

Build Alternative 3 – Hybrid Widening

Based on the Synchro results, all the 18 signalized intersections in the study are projected to operate under acceptable LOS except the following:

- US 521 & River Road / Collins Road
 - Projected to operate at LOS E during the AM peak hour.

LOS results for the build alternatives are shown in **Figures 23** through **25**.

Alternative Comparison

A comparison of the network/arterial performance measure of effectiveness (MOE) results from SimTraffic between the No-Build and Build alternatives is shown in **Tables 8** and **Table 9** below. An overall assessment of the No-Build and Build alternatives evaluation criteria is presented in **Figure 25**.

Table 8 Arterial Performance – AM(PM)

Measure of Effectiveness	Direction	No-Build	Build 1 (Traditional)	Build 2 (RCI)	Build 3 (Hybrid)
Delay (seconds/vehicle)	Northbound	413 (508)	407 (558)	435 (283)	381 (542)
	Southbound	491 (753)	386 (689)	322 (1053)	354 (653)
Travel Time (minutes)	Northbound	16.5 (18.3)	16.4 (19.1)	17.1 (14.4)	14.2 (17.0)
	Southbound	17.8 (23.0)	16.0 (21.6)	15.5 (29.0)	16.8 (22.2)
Arterial Speed (mph)	Northbound	30 (27)	31 (26)	29 (35)	35 (30)
	Southbound	29 (23)	33 (24)	34 (18)	31 (24)

Table 9 Network Performance – AM(PM)

Measure of Effectiveness	No-Build	Build 1 (Traditional)	Build 2 (RCI)	Build 3 (Hybrid)
Total Delay/Vehicle (seconds)	182 (249)	161 (246)	174 (278)	172 (232)
Stop Delay/Vehicle (seconds)	112 (162)	87 (143)	91 (169)	101 (130)
Arterial Speed (mph)	24 (20)	27 (21)	26 (20)	25 (22)
Vehicles Entered	12,365 (13,735)	14,621 (16,336)	14,569 (15,694)	14,686 (16,330)

Figure 23 – 2045 LOS Results - Build Alternative 1

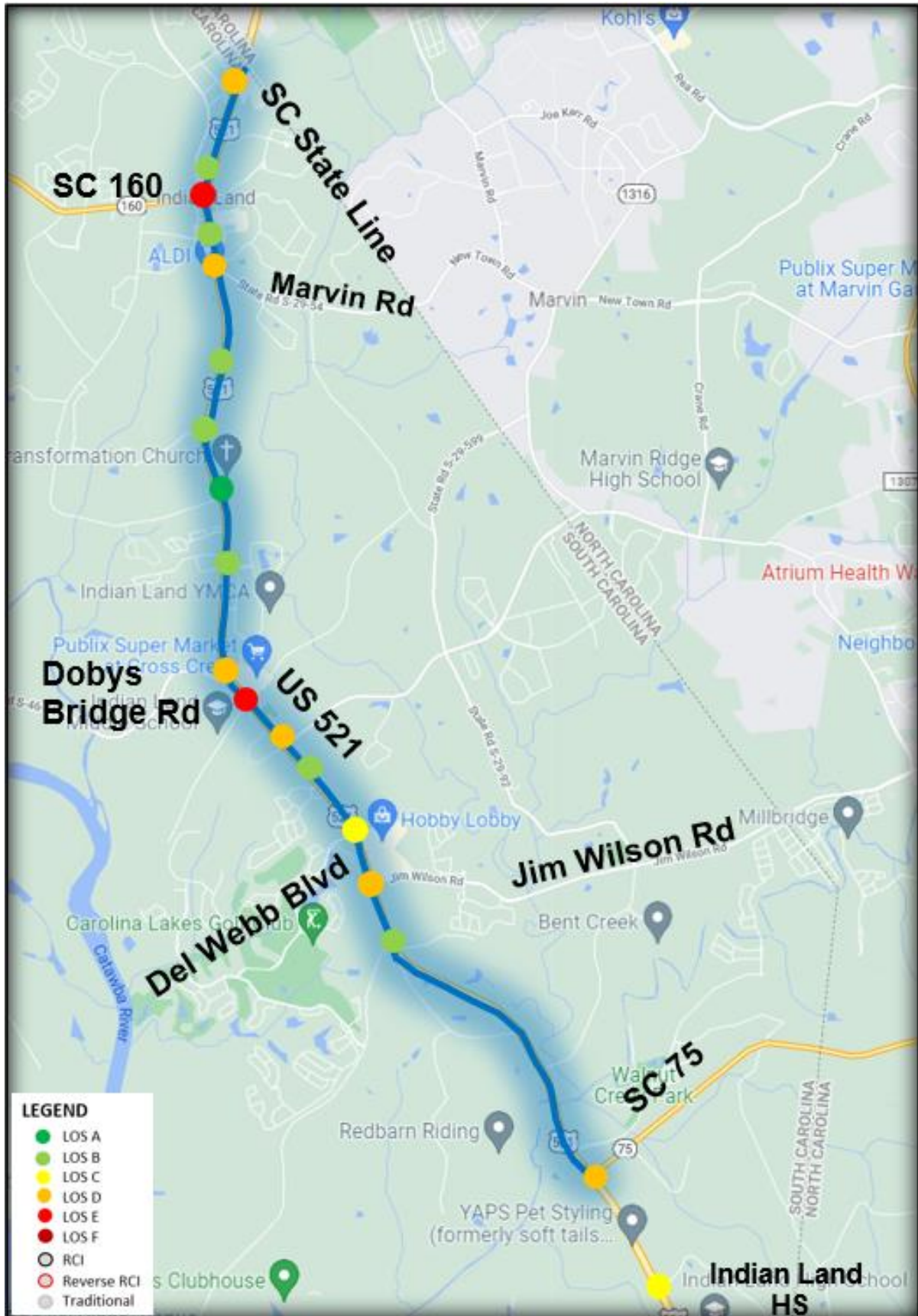


Figure 24 – 2045 LOS Results - Build Alternative 2

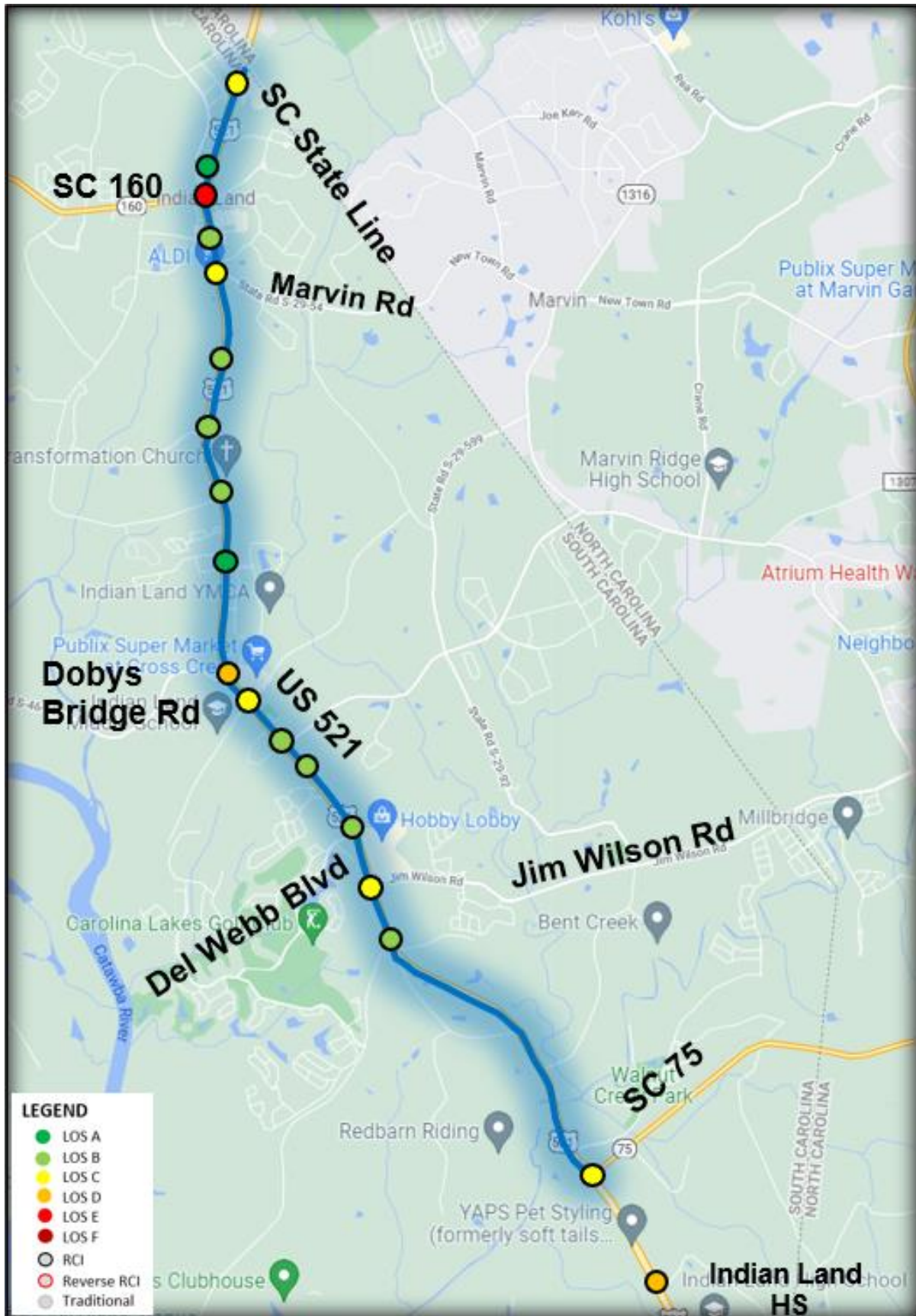


Figure 25 – 2045 LOS Results - Build Alternative 3

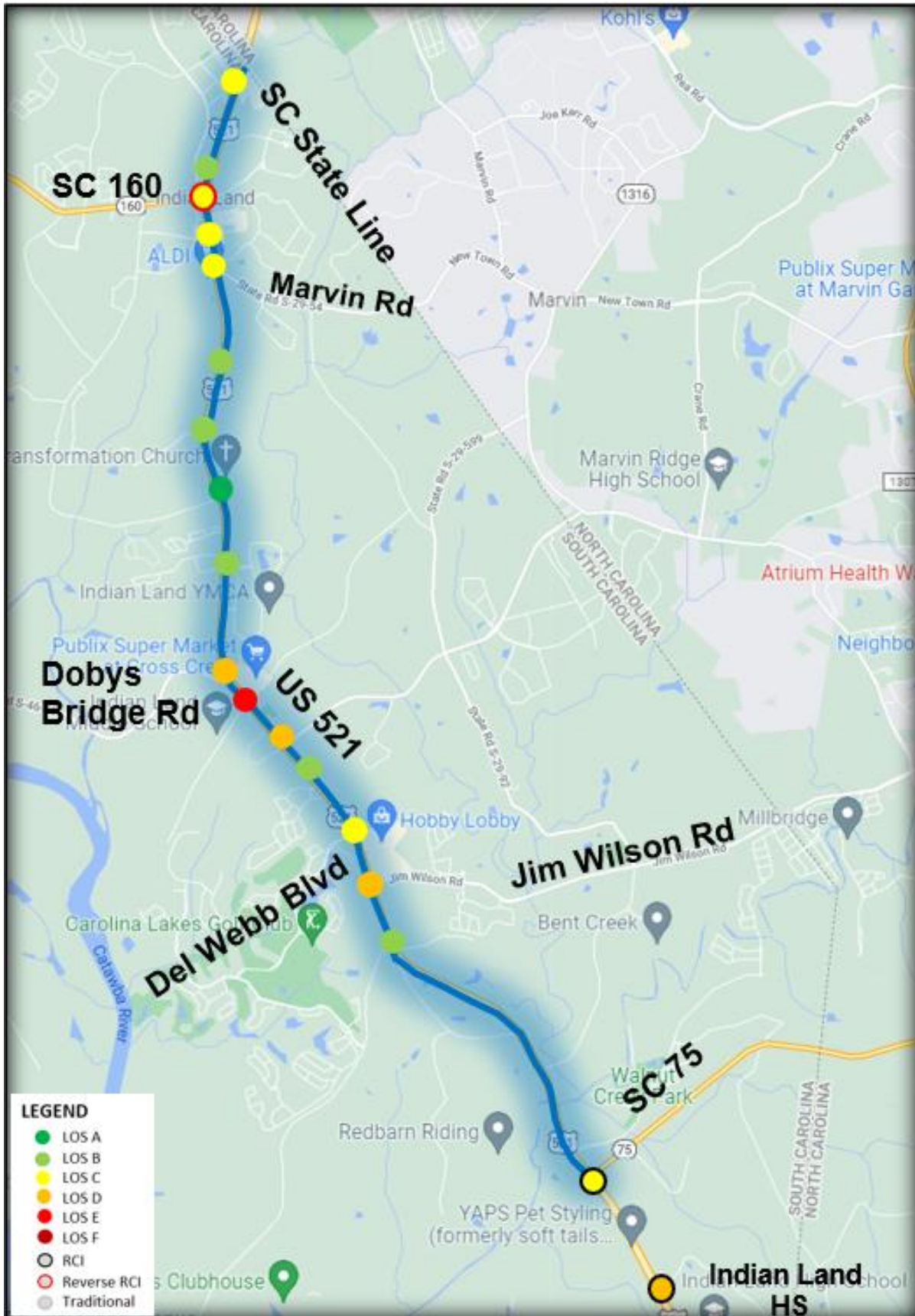
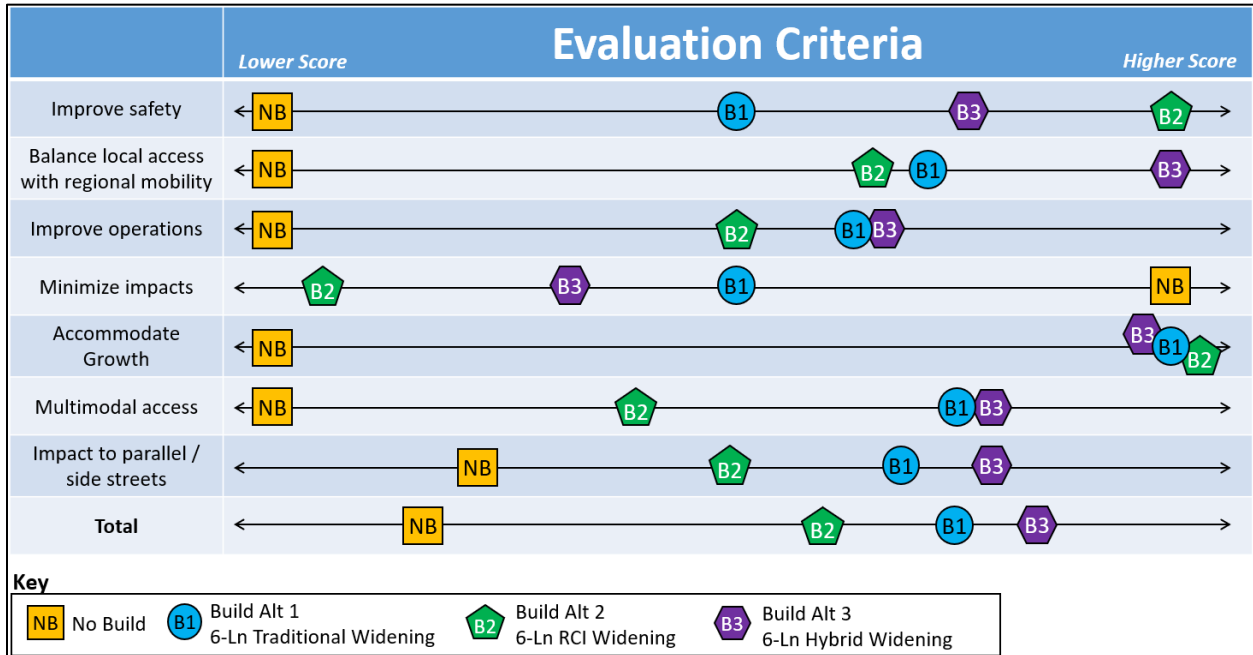


Figure 26 – Alternative Assessment



10.0 CONCLUSIONS

Based on the capacity analysis results, four-lane US 521 is projected to experience traffic operational issues including failing level of service (LOS) and heavy queuing at multiple intersections. Widening US 521 to six lanes is projected to improve traffic operations and address queuing issues while serving approximately 26% additional traffic demand.

The lower-cost traditional widening alternative includes traditional intersections along US 521. The traditional configuration includes no restriction to the existing intersection movements. Traditional widening alternative is projected to address the operational issues at most intersections except the US 521 intersections at SC 160 and River Road/Collins Road. Additionally, significant queuing is projected at the intersection of US 521 and SC 160.

The higher-cost RCI widening alternative includes RCI intersections along US 521. Under the RCI configuration, cross street left turns and through movements are rerouted to make a right-turn and downstream U-turn. RCI widening alternative is projected to address the operational issues at all the intersections except the intersection at SC 160. However, in addition to the access restrictions/modifications along the corridor, this alternative presents design feasibility and intersection spacing challenges like inability to provide adequate storage length for specific turn lanes on US 521. Due to this, significant queuing is projected at the US 521 intersections at SC 160, Dobys Bridge Road, and River Road/Collins Road.

The medium-cost hybrid widening alternative includes traditional widening from the state line to north of Jim Wilson Road, with an exception at the intersection of US 521 and SC 160, and RCI widening from Jim Wilson Road to SC 75. At the US 521 and SC 160 intersection, an innovative design concept of Reverse RCI is incorporated to better accommodate the largest traffic movements north-south along US 521 and SC 160 to/from US 521 towards the state line. While similar to the RCI concept, the reverse RCI concept reroutes US 521 major street left turns and SC 160 cross street through movements to make U-turns downstream. The hybrid widening alternative is projected to address the operational issues at all the intersections except the intersection of US 521 and River Road/Collins Road.

The three US 521 widening alternatives support the project evaluation criteria in varying degrees to improve safety, balance local access with regional mobility, improve operations, minimize impacts to the corridor, accommodate future growth, accommodate multimodal access, and minimize impacts to parallel/side streets. The US 521 corridor study alternatives, designs and cost estimate information presented in this study can be used to advance local transportation planning, funding discussions, future engagement, corridor preservation, and SCDOT's project development process.