Wendell Boulevard Intersection Study

July 14, 2011

Prepared for:

Submitted by:

MARTIN ALEXIOU BRYSON

License#: C-3496

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1. INTRODUCTION

The Capital Area Metropolitan Planning Organization (CAMPO), in cooperation with staff from member agencies, has begun development of the region's Comprehensive Transportation Plan (CTP). The CTP will serve as the unconstrained element of the region's 2040 Long Range Transportation Plan (LRTP). Throughout 2010, the CAMPO conducted a series of workshops to identify transportation projects for inclusion in the CTP element of the LRTP. As a result of these workshops several areas were identified as needing more detailed study to identify feasible and appropriate transportation solutions. Alternatives developed as part of this study will be used by the CAMPO as a basis for recommendations in the CTP element of the LRTP.

This study is an analysis of potential operational and safety improvements for one of these areas, the intersection of US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road). This location is the intersection of two major roadways through Wendell; however, the offset of Old Wilson Road, from the main intersection by approximately 100 feet to the east, creates a confusing intersection with inefficient traffic control and potential safety concerns. Streamlining the interactions at this intersection is a priority for the CAMPO as it would result in improved operations at a critical crossroads in this area. Consideration will also be given to the US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) intersection, which is located approximately 200 feet west of the main study intersection.

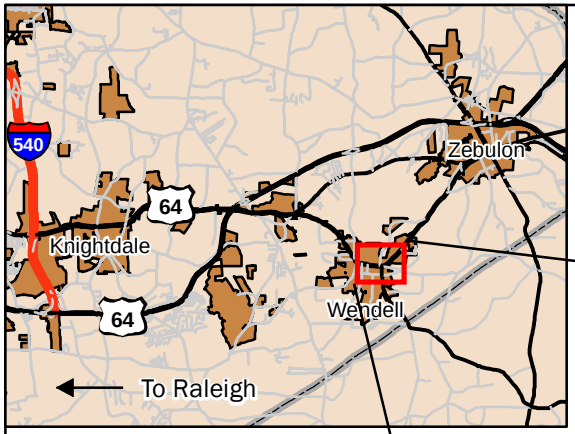
This study is intended to develop various alternatives for these improvements and to analyze the direct and indirect impacts of such improvements. Impacts include operational, safety, and environmental considerations.

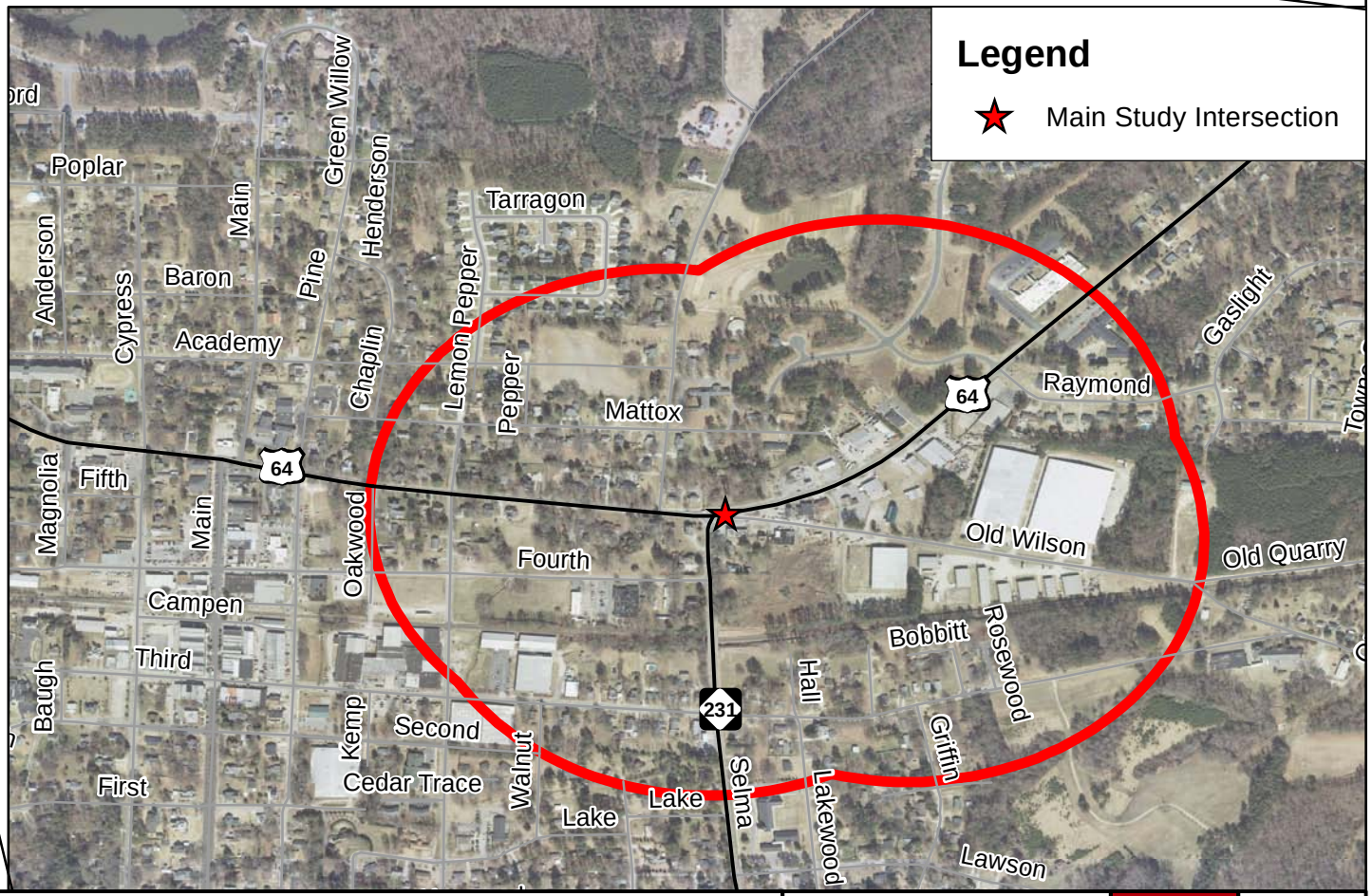
Martin/Alexiou/Bryson, P.C. was retained to study this intersection and identify potential improvements. This report summarizes the findings and results of the study and presents the recommendations associated with the analyzed alternatives.

1.1 STUDY AREA

This report focuses on a study area including the main study intersection, US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) and a one-quarter mile buffer around the intersection, as shown in Figure 1-1. The following key intersections are included in the study area and any existing or future year analyses:

- US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road)
- US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)





Not To Scale	N	Study Area Map Prepared by: M/A/B Date: June 2011	Wendell Boulevard Intersection Study Wendell, North Carolina	MARTIN ALEXIOU BRYSON	Figure 1-1

2. EXISTING (2011) CONDITIONS

2.1 ENVIRONMENTAL SCREENING

A qualitative screening was performed to assess the possible environmental impacts of potential improvements in the study area. This analysis consisted of overlaying project alignments/locations onto a series of maps depicting sensitive natural and community resources (see Figure 2-1). Any proposed alignment determined to encroach on a sensitive area was identified. The nature and degree of conflict determines the level of impact assessed. For example, a roadway alignment across a stream is generally considered to have less severe impacts than one running along the course of the stream. As another example, a road widening is typically assumed to be less disruptive to the natural environment than a comparable project on new alignment. On the other hand, widening may be more disruptive than a new facility in terms of community impacts, depending on available right-of-way, alignment, type of development, and other factors.

This analysis is a system-wide, planning-level screening, not a detailed site survey of sensitive areas. As project plans are further refined, more precise environmental assessments may be necessary. This analysis is used to eliminate any candidate alignments with "fatal" flaws, or environmental impacts that were considered potentially too severe to justify the treatment. In addition, the information obtained from this analysis allows proposed roadway alignments to be adjusted or refined to minimize possible environmental impacts. Finally, this screening process allows early identification of likely impacts and areas of uncertainty that should be investigated more fully as a particular project moves forward through more detailed planning and design.

Degree of impact was determined to be either Not Applicable, Minor, Moderate, or Major. Not Applicable is used for impact categories that are not present within one-quarter mile of the study intersection and alignments. The degree of impact is meant to categorize the potential impact to that resource that is within the study area but does not mean that any specific improvement alternative will necessarily impact that resource. The screening results are summarized in Table 2-1. The specific impacts are discussed in more depth below.

Table 2-1 Environmental Screening Impact Ratings

Impact Category	Degree of Impact
Hydrological	
Bodies of Water	Minor
Impaired Streams	N/A
Streams	Minor
Wetland	Minor
100-Year Floodplain	N/A
500-Year Floodplain	N/A
High Quality/Outstanding Resource Waters	N/A
Water Supply Watershed	N/A
Environmental Factors	
National Discharge Elimination System Site	N/A
Hazardous Substance Disposal Site	Moderate
Land Trust Conservation Property	N/A
Lands Managed for Conservation and Open Space	N/A

Conservation Tax Credit Property	N/A
Natural Heritage Element Occurrence	N/A
Significant Natural Heritage Area	N/A
Historic, Cultural, and Agricultural Factors	
Schools	N/A
State-Owned Lands	N/A
Federally-Owned Lands	N/A
National Register of Historic Properties Places	Major
Threatened Farmland	N/A
Farmland Viability	N/A
Threatened Forestland	N/A
Important Forestland	N/A
Churches	Minor
Senior Centers	Minor
Maximum Possible Score	**Major**

Specific Impacts

As shown on the map of the impact area in Figure 2-1, the bodies of water, streams, and wetlands that could potentially be impacted by intersection treatments are near the edge of the one-quarter mile buffer of the study alignments to the north and southeast. The whole study area is also listed as a sub-watershed with federally listed fish and mussels meaning extra care must be made not to disturb streams and water features. The Biodiversity and Wildlife Habitat Assessment score is a qualitative ranking of the relative significance of a natural area on a scale of 1 to 10 based on several different datasets and measurements. In this case, a medium-high conservation value rank of 7 indicates this is a riparian buffer for a tributary in a watershed contributing to federally listed species habitat.

However, there is ample room for any improvements to the intersection while maintaining a sufficient buffer of the water features. The potential impacts to these hydrologic features are minor.

Three churches are located in the proximity of the main study intersection – Grace Fellowship on US 64 Business (Wendell Boulevard), Shiloh Temple Tabernacle of Prayer Deliverance Church on SR 2353 (Old Wilson Road), and Wendell Christian Church on SR 2359 (Old Zebulon Road). Grace Fellowship and Shiloh Temple Tabernacle of Prayer Deliverance Church are near the intersection of US 64 Business (Wendell Boulevard) SR 2353 (Old Wilson Road) and could be affected by changes to the intersection or a new alignment to the east of the intersection. Wendell Christian Church is located near the intersection of SR 2359 (Old Zebulon Road) and Mattox Street. Realignment of SR 2359 (Old Zebulon Road) could potentially impact this church's property.

A senior home, Oliver House, is located on Wendell Boulevard to the northeast of the study intersections. Because of its distance from the study area, impacts would likely be minor. A Hazardous Substance Disposal Site is located between Old Wilson Road and the train tracks to the southeast of the main study intersection. The company listed along with this site is Photo Chemical Systems, Inc. The data for this is from 1998, so any hazardous materials may have been cleaned up by now. The extent and nature of the hazardous substances is not known and merits additional study if construction would impact this site. The degree of impact is rated as moderate

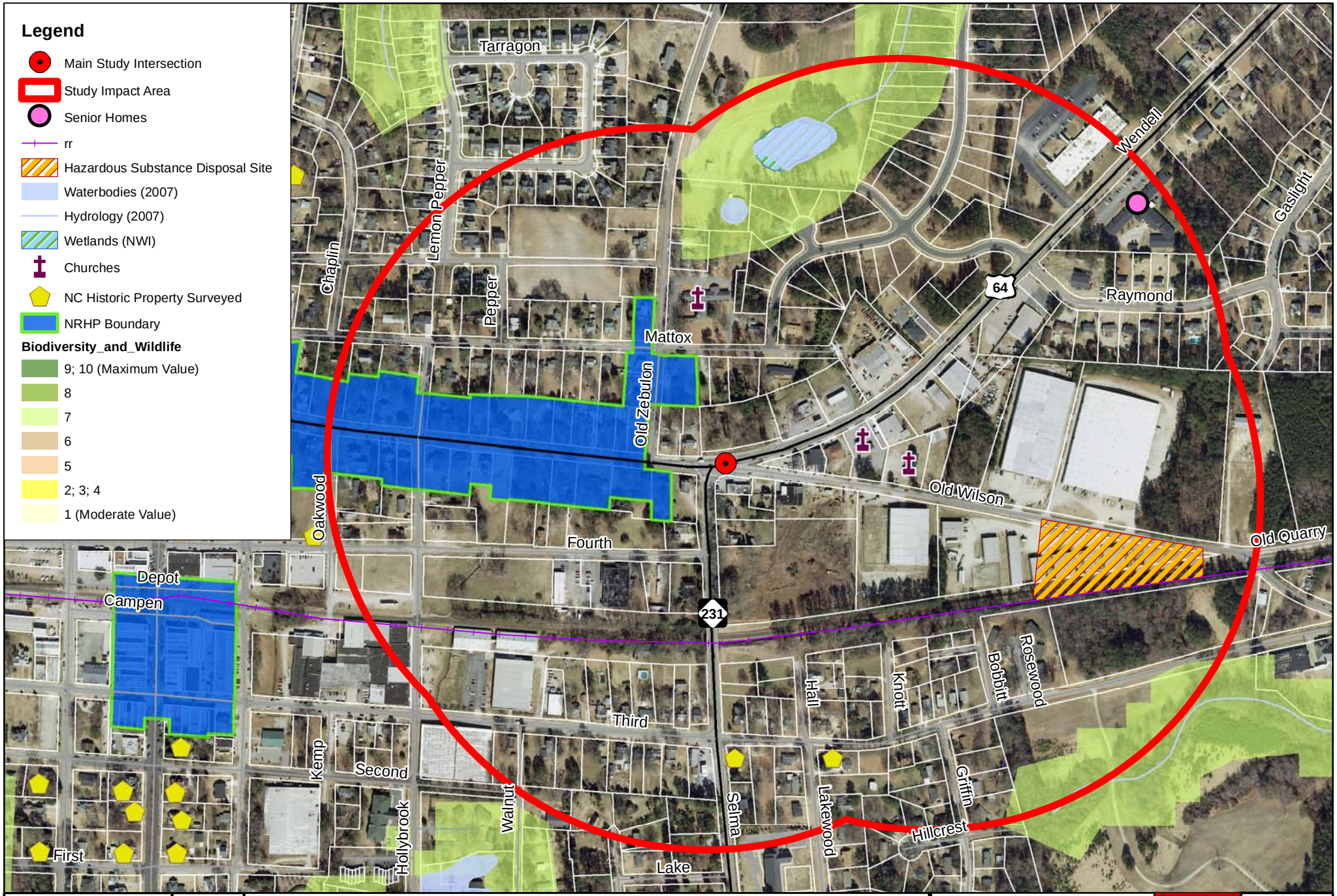
because the site is located over 1,000 feet from the study intersection but less than 500 feet from some possible alignments.

The largest potential impact is on historic preservation sites. Two properties are located in the southern portion of the one-quarter mile buffer listed on the NC Historic Preservation Surveyed Property List – WA2128 Knott House and WA2129 Knott House. The Survey List is for properties that have not received any form of historic designation, but have typically been plotted by the U.S. Geological Survey. These two homes are likely far enough from the intersection to avoid any impact.

The biggest potential impact is to the Wendell Boulevard National Historic District. The eastern edge of this district is very close to the intersection of US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road). Treatments at the intersection or east of the intersection would likely have no adverse impact to the historic district or any of its contributing structures. Any new alignments to the west of the intersection of US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) could potentially have an impact on the historic district. Figure 2-2 shows the main study intersection and the potential conflicts with the Wendell Boulevard Historic District and the Hazardous Substance Disposal Site.

Data Sources

The sources of the data used in this screening were: the U.S. Fish and Wildlife Service, the North Carolina Department of Environment and Natural Resources Division of Water Quality, NC OneMap, One NC Naturally, NC Green Growth Toolbox, Wake County, North Carolina Department of Transportation, and the North Carolina Historic Preservation Office. NC OneMap is an initiative of the NC Geographic Information Coordinating Council which partners with county, municipal, state, and federal data providers. One NC Naturally is resource provided through the NC Department of Environment and Natural Resources. The NC Green Growth Toolbox is provided through the NC Wildlife Resources Commission. The specific datasets analyzed are the most up to date available, but some data sources have not been updated recently or draw on less rigorous methodologies creating a need for further detailed analysis later.



Environmental Screening

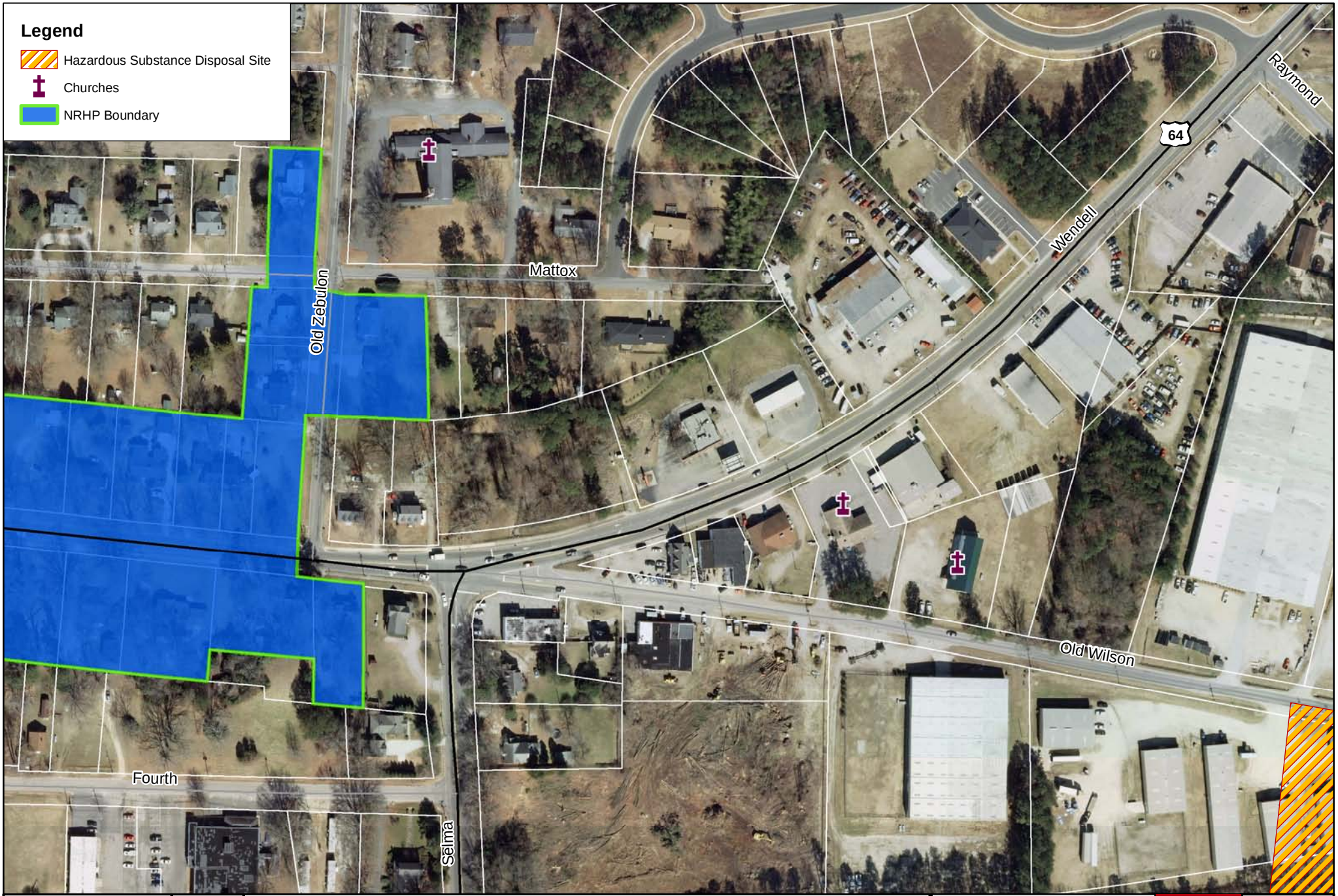
Data Sources: NCDOT; NC One Map; NCDENR-DWQ;
NC Green Growth Toolbox; NC Historic Preservation Office; One NC Naturally

Prepared by: M/A/B
Date: June 2011

Wendell Boulevard Intersection Study
Wendell, North Carolina

MARTIN ALEXIOU BRYSON

Figure 2-1



SCALE
0 50 100 200
Feet

N

Environmental Screening

Data Sources: NCDOT; NC One Map; NCDENR-DWQ;
NC Green Growth Toolbox; NC Historic Preservation Office; One NC Naturally

Prepared by: M/A/B
Date: June 2011

Wendell Boulevard
Intersection Study
Wendell, North Carolina

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Figure
2-2

2.2 ACCIDENT ANALYSIS

The accident analysis was derived from the most recent three years of available crash data obtained from the North Carolina Department of Transportation (NCDOT) and data provided by the Wendell Police Department. The data covered the period from May 1, 2008 to April 30, 2011 and is summarized in Appendix A. The summary includes accidents that were reported along US 64 Business (Wendell Boulevard) from Hollybrook Road to Raymond Drive, along SR 2353 (Old Wilson Road) from US 64 Business (Wendell Boulevard) to SR 2356 (Old Quarry Road) and NC 231 (N. Selma Road) at US 64 Business. Table 2-2 details the total number of accidents, by type, reported along the corridors and the intersection.

Table 2-2 Accident Summary

Roadway/Intersection	From/At	To	Length in miles	Angle	Object	Ran Off Road	Rear End	TOTAL
US 64 Business (Wendell Boulevard)	Hollybrook Road	Raymond Drive	0.49			2	11	**13**
SR 2353 (Old Wilson Road)	US 64 Business (Wendell Boulevard)	SR 2356 (Old Quarry Road)	0.4		2			**2**
US 64 Business (Wendell Boulevard)	at NC 231 Selma Road	-	-	1		1		**2**
TOTAL			**0.89**	**1**	**2**	**3**	**11**	**17**

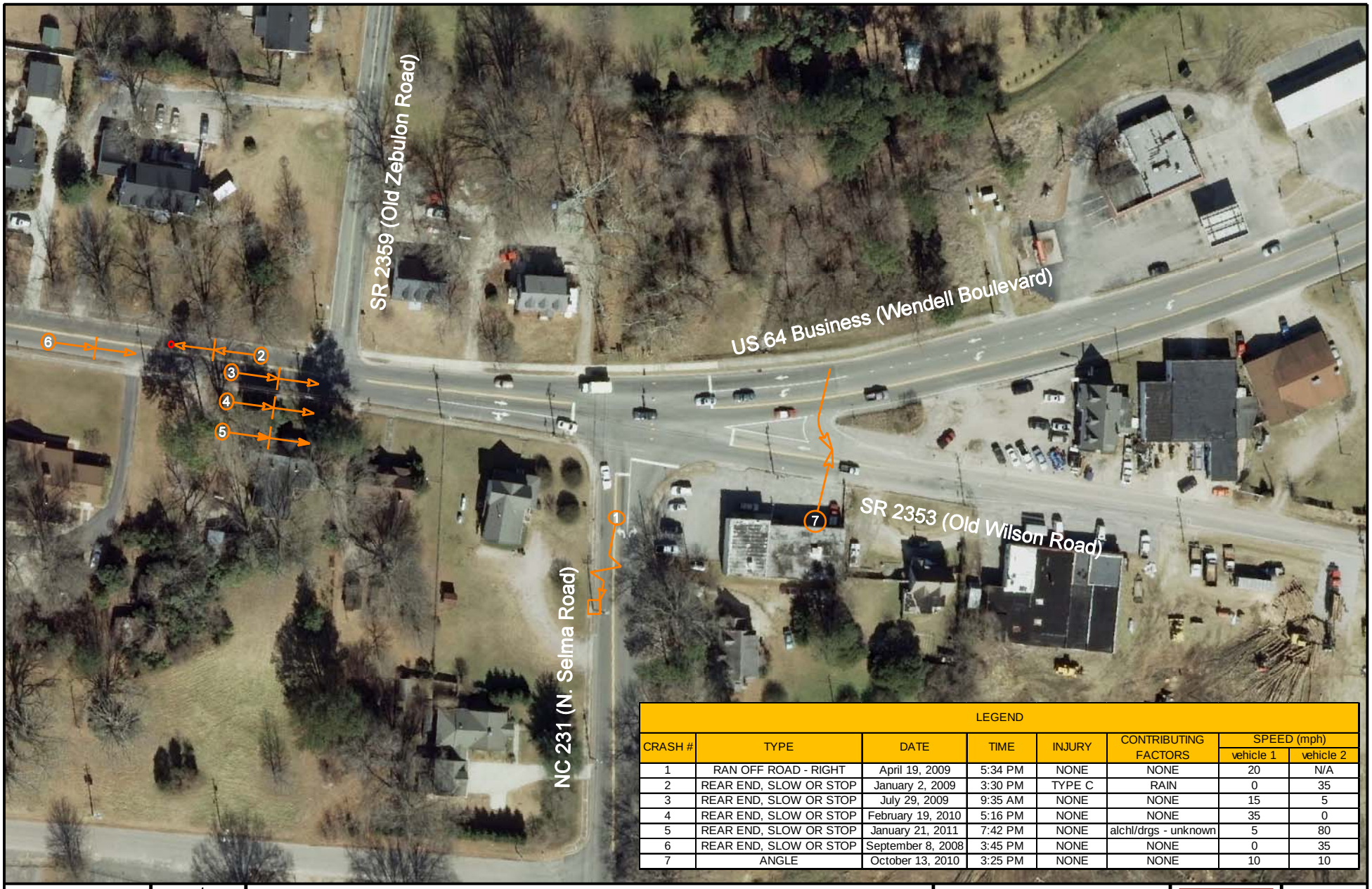
As shown in the summary table, the main accident type along the US 64 Business (Wendell Boulevard) was rear-end collisions. Rear-end collisions generally indicate overall congestion issues, as these type of accidents occur mainly in areas where there is frequent "stop and go" traffic or at traffic signals where vehicles may stop suddenly to avoid running a red light.

A comparison of crash rates for this area to average crash rates for similar facilities statewide indicates that the crash rates for this area are generally lower than statewide averages for similar facilities. Crash rates are defined by NCDOT as the number of crashes per unit of exposure. In this study, the rate for the roadway segments is the number of crashes per million of vehicle miles traveled along that section in a given year. At an intersection, the crash rate is the number of crashes per million entering vehicles in a given year. It should be noted that the examined corridor includes two facility types, a two-lane undivided section and a section of two-lanes with a continuous left-turn lane. The data received from NCDOT does not split the reported accidents between the facility types, but rather provides statistic for the segment as a whole. Thus, Table 2-3 shows the comparison of the segment as a whole against each of the two facility types' statewide averages. As shown in the comparison table, the roadway segment has lower accident rates than a two-lane facility with a continuous left-turn lane. The segment has a slightly higher wet crash rate than similar two-lane undivided facilities.

Table 2-3 Facility Type Crash Rate Comparison

Roadways	To/From	Total Crash Rate	Fatal Crash Rate	Non-Fatal Injury Crash Rate	Night Crash Rate	Wet Crash Rate
US 64 Business (Wendell Boulevard)	Hollybrook Road to Raymond Drive	158.34	0.95	44.70	39.47	29.01
Statewide Rural US Routes (2-lanes undivided)	n/a	151.02	1.78	55.37	50.88	27.54
Statewide Rural US Routes (2-lanes, cont. left-turn lane)	n/a	270.87	1.27	91.13	86.07	48.1

A crash diagram was developed for the study intersections. The primary crash type at these locations was a rear end crash in the eastbound direction along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road), accounting for four of the seven total intersection crashes. This trend is likely attributable to backups along US 64 Business (Wendell Boulevard) from the NC 231 (N. Selma Road) intersection or from queues resulting from the absence of an exclusive left-turn lane on the eastbound approach of US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road). Figure 2-3 illustrates the crashes at these intersections.



LEGEND							
CRASH #	TYPE	DATE	TIME	INJURY	CONTRIBUTING FACTORS	SPEED (mph)	
						vehicle 1	vehicle 2
1	RAN OFF ROAD - RIGHT	April 19, 2009	5:34 PM	NONE	NONE	20	N/A
2	REAR END, SLOW OR STOP	January 2, 2009	3:30 PM	TYPE C	RAIN	0	35
3	REAR END, SLOW OR STOP	July 29, 2009	9:35 AM	NONE	NONE	15	5
4	REAR END, SLOW OR STOP	February 19, 2010	5:16 PM	NONE	NONE	35	0
5	REAR END, SLOW OR STOP	January 21, 2011	7:42 PM	NONE	alchl/drgs - unknown	5	80
6	REAR END, SLOW OR STOP	September 8, 2008	3:45 PM	NONE	NONE	0	35
7	ANGLE	October 13, 2010	3:25 PM	NONE	NONE	10	10

SCALE
not to scale

CRASH DIAGRAM
5/1/2008 THROUGH 4/30/2011

Wendell Boulevard
Intersection Study
Wake County

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Figure
2-3

2.3 EXISTING ROADWAY AND TRAFFIC CONDITIONS

This section describes the existing streets in the study area. Annual Average Daily Traffic (AADT) data for the surrounding network of roads was obtained from the NCDOT. The most recent AADT counts from the NCDOT on the study area roads are for 2009, while M/A/B collected a 16-hour count at the subject intersections while school was in session.

2.3.1 Existing Roadways

US 64 Business (Wendell Boulevard)

- West of the intersection with SR 2353 (Old Wilson Road), US 64 Business (Wendell Boulevard) is a two-lane roadway with a posted speed limit of 30 miles per hour (mph) within the study area. East of the intersection with SR 2353 (Old Wilson Road), US 64 Business (Wendell Boulevard) is a three-lane roadway (two travel lanes plus a center two-way left-turn lane) with a posted speed limit of 35 mph in the study area.
- The land use along US 64 Business (Wendell Boulevard) west of SR 2353 (Old Wilson Road) is primarily residential within the study area and is primarily retail and commercial east of Old Wilson Road.
- According to the NCDOT, in 2009 the AADT along US 64 Business (Wendell Boulevard) was 11,000 vehicles per day (vpd) west of SR 2359 (Old Zebulon Road) and 7,000 vpd east of SR 2353 (Old Wilson Road). The traffic volume counted during a recent 16-hour count was 6,833 vehicles east of SR 2353 (Old Wilson Road) and 10,248 vehicles west of SR 2359 (Old Zebulon Road) and between 6:00 AM and 10:00 PM.

Looking west along Wendell Boulevard towards the intersection with Old Wilson Road and N Selma Road

Looking east along Wendell Boulevard towards the intersection with Old Wilson Road and N Selma Road

SR 2353 (Old Wilson Road)

- SR 2353 (Old Wilson Road) is a two-lane roadway with a posted speed limit of 35 mph; it intersects with US 64 Business (Wendell Boulevard) forming a very acute angle.
- The land use along SR 2353 (Old Wilson Road) is primarily industrial providing access to materials distribution centers.
- According to the NCDOT, in 2009 the AADT along the SR 2353 (Old Wilson Road) was 1,600 vpd in the vicinity of the study area. The traffic volume counted during a recent 16-hour count was 1,532 vehicles south of US 64 Business (Wendell Boulevard) between 6:00 AM and 10:00 PM.

Looking east along Old Wilson Road from the intersection with Wendell Boulevard

Looking west along Old Wilson Road towards the intersection with Wendell Boulevard

NC 231 (North Selma Road)

- NC 231 (N. Selma Road) is a three-lane road at the intersection with US 64 Business (Wendell Boulevard) – one lane outbound and two lanes inbound.
- The land use along on NC 231 (N. Selma Road) is a mix of commercial and residential.
- According to the NCDOT, in 2009 the AADT along the NC 231 (N. Selma Road) was 5,900 vpd in the study area. The traffic volume counted during a recent 16-hour count was 5,665 vehicles on NC 231 (N. Selma Road) north of US 64 Business (Wendell Boulevard) between 6:00 AM and 10:00 PM.

Looking south along North Selma Road from the intersection with Wendell Boulevard

Looking north along North Selma Road towards the intersection with Wendell Boulevard

SR 2359 (Old Zebulon Road)

- SR 2359 (Old Zebulon Road) is a two lane road with a posted speed limit of 35 mph.
- The land use along SR 2359 (Old Zebulon Road) is residential north of US 64 Business (Wendell Boulevard).
- No AADT is available from the NCDOT for this roadway, but the traffic volume from the recent 16-hour count was 1,258 vehicles on SR 2359 (Old Zebulon Road) north of US 64 Business (Wendell Boulevard) between 6:00 AM and 10:00 PM.

	
Southbound approach of Old Zebulon Road Wendell Boulevard	*Looking north along Old Zebulon Road from Wendell Boulevard*

Figure 2-4 illustrates the existing lane configurations and traffic control within the study area.

SCALE not to scale		Existing (2011) Traffic Control and Lane Configurations	Wendell Boulevard Intersection Study Wake County	MARTIN ALEXIOU BRYSON	Figure 2-4

2.3.2 Existing Turning Movement Data

Martin/Alexiou/Bryson, P.C. collected 16-hour turning movement counts for the intersections analyzed in this study in May 2011 while schools were still in session. Table 2-4 summarizes the schedule used to obtain the turning movement data. A detailed summary of the traffic count can be found in Appendix B.

Table 2-4 Weekday Turning Movement Count Schedule

Intersection	Traffic Control	Time of Data Collection	Date of Count
US 64 Business (Wendell Boulevard) at SR 2353 (Old Wilson Road)/NC 231 (N. Selma Road)	Signalized	6:00 AM – 10:00 PM	Wednesday May 18, 2011
US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)	Unsignalized	6:00 AM – 10:00 PM	Wednesday May 18, 2011

The intersection turning movement volumes were adjusted in the Existing (2011) scenario to ensure balancing along the corridor. The existing peak hour turning movement volumes are shown in Figure 2-5.

2.3.3 Existing (2011) Traffic Conditions

An intersection capacity analysis was performed for the existing conditions. In general, traffic level of service (LOS) operations are reported on a letter scale, with "A" being the best operations and "F" being the worst or failing. Typically, operations are considered acceptable if they remain at a LOS D or better during peak travel hours. Sometimes, however, unsignalized intersections may operate below LOS D during peak hours without warranting specific improvements. The reported operations at intersections describe operations during two peak hours of travel during the day, one in the AM and one in the PM. Table 2-5 provides a general description of various levels of service categories and delay ranges.

Table 2-5 Level of Service Descriptions for Intersections

Level of Service	Description	Signalized Intersection	Unsignalized Intersection
A	Little or no delay	<= 10 sec.	<= 10 sec.
B	Short traffic delay	10-20 sec.	10-15 sec.
C	Average traffic delay	20-35 sec.	15-25 sec.
D	Long traffic delay	35-55 sec.	25-35 sec.
E	Very long traffic delay	55-80 sec.	35-50 sec.
F	Unacceptable delay	> 80 sec.	> 50 sec.

In this report, levels of service for a signalized or an all-way stop intersection are reported as an overall LOS, with its lowest operating approach and subsequent LOS also listed (Example: A reported LOS of "B (WB-C)" would indicate that overall the intersection operates at a LOS B, but the individual westbound approach operates at a LOS C. This is because the overall LOS is an average of the individual approaches.). For intersections with partial stop control, levels of service

are reported based only on the LOS of their lowest operating approach (Example: A reported LOS of "(SB-D)" would indicate that the southbound approach operates at a LOS D and all other approaches operate at a higher level than this approach.

The following intersections within the study area were analyzed for AM, Noon, and PM peak hour operations:

- US 64 Business (Wendell Boulevard) at NC 231 (North Selma Road)/SR 2353 (Old Wilson Road)
- US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)

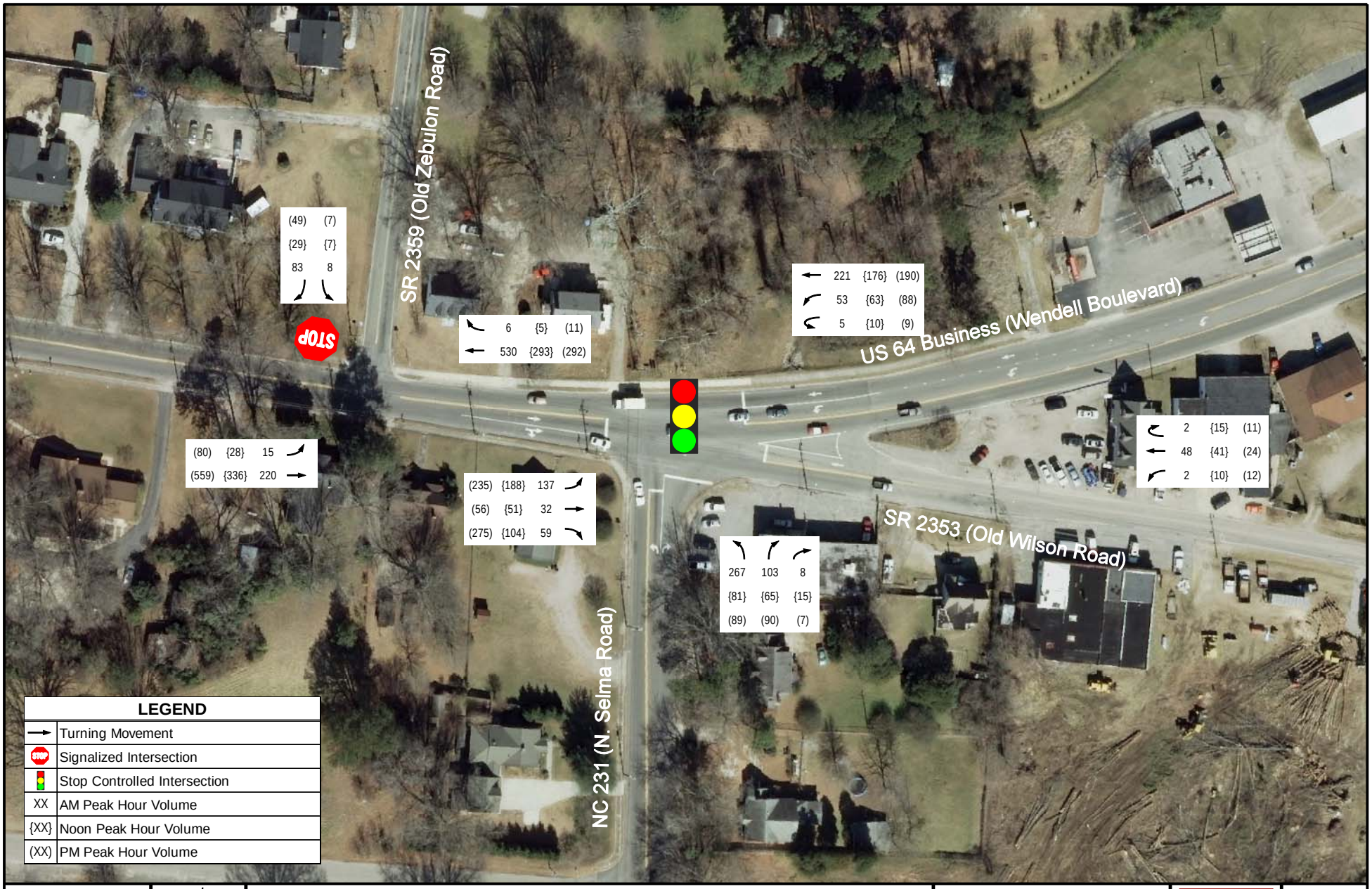
Analysis of the existing traffic volumes in the area indicate the key intersections are all operating acceptably during the peak travel periods, as shown in Table 2-6. The full capacity analysis can be found in Appendix C.

Table 2-6 Intersection LOS Summary – Existing (2011) Conditions

Intersection	Existing (2011)		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road)	C (NW-D) 29.7 sec	C (NB-C) 25.2 sec	C (NW-D) 28.6 sec
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)



SCALE
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Existing (2011) Peak Hour Turning Movement Volumes

Wendell Boulevard Intersection Study
Wake County

MARTIN ALEXIOU BRYSON

Figure 2-5

3. FUTURE VOLUME PROJECTIONS

In order to forecast future conditions within the study area, historic traffic volumes in the area and the Triangle Regional Model (TRMv4) were used to derive an annual growth rate for traffic in the study area. The derived annual growth rate was then applied to the existing traffic volumes to arrive at the future year traffic volumes.

3.1 HISTORICAL DATA

The first step in the methodology was to review historical AADT counts. Daily traffic volumes were obtained from the NCDOT from 1991-2009 as shown in Table 3-1. A trend analysis was performed for the roadways and the growth rates were determined from the historical data. Growth was calculated between the earliest AADT and the 2020 AADT extrapolated via the trend analysis as shown in Table 3-2. Historical growth rates along the area roadways peak around 1.5 percent per year. The historical data projects negative growth on NC 231 (N. Selma Road).

Table 3-1 Historic Traffic Volumes

Intersection	Route	Selected Segment	Year												
			1991	1993	1994	1995	1996	1997	1998	1999	2001	2003	2005	2007	2009
US 64 Bus (Wendell Boulevard) at Old Wilson Road and NC 231 (N. Selma Road)	Wendell Boulevard	NORTH of Wendell Boulevard and Old Wilson Road		6,100	6,300	6,500	7,400	7,300	7,500	7,700	7,800	9,100	7,100	7,800	7,000
	Old Wilson Road	EAST of Wendell Boulevard and NC 231 (North Selma Road)	1,300	1,100		1,800		2,100		2,500	880	1,200	1,200	1,800	1,600
	NC 231 (N.Selma Road)	SOUTH of Wendell Boulevard and Old Wilson Road										6,600	6,200	6,600	5,900
US 64 Bus(Wendell Boulevard) at Old Zebulon Road	Old Zebulon Road	NORTH of Wendell Boulevard										540	440	500	560
	Wendell Boulevard	WEST of Old Zebulon Road		9,100	10,000	10,000	12,000	11,000	11,000	12,000	11,000	12,000	13,000	12,000	11,000

Table 3-2 Historic AADT Growth Rates

Intersection	Route	Selected Segment	Earliest AADT	1990-2009 Extrapolation	Historic Annual Growth
			Varies	2020	
US 64 Bus (Wendell Boulevard) at Old Wilson Road and NC 231 (N. Selma Road)	Wendell Boulevard	NORTH of Wendell Boulevard and Old Wilson Road	6,100	8,800	**1.37%**
	Old Wilson Road	EAST of Wendell Boulevard and NC 231 (North Selma Road)	1,300	1,600	**0.72%**
	NC 231 (N.Selma Road)	SOUTH of Wendell Boulevard and Old Wilson Road	6,600	5,200	**-1.39%**
US 64 Bus(Wendell Boulevard) at Old Zebulon Road	Old Zebulon Road	NORTH of Wendell Boulevard	-	-	**-**
	Wendell Boulevard	WEST of Old Zebulon Road	9,100	13,800	**1.55%**

3.2 MODEL DATA

The next step involved analyzing model volumes for 2005, 2015, and 2035 as extracted from the Triangle Regional Model (TRM). The 2015 and 2035 models are fiscally-constrained for the area, meaning they include projects documented in the 2035 Joint Long-Range Transportation Plan (LRTP) for the Capital Area Metropolitan Planning Organization (CAMPO) and the Durham-Chapel Hill-Carrboro (DCHC MPO). Using output extracted from the 2005 and 2035 models, volumes were interpolated to yield 2020 volumes. The same interpolation process was completed using output from the 2015 and 2035 models. Growth rates for each process were compared against one another. The growth rate developed from the 2005-2035 interpolation ranged from 3.5-4 percent per year along Wendell Boulevard while the 2005-2015 interpolated growth rate centered around 4.5 percent per year along Wendell Boulevard. All growth rates resulting from the review of outputs form the TRM are shown in the Table 3-3.

Table 3-3 Model Derived Growth Rates

Intersection	Route	Selected Segment	2005 Base Year Model		2015 Intermediate Year Model		2035 Future Year Model		2020 Interpolated Results Between 2005-2035		2020 Interpolated Results Between 2015-2035	
			AADT	Model	Model	Growth Rate	Model	Growth Rate	Model	Growth Rate	Model	Growth Rate
US 64 Bus (Wendell Boulevard) at Old Wilson Road and NC 231 (N. Selma Road)	Wendell Boulevard	NORTH of Wendell Boulevard and Old Wilson Road	7,100	4,859	8,134	5.29%	12,207	3.12%	8,533	3.83%	9,152	4.31%
	Old Wilson Road	EAST of Wendell Boulevard and NC 231 (North Selma Road)	1,200	1,459	4,195	11.14%	5,376	4.44%	3,418	5.84%	4,490	7.78%
	NC 231 (N.Selma Road)	SOUTH of Wendell Boulevard and Old Wilson Road	6,200	4,583	6,566	3.66%	8,169	1.95%	6,376	2.23%	6,967	2.83%
	Wendell Boulevard	WEST of Wendell Boulevard and NC 231 (North Selma Road)	-	6,741	12,472	6.35%	16,144	2.95%	11,443	3.59%	13,390	4.68%
US 64 Bus(Wendell Boulevard) at Old Zebulon Road	Old Zebulon Road	NORTH of Wendell Boulevard	440	-	-	-	-	-	-	-	-	-
	Wendell Boulevard	EAST of Old Zebulon Road	-	6,741	12,472	6.35%	16,144	2.95%	11,443	3.59%	13,390	4.68%
	Wendell Boulevard	WEST of Old Zebulon Road	13,000	6,741	12,472	6.35%	16,144	2.95%	11,443	3.59%	13,390	4.68%

3.3 COMPARISON

The final step in the methodology was to compare the resulting growth rates from the review of the historical AADTs and the review of the TRM outputs. The model data shows higher growth rates than the historical data. Several factors could contribute to this including how centroid connectors are loading onto the network and loading assignments. It is difficult to speculate without conducting detailed analysis on the sub-area. The major roadways along US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) are under assigning trips in the 2005 base year. However, the 30-year projected growth on those roadways hover around two-percent to three-percent per year.

Taking all of this into consideration, the derived historical growth rates and the derived model growth rates were averaged. Any growth rates less than one-percent per year were raised to one-percent per year. The selected growth rates by roadway segment are displayed in Table 3-4. The growth rate for the area is selected as 2.75 percent per year. This growth rate was applied globally to the turning movement volumes from year 2011 to estimate the peak period turning movement volumes for year 2020.

Table 3-4 Derived Growth Rates Comparison

Intersection	Route	Selected Segment	Growth Rates				
			Derived from Historical Data	Derived from Historical Data (Adjusted for 1% cap)	Derived from 2020 Interpolated 2005 and 2035	Derived from 2020 Interpolated 2015 and 2035	Selected Growth Rate
US 64 Bus (Wendell Boulevard) at Old Wilson Road and NC 231 (N. Selma Road)	Wendell Boulevard	NORTH of Wendell Boulevard and Old Wilson Road	1.37%	1.37%	3.83%	4.31%	**2.75%**
	Old Wilson Road	EAST of Wendell Boulevard and NC 231 (North Selma Road)	0.72%	1.00%	5.84%	7.78%	**3.75%**
	NC 231 (N.Selma Road)	SOUTH of Wendell Boulevard and Old Wilson Road	-1.39%	1.00%	2.23%	2.83%	**1.25%**
	Wendell Boulevard	WEST of Wendell Boulevard and NC 231 (North Selma Road)	-	-	3.59%	4.68%	**4.25%**
US 64 Bus(Wendell Boulevard) at Old Zebulon Road	Old Zebulon Road	NORTH of Wendell Boulevard	-	-	-	-	**1.25%**
	Wendell Boulevard	EAST of Old Zebulon Road	-	-	3.59%	4.68%	**4.25%**
	Wendell Boulevard	WEST of Old Zebulon Road	1.55%	1.55%	3.59%	4.68%	**2.75%**

4. CONCEPTUAL DESIGNS

Conceptual designs for five improvement alternatives were developed, which are discussed below. Additionally, this section will address any specific environmental concerns associated with each alternative. The future year conditions for the improvement alternatives included the following:

- **2020 Build Alternative 1** – This alternative includes the construction of a roundabout at the intersection of US 64 Business (Wendell Boulevard) at SR 2353 (Old Wilson Road) and NC 231 (N. Selma Road). The roundabout would continue all traffic movements that are provided by the existing intersection.
- **2020 Build Alternative 2** – This alternative includes the closure of Old Wilson Road at the intersection with US 64 Business (Wendell Boulevard), resulting in a T-intersection of US 64 Business (Wendell Boulevard) with NC 231 (N. Selma Road). This alternative also includes the construction of a new connector street east of the intersection of US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) to provide access between SR 2353 (Old Wilson Road) and US 64 Business (Wendell Boulevard). Additionally, it includes the construction of a left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) and restriping the existing pavement along US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) to accommodate a through lane and exclusive right-turn lane.
- **2020 Build Alternative 3** – This alternative includes the closure of SR 2353 (Old Wilson Road) at the intersection with US 64 Business (Wendell Boulevard), the construction of a new connector street east of the intersection of US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road), and the relocation of NC 231 (N. Selma Road) and SR 2359 (Old Zebulon Road) to form a four-approach intersection with US 64 Business (Wendell Boulevard). Additionally, it includes the restriping and widening the eastbound approach of US 64 Business (Wendell Boulevard) at the relocated SR 2359 (Old Zebulon Road) to accommodate a left-turn, through, and right-turn lane.
- **2020 Build Alternative 4A** – This alternative includes the closing of SR 2353 (Old Wilson Road), resulting in a T-intersection of US 64 Business (Wendell Boulevard) with NC 231 (N. Selma Road) and a realignment of SR 2353 (Old Wilson Road). Alternative 4A realigns SR 2353 (Old Wilson Road) such that the westbound traffic along SR 2353 (Old Wilson Road) maintains free flow to US 64 Business (Wendell Boulevard) and the eastbound movements operate under stop control. Additionally, it includes the construction of a left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) and restriping the existing pavement along US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) to accommodate a through lane and exclusive right-turn lane.
- **2020 Build Alternative 4B** – This alternative is identical to Alternative 4A except in this alternative SR 2359 (Old Zebulon Road) is relocated to form a fourth leg of the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. NC 231 (N. Selma Road) is not realigned. Additionally, it includes the restriping and widening the eastbound approach of US 64 Business (Wendell Boulevard) at the relocated SR 2359 (Old Zebulon Road) to accommodate a left-turn, through, and right-turn lane.
- **2020 Build Alternative 5A** – This alternative is identical to Alternative 4A with the exception of the implementation of a three-legged roundabout at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection as opposed to a conventional T-intersection. Alternative 5A realigns SR 2353 (Old Wilson Road) such that

the westbound traffic along SR 2353 (Old Wilson Road) maintains free flow to US 64 Business (Wendell Boulevard) and the eastbound movements operate under stop control.

- **2020 Build Alternative 5B** – This alternative is identical to Alternative 5A except in this alternative SR 2359 (Old Zebulon Road) is relocated to form a fourth leg of the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. NC 231 (N. Selma Road) is not realigned.

4.1 ROADWAY IMPROVEMENTS – ALTERNATIVE 1

Geometric Improvements

Alternative 1 includes the following geometric improvements, as shown in Figure 4-1:

- Construction of a single-lane roundabout at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road) intersection
- Realignment of US 64 Business (Wendell Boulevard) westbound approach such that it becomes the southbound leg of the roundabout
- Construct an eastbound left-turn along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)

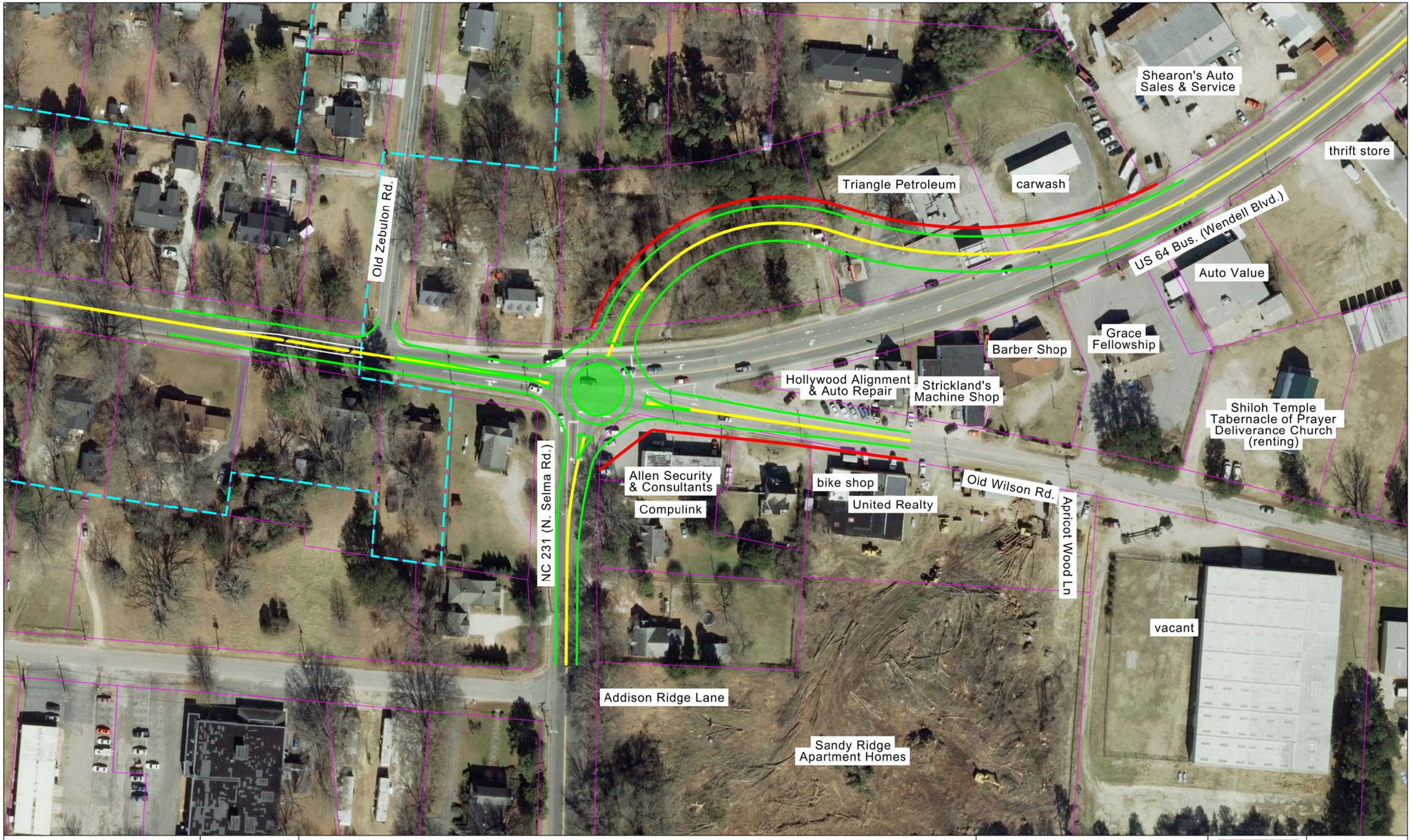
Impact Evaluation

The impacts of this alternative occur primarily in the northeast and southeast quadrants of the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. The implementation of a roundabout at this location will alter the access to the existing Allen Security and Consultants as the concrete islands associated with the roundabout would naturally prohibit left-turns onto US 64 Business (Wendell Boulevard) from this parcel. Additionally, the orientation of the roundabout will cause a small portion of the parcel to be taken for construction.

Impacts will also be made to the existing gas station located along the north side of US 64 Business (Wendell Boulevard). In order to bring the westbound US 64 Business (Wendell Boulevard) approach into the roundabout at an acceptable angle, the roadway will sweep north of the existing pavement, primarily into a vacant parcel; however, the new roadway will also impact the existing Triangle Petroleum gas station building as well as the pump canopy. It is likely that this alignment would require a taking of the gas station property and exploration into underground storage tanks will be required. Additionally, a small portion of the parcel to the east of the gas station, which is currently a car wash, would be impacted; however, it is unlikely that this impact will result in a taking of that property.

The realignment of the US 64 Business (Wendell Boulevard) westbound approach may require substantial earthwork given the existing elevation of the vacant parcel. No perennial streams are apparent in this area; however, there is a small pipe with substantial reinforcement measures (rip rap) surrounding it, although there are no apparent streams or other water features in this area. A stormwater study exploring this pipe and any other water features in this area would be required.

Additionally, the realignment of US 64 Business (Wendell Boulevard) would likely result in a reduction in the posted speed limit along the westbound leg. In order to accommodate the preferred design vehicle and meet geometric standards, the curvature of the realignment would result in a posted speed limit of 25 miles per hour (mph). The current speed limit along this roadway is 35 mph.



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Conceptual Design - Alternative 1
Roundabout

Prepared by: M/A/B
Date:

Wendell Boulevard
Intersection Study
Wake County

MARTIN ALEXIOU BRYSON

Figure
4-1

The recommended eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) will require additional pavement width and new curb and gutter; however, the extra lane can be constructed without disrupting the existing sidewalks.

This alternative would likely require the acquisition of two parcels, one which is currently vacant and another with a business on site. There are no residential displacements expected from this alignment.

General Comments

This alternative generally maintains the existing roadway configurations, allowing a connection of SR 2353 (Old Wilson Road) at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. There is potential for the discovery of in-depth environmental issues surrounding the underground storage tanks (USTs) of the gas station. This alternative would help make the movement from US 64 Business (Wendell Boulevard) SR 2353 (Old Wilson Road) to EB US 64 Business (Wendell Boulevard) easier due to the realignment of US 64 Business (Wendell Boulevard).

The construction of a roundabout is typically more expensive than a conventional signalized intersection. This alternative also requires the acquisition of multiple parcels and a business, which may be costly.

4.2 ROADWAY IMPROVEMENTS – ALTERNATIVE 2

Geometric Improvements

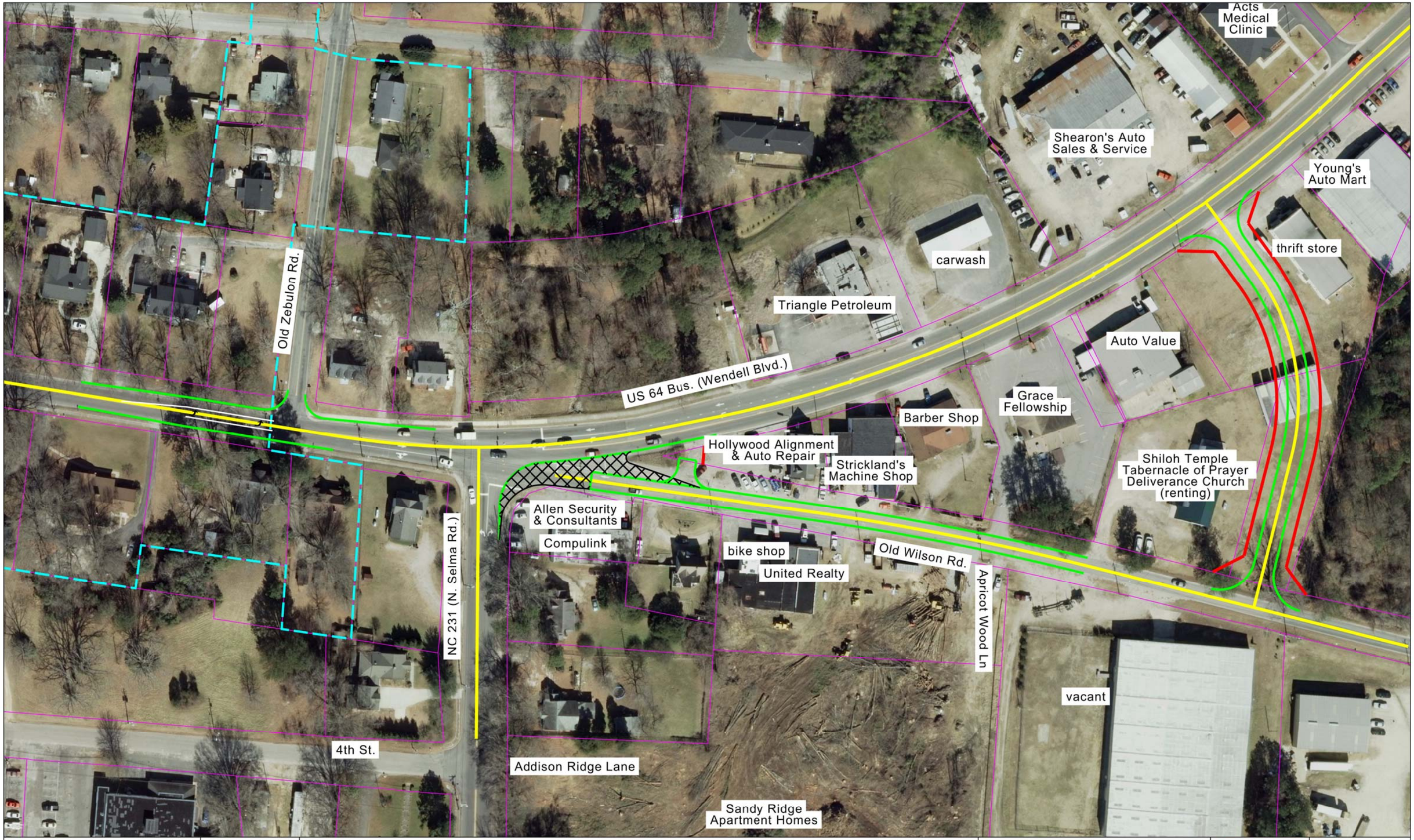
Alternative 2 includes the following geometric improvements, as shown in Figure 4-2:

- Construction of a new two-lane section connecting the existing SR 2353 (Old Wilson Road) to US 64 Business (Wendell Boulevard)
- Removing the existing connection at US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road)
- Construct an eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)
- Restripe eastbound approach of US 64 (Wendell Boulevard) at NC 231 (N. Selma Road) to accommodate a single through lane and exclusive right-turn lane

Impact Evaluation

The greatest impact of this alternative results from the new connector between US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road). This connector would create a roadway on new location that would require the acquisition of two parcels. One of these parcels is vacant, while another has a thrift store located on the parcel. The new connector will require the acquisition of a substantial portion of this parcel; however, the roadway is not projected to impact the retail building. Thus, no displacements would result from this alternative. It should be noted that the aerial image used as a base map for the conceptual designs shows a set of seven tractor trailers in the path of the new connector roadway. Field observations indicate that these trailers have been removed and are no longer in the path of the connector roadway.

Due to the removal of the existing connection of US 64 Business (Wendell Boulevard) to SR 2353 (Old Wilson Road) the access to the Allen Security and Consultants business would be altered. It is likely that the driveway for this parcel would be shifted to the east and all vehicles would use the new connector roadway to access US 64 Business (Wendell Boulevard).



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Conceptual Design - Alternative 2
T intersection

Prepared by: M/A/B
Date:

Wendell Boulevard
Intersection Study
Wake County

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Figure
4-2

The recommended eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) will require additional pavement width and new curb and gutter; however, the extra lane can be constructed without disrupting the existing sidewalks.

General Comments

This alternative is the least impact intensive alternative that provides a new connection between US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road). The recommended left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road) can be constructed within the existing right of way and there are no construction improvements recommended at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection.

This alternative would also be one of the less costly alternatives as there are minimal impacts to parcels and the least amount of new roadway.

4.3 ROADWAY IMPROVEMENTS – ALTERNATIVE 3

Geometric Improvements

Alternative 3 includes the following geometric improvements, as shown in Figure 4-3:

- Relocation of existing NC 231 (N. Selma Road) and SR 2359 (Old Zebulon Road) to form a four-legged intersection with US 64 Business (Wendell Boulevard)
- Removing the existing connection at US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road)
- Construction of a new two-lane section connecting the existing SR 2353 (Old Wilson Road) to US 64 Business (Wendell Boulevard)
- Restripe eastbound approach of US 64 (Wendell Boulevard) at NC 231 (N. Selma Road) to accommodate a single through lane and an exclusive left-turn lane. Construct an exclusive right-turn lane on this approach as well.

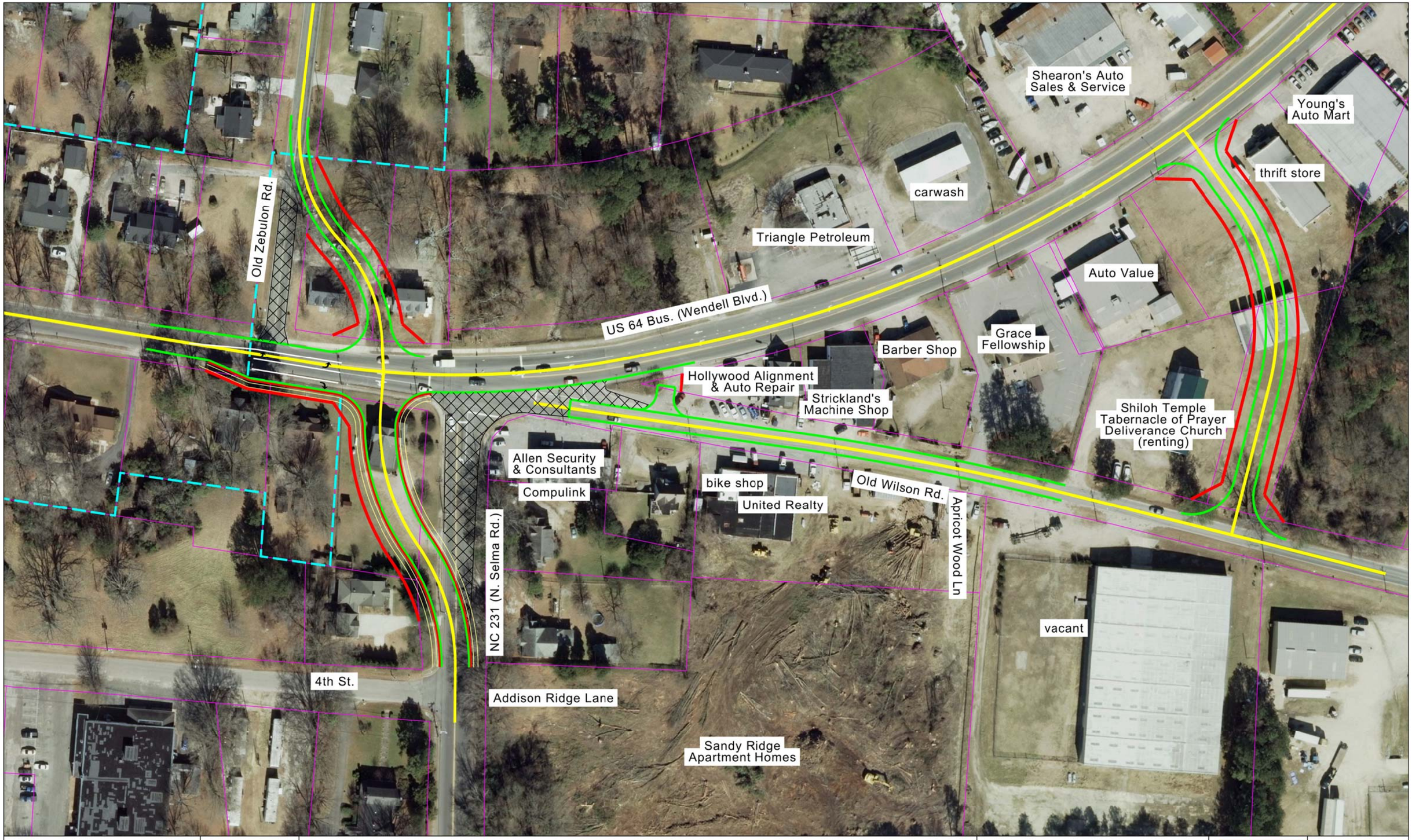
Impact Evaluation

This alternative includes a larger amount of new roadway due to the relocation of NC 231 (N. Selma Road) and SR 2359 (Old Zebulon Road). This alternative also includes the construction of a new two-lane connector between US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road).

The relocation of SR 2359 (Old Zebulon Road) will have a major impact on two parcels, both of which have residences on them. The proposed relocation on this approach would result in the taking of both residences. A small portion of a third parcel would also be impacted by the alignment. Although, this impact is very minor, it should be noted that this parcel is located within the Wendell Boulevard National Historic District.

The relocation of NC 231 (N. Selma Road) will have a major impact on one parcel, which has a residence on it. The proposed relocation on this approach would result in the taking of this residence. A small portion of a parcel fronting NC 231 (N. Selma Road) would also be impacted by the alignment; however, this impact is very minor.

In order to minimize overall impacts of these relocations, specifically to structures within the historic district, the curvatures of the road are decreased, resulting in a localized reduction in the speed limit on both realigned approaches. The speed limit on SR 2359 (Old Zebulon Road) would



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Conceptual Design - Alternative 3
4 legged Intersection and Realigned Old Wilson Rd.

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Date:

Wendell Boulevard
Intersection Study
Wake County

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Figure
4-3

be reduced from 35 miles per hour (mph) to 20 mph. The speed limit on NC 231 (N. Selma Road) would be reduced from 35 mph to 25 mph.

In order to accommodate the recommended three-lane approach on eastbound US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road), some widening will be required on the south side of US 64 Business (Wendell Boulevard). This widening will be relatively minor, but the reconstructed sidewalk and ROW lines would encroach slightly onto a property that is within the Wendell Boulevard National Historic District.

As in previously discussed alternatives, the closure of SR 2353 (Old Wilson Road) will result in altered access to the Allen Securities and Consultants business. It is likely that the driveway for this parcel would be shifted to the east and all vehicles would use the new connector roadway to access US 64 Business (Wendell Boulevard).

Another impact of this alternative results from the new connector between US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road). This connector would create a roadway on new location that would require the acquisition of two parcels. One of these parcels is vacant, while another has a thrift store located on the parcel. The new connector will require the acquisition of a substantial portion of this parcel; however, the roadway is not projected to impact the retail building. Thus, no displacements would result from this new connector. It should be noted that the aerial image used as a base map for the conceptual designs shows a set of seven tractor trailers in the path of the new connector roadway. Field observations indicate that these trailers have been removed and are no longer in the path of the connector roadway.

General Comments

This alternative is one of the more impact intensive alternatives and would thus be one of the more costly alternatives; however, the recommended improvements of Alternative 3 address all of the existing issues of the study area.

This alternative involves the most property acquisitions and residential relocations due to the relocation of both SR 2359 (Old Zebulon Road) and NC 231 (N. Selma Road). Additionally, the relocations of these roadways would have minor impacts on two different parts of the historic district, although these impacts are considered to be minor and would not impact any contributing factors to the district.

4.4 ROADWAY IMPROVEMENTS – ALTERNATIVE 4

Geometric Improvements

Alternative 4 includes two scenarios, a short-term and an ultimate configuration for the US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection. The geometric improvements for this alternative, as shown in Figure 4-4, include:

Alternative 4A

- Closure of the existing connection between SR 2353 (Old Wilson Road) and US 64 Business (Wendell Boulevard); Construction of a turn-around on the western extent of SR 2353 (Old Wilson Road)
- Realignment of SR 2353 (Old Wilson Road) such that it connects to US 64 Business (Wendell Boulevard) approximately 800 feet east of the existing intersection, allowing the westbound movement to operate under free flow; eastbound SR 2353 (Old Wilson Road) will form a T-intersection with the realigned segment

- Construction of an eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)
- Restripe eastbound approach of US 64 (Wendell Boulevard) at NC 231 (N. Selma Road) to accommodate a single through lane and exclusive right-turn lane

Alternative 4B

- Closure of the existing connection between SR 2353 (Old Wilson Road) and US 64 Business (Wendell Boulevard); Construction of a turn-around on the western extent of SR 2353 (Old Wilson Road)
- Realignment of SR 2353 (Old Wilson Road) such that it connects to US 64 Business (Wendell Boulevard) approximately 800 feet east of the existing intersection, allowing the westbound movement to operate under free flow; eastbound SR 2353 (Old Wilson Road) will form a T-intersection with the realigned segment
- Relocation of SR 2359 (Old Zebulon Road) such that it forms the northern leg of the US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection
- Restripe eastbound approach of US 64 (Wendell Boulevard) at NC 231 (N. Selma Road)/Realigned SR 2359 (Old Zebulon Road) to accommodate a single through lane and an exclusive left-turn lane. Construct an exclusive right-turn lane on this approach as well

Impact Evaluation

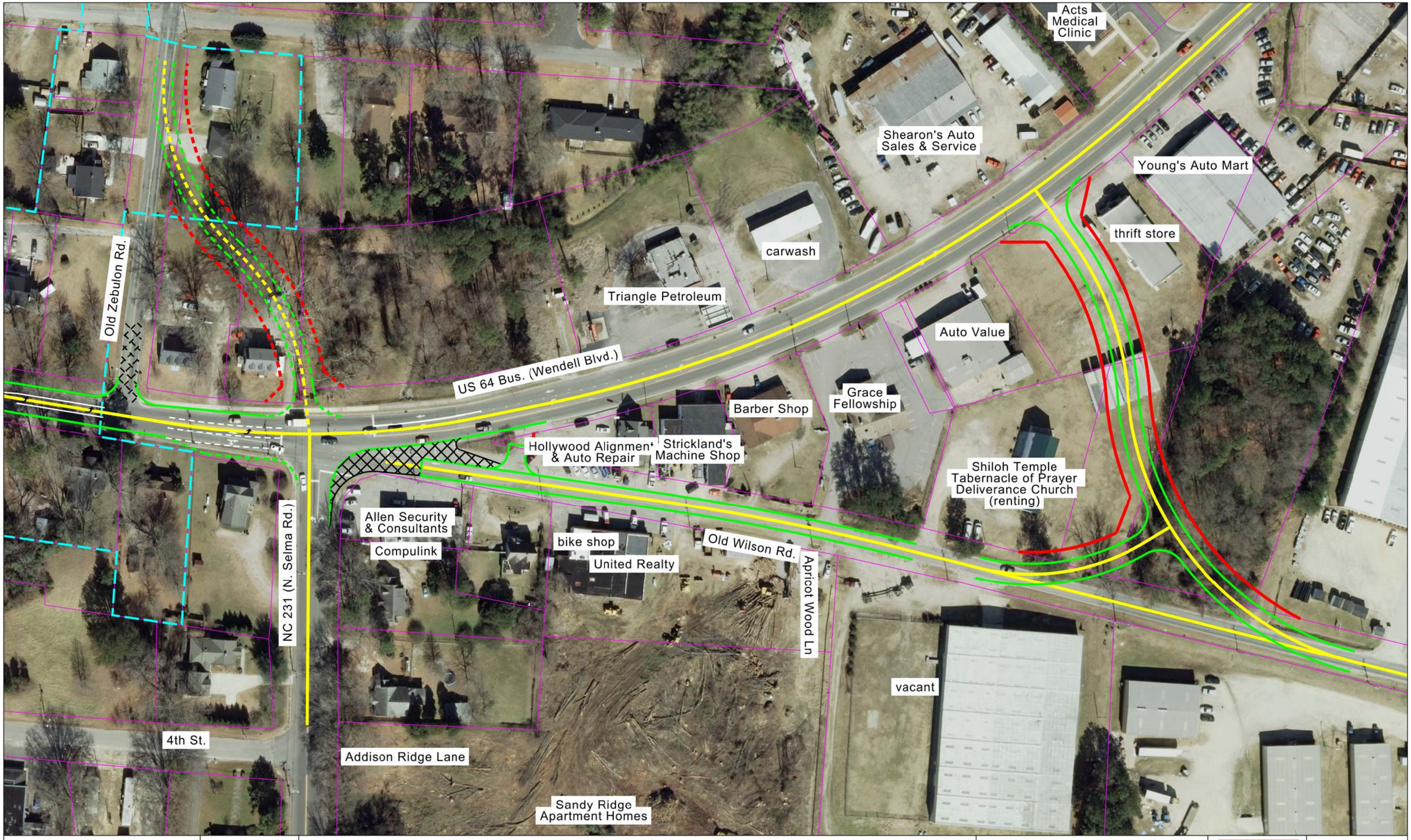
This alternative includes a larger amount of new roadway due to the construction of a new two-lane connector between US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road). Under the Alternative 4B alternative, there is also additional new roadway as part of the SR 2359 (Old Zebulon Road) relocation.

The new connector, which is present in both versions of this alternative, includes realigning SR 2353 (Old Wilson Road) such that the westbound movement maintains free flow until it intersects with US 64 Business (Wendell Boulevard). This is a different configuration than presented in Alternatives 2 and 3 and requires additional new pavement and ROW to accommodate the new T-intersection of the existing SR 2353 (Old Wilson Road) and the realigned segment. This realignment will impact the same parcels as the original connector, including the parcel with a thrift shop and, in addition, will have minor impacts to three other parcels along SR 2353 (Old Wilson Road). It is not projected, however, that this realignment will require the taking of any businesses or residences. It should be noted that the aerial image used as a base map for the conceptual designs shows a set of seven tractor trailers in the path of the new connector roadway. Field observations indicate that these trailers have been removed and are no longer in the path of the connector roadway.

Under both scenarios of Alternative 4, the closure of SR 2353 (Old Wilson Road) will result in altered access to the Allen Securities and Consultants business. It is likely that the driveway for this parcel would be shifted to the east and all vehicles would use the new connector roadway to access US 64 Business (Wendell Boulevard).

Under Alternative 4A conditions, there are no additional impacts to parcels as the recommended left turn lane at SR 2359 (Old Zebulon Road) can be implemented within the existing ROW and implementing the right-turn lane at NC 231 (N. Selma Road) is a restriping effort.

Under Alternative 4B conditions, however, there are some impacts associated with the relocation of SR 2359 (Old Zebulon Road). Primarily, the impacts are to the three parcels in the northeast quadrant of the realigned intersection. The parcel fronting SR 2359 (Old Zebulon Road), which is



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Conceptual Design - Alternative 4
T-intersection and Future 4-legged Intersection with
Free Flow Alternative on Old Wilson Road

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Date:

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Figure
4-4

within the Wendell Boulevard National Historic District, will be moderately impacted as the realigned roadway infringes upon the existing driveway. The alignment would not likely result in a taking of either structure on this parcel; however, reconfigured driveway access to SR 2359 (Old Zebulon Road) would be required. The parcel fronting US 64 Business (Wendell Boulevard) just east of the existing SR 2359 (Old Zebulon Road) will be impacted by the alignment in the northeast corner of the parcel. The roadway would not require a taking of the existing residential structure, only a reconfiguration of the parcel's access to SR 2359 (Old Zebulon Road). The other parcel along US 64 Business (Wendell Boulevard) would require a taking of the property and residence. There will also be a minor impact to the existing vacant lot along US 64 Business (Wendell Boulevard).

In order to minimize overall impacts of the relocation, specifically to the structures within the historic district, the curvature of the road is decreased. To safely accommodate these curves, the speed limit on SR 2359 (Old Zebulon Road) would be reduced. Currently the speed limit is posted at 35 mph; the reduced speed limit would be posted at 25 mph and can be limited to the affected blocks.

Also under the Alternative 4B conditions, the recommended right-turn lane along US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) would require widening along the south side of the roadway. This widening would be minor and is not projected to impact any structures or the property that is within the historic district.

General Comments

This alternative provides an effective and efficient solution to the transportation issues within the study area; however, a relatively high cost is associated with implementing all parts of this alternative.

This alternative presents a different configuration for the new connector roadway that allows uninterrupted flow for the major movements along SR 2353 (Old Wilson Road). Although this requires slightly more new roadway than the original connector, this configuration is more efficient.

Alternative 4B includes the relocation of SR 2359 (Old Zebulon Road) which will require some parcel acquisition and most likely a residential displacement; however, by not realigning NC 231 (N. Selma Road), the overall impact is less than that of Alternative 3.

The cost of implementing this alternative would likely be higher than the less intensive Alternative 2 option; however, it would be less than Alternative 3 and would more effectively improve geometric issues in the area.

4.5 ROADWAY IMPROVEMENTS – ALTERNATIVE 5

Geometric Improvements

Alternative 5 includes two scenarios, a short-term and an ultimate configuration for the US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection. The geometric improvements for this alternative are identical to those described in Alternative 4 with the implementation of a roundabout instead of a conventional signalized intersection, as shown in Figure 4-5.

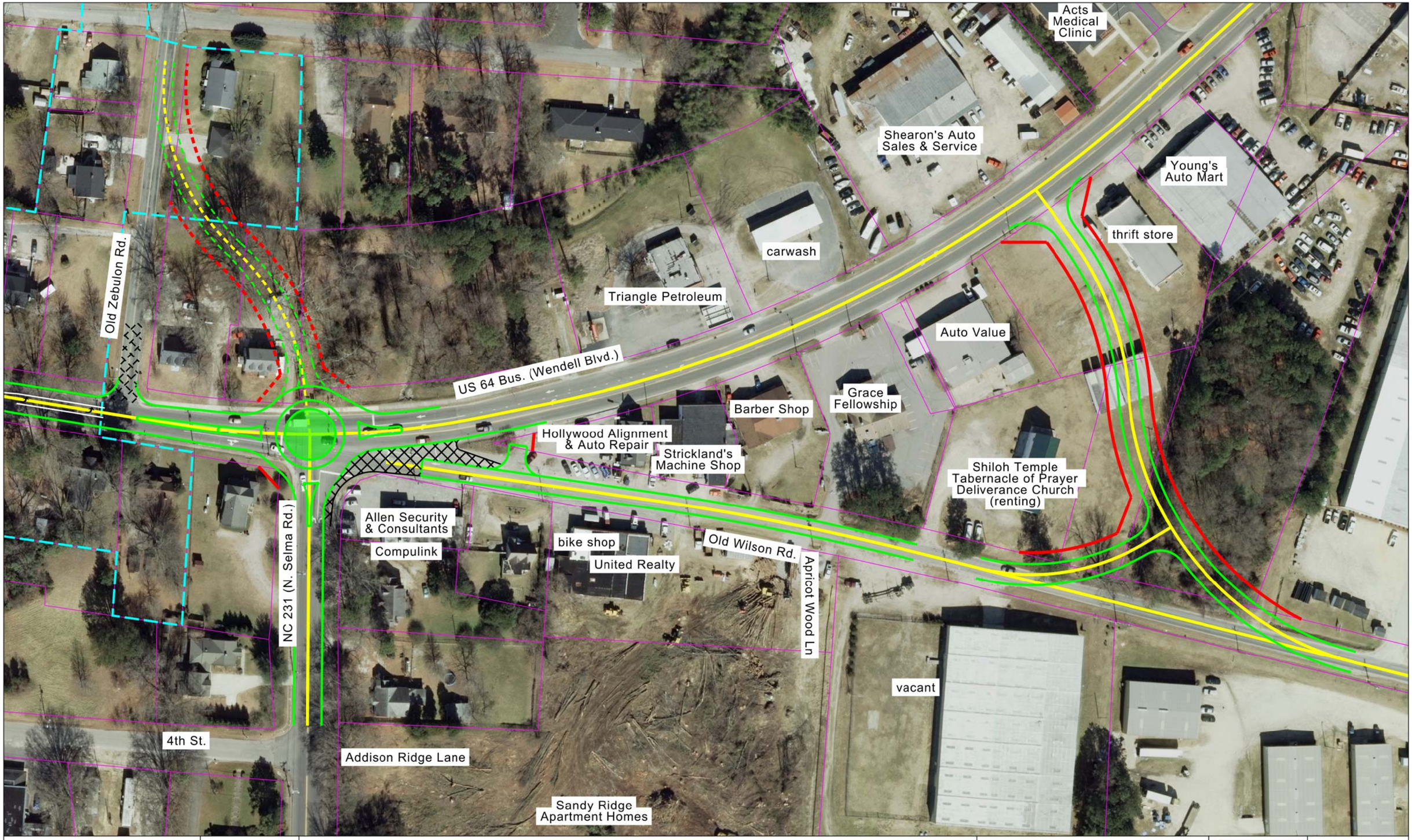
Impact Evaluation

The impacts associated with this alternative are very similar to those described for Alternative 4. The construction of a roundabout instead of a conventional intersection at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection will require some additional ROW due to the geometry of a roundabout, but no additional relocations would be required

The impacts on displacements, changes in access, and speed limits will be the same as those described in Alternative 4.

General Comments

Alternative 5 has the same benefits and drawbacks as Alternative 4, with the exception of the roundabout. The roundabout would likely be more expensive to implement than a typical signalized intersection; however, it has added aesthetic value as well as capacity benefits. If the cost of a roundabout at this location is too high at the current time, the implementation can come as a later phase of the Alternative 4 concept.



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Conceptual Design - Alternative 5
Roundabout with Future 4th leg and
Free Flow Alternative Old Wilson Road

Prepared by: M/A/B
Date:

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Intersection Study
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Figure
4-5

5. CAPACITY ANALYSIS OF FUTURE YEAR SCENARIOS

An intersection capacity analysis was performed for each of the future year alternatives. Intersection capacity analyses were conducted for the AM, Noon, and PM peak hours. The intersection level capacity analysis was completed using the *Synchro/SimTraffic, Version 7* software package. Roundabout analysis was completed using *Sidra 5.0* software. The results for each scenario are summarized below, and the detailed software output can be found in Appendix C. The geometry analyzed in each alternative reflects the proposed intersection improvements for that scenario, meaning that the reported LOS reflects the improved conditions at each intersection.

Table 5-1 summarizes the alternatives and their respective improvements as discussed in Chapter 4. These configurations were included in the future year capacity analyses.

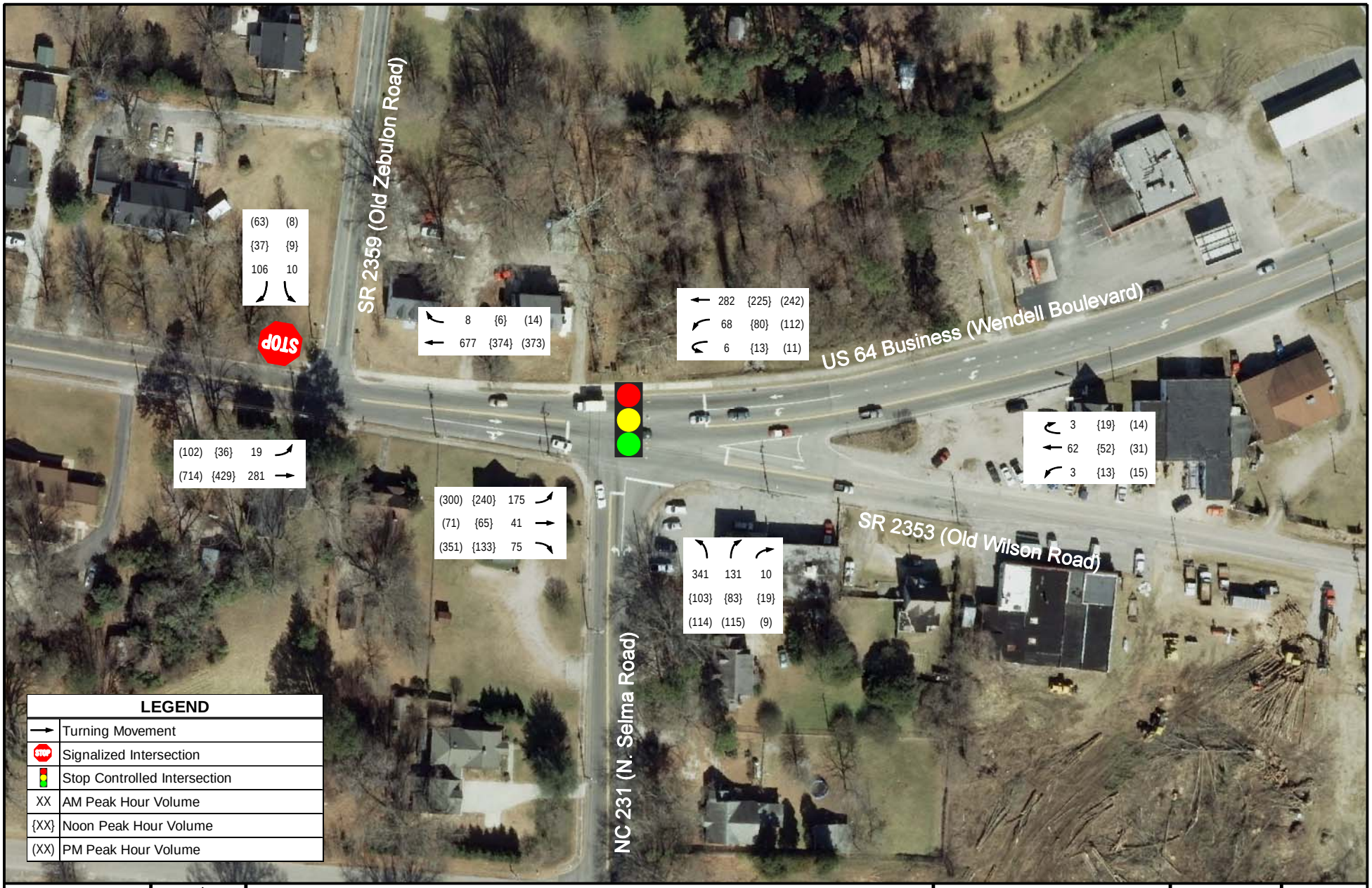
Table 5-1 Alternatives Improvement Summary

Improvement/Alternative	1	2	3	4A	4B	5A	5B
Roundabout	✓					✓	✓
Realign US 64 Business (Wendell Boulevard)	✓						
Construct eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)	✓	✓	✓	✓	✓		
Construct eastbound right-turn lane along US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road)			✓		✓		
Closure of SR 2353 (Old Wilson Road)		✓	✓	✓	✓	✓	✓
New Connection for SR 2353 (Old Wilson Road)		✓	✓				
Realignment of SR 2353 (Old Wilson Road) to connect with US 64 Business (Wendell Boulevard)				✓	✓	✓	✓
Relocation of NC 231 (N. Selma Road)			✓				
Relocation of SR 2359 (Old Zebulon Road)			✓		✓		✓

5.1 NO-BUILD (2020) CONDITIONS

No-Build (2020) Alternative assumes the existing intersection geometry and roadway alignments remain unchanged in year 2020. The volumes used in this alternative analysis are shown in Figure 5-1.

As shown in Table 5-2, the peak hour operations at both the study area intersections are all expected to remain acceptable.



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No-Build (2020) Peak Hour Turning Movement Volumes

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Wake County

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Figure 5-1

Table 5-2 Intersection LOS Summary – No-Build (2020)

Intersection	No-Build (2020)		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road)	C (NW-D) 31.8 sec	C (NB-D) 27.6 sec	C (NW-D) 31.6 sec
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

5.2 BUILD (2020) ALTERNATIVE 1 CONDITIONS

The Build (2020) Alternative 1 includes the construction of a roundabout at the intersection of US 64 Business (Wendell Boulevard) at SR 2353 (Old Wilson Road) and NC 231 (N. Selma Road). The volumes used in this alternative analysis are shown in Figure 5-2.

As shown in Table 5-3, the peak hour operations at both the study area intersections are all expected to remain acceptable under Alternative 1, given the recommended geometric improvements.

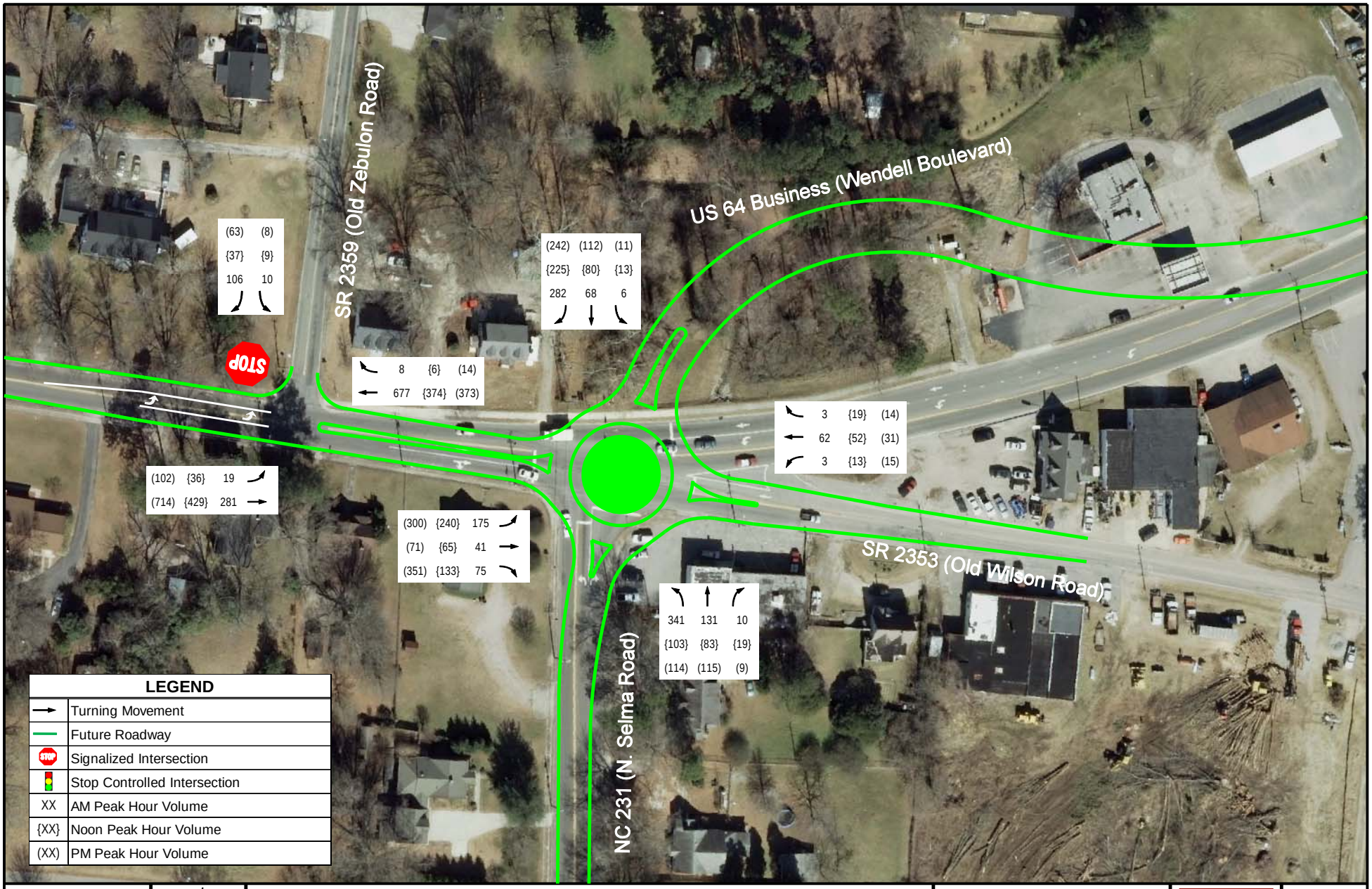
Table 5-3 Intersection LOS Summary – Build (2020) Alternative 1

Intersection	Build (2020) Alt 1		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2353 (Old Wilson Road)*	(WB-B)	(WB-B)	(WB-B)
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)

***** *Roundabout analysis performed in SIDRA 5.0*

LEGEND

(XX-X) = (lowest operating approach for unsignalized intersection – LOS)



SCALE
not to scale

Build (2020) Alternative 1 Peak Hour Turning Movement Volumes

Wendell Boulevard Intersection Study
Wake County

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Figure 5-2

5.3 BUILD (2020) ALTERNATIVE 2 CONDITIONS

The Build (2020) Alternative 2 includes the closure of SR 2353 (Old Wilson Road) at the intersection with US 64 Business (Wendell Boulevard), resulting in a T-intersection of US 64 Business (Wendell Boulevard) with NC 231 (N. Selma Road). This alternative also includes the construction of a new connector street east of the intersection of US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) to provide access between SR 2353 (Old Wilson Road) and US 64 Business (Wendell Boulevard). The volumes used in this alternative analysis are shown in Figure 5-3.

As shown in Table 5-4, the peak hour operations at both the study area intersections are all expected to remain acceptable under Alternative 2, given the recommended geometric improvements.

Table 5-4 Intersection LOS Summary – Build (2020) Alternative 2

Intersection	Build (2020) Alt 2		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)	B (EB-C) 19.1 sec	B (NB-B) 13.8 sec	B (NB-B) 15.4 sec
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(SB-A)	(SB-A)	(SB-A)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

SCALE
not to scale

Build (2020) Alternative 2 Peak Hour Turning Movement Volumes

Wendell Boulevard
Intersection Study
Wake County

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Figure
5-3

5.4 BUILD (2020) ALTERNATIVE 3 CONDITIONS

This alternative includes the closure of SR 2353 (Old Wilson Road) at the intersection with US 64 Business (Wendell Boulevard), the construction of a new connector street east of the intersection of US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road), and the relocation of both NC 231 (N. Selma Road) and SR 2359 (Old Zebulon Road) to form a four-approach intersection with US 64 Business (Wendell Boulevard). The volumes used in this alternative analysis are shown in Figure 5-4.

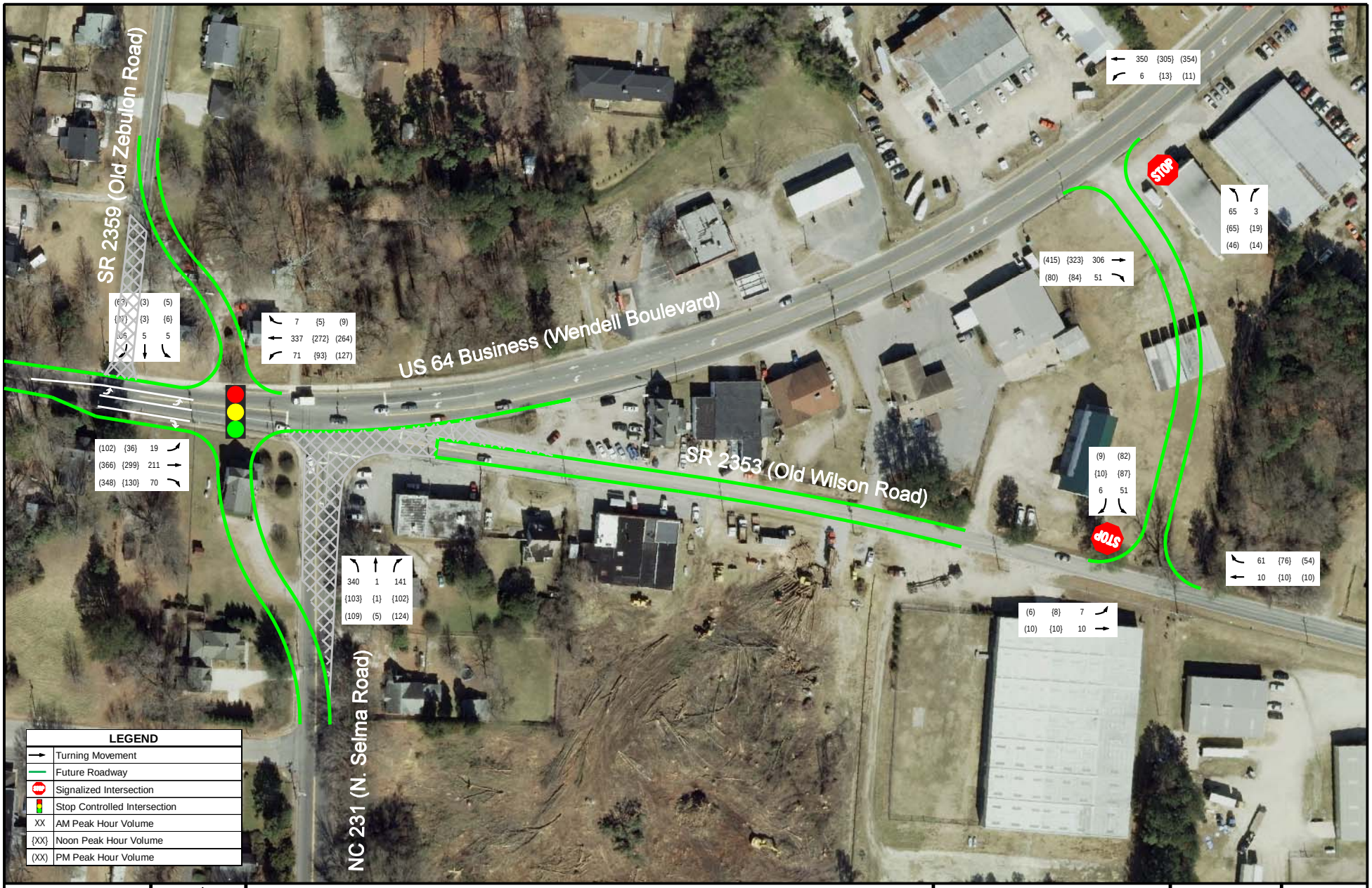
As shown in Table 5-5, the peak hour operations at both the study area intersections are all expected to remain acceptable under Alternative 3, given the recommended geometric improvements.

Table 5-5 Intersection LOS Summary – Build (2020) Alternative 3

Intersection	Build (2020) Alt 3		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2359 (Old Zebulon Road)	C (SB-D) 34.7 sec	C (SB-D) 25.1 sec	C (SB-D) 29.1 sec
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(SB-A)	(SB-A)	(SB-A)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)



SCALE
not to scale

Build (2020) Alternative 3 Peak Hour Turning Movement Volumes

Wendell Boulevard
Intersection Study
Wake County

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Figure
5-4

5.5 BUILD (2020) ALTERNATIVE 4A CONDITIONS

This alternative includes the closing of SR 2353 (Old Wilson Road), resulting in a T-intersection of US 64 Business (Wendell Boulevard) with NC 231 (N. Selma Road) and a realignment of SR 2353 (Old Wilson Road). Alternative 4A also realigns SR 2353 (Old Wilson Road) such that the westbound traffic along SR 2353 (Old Wilson Road) maintains free flow to US 64 Business (Wendell Boulevard) and the eastbound movements operate under stop control. The volumes used in this alternative analysis are shown in Figure 5-5.

As shown in Table 5-6, the peak hour operations at all the study area intersections are all expected to remain acceptable under Alternative 4A, given the recommended geometric improvements.

Table 5-6 Intersection LOS Summary – Build (2020) Alternative 4A

Intersection	Build (2020) Alt 4A		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)	B (EB-C) 19.1 sec	B (NB-B) 13.8 sec	B (NB-B) 15.4 sec
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(EB-A)	(EB-A)	(EB-A)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

SCALE
not to scale

Build (2020) Alternative 4A Peak Hour Turning Movement Volumes

Wendell Boulevard
Intersection Study
Wake County

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Figure
5-5

5.6 BUILD (2020) ALTERNATIVE 4B CONDITIONS

This alternative is identical to Alternative 4A with the exception of the relocation of SR 2359 (Old Zebulon Road) to form a fourth leg of the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. NC 231 (N. Selma Road) is not realigned. The volumes used in this alternative analysis are shown in Figure 5-6.

As shown in Table 5-7, the peak hour operations at all the study area intersections are all expected to remain acceptable under Alternative 4B, given the recommended geometric improvements.

Table 5-7 Intersection LOS Summary – Build (2020) Alternative 4B

Intersection	Build (2020) Alt 4B		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2359 (Old Zebulon Road)	C (SB-D) 34.7 sec	C (SB-D) 25.1 sec	C (SB-D) 29.1 sec
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(EB-A)	(EB-A)	(EB-A)

LEGEND

X (XX-X) = overall LOS for signalized intersection (lowest operating approach - LOS)
XX.X sec = overall average delay per vehicle for signalized intersection
(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

SCALE
not to scale

Build (2020) Alternative 4B Peak Hour Turning Movement Volumes

Wendell Boulevard Intersection Study
Wake County

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Figure 5-6

5.7 BUILD (2020) ALTERNATIVE 5A CONDITIONS

This alternative is identical to Alternative 4A with the exception of the implementation of a three-legged roundabout at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection as opposed to a conventional T-intersection. Alternative 5A realigns SR 2353 (Old Wilson Road) such that the westbound traffic along SR 2353 (Old Wilson Road) maintains free flow to US 64 Business (Wendell Boulevard) and the eastbound movements operate under stop control. The volumes used in this alternative analysis are shown in Figure 5-7.

As shown in Table 5-8, the peak hour operations at all the study area intersections are all expected to remain acceptable under Alternative 5A, given the recommended geometric improvements.

Table 5-8 Intersection LOS Summary – Build (2020) Alternative 5A

Intersection	Build (2020) Alt 5A		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)*	(NB-B)	(NB-B)	(NB-B)
US 64 Business (Wendell Boulevard) and SR 2359 (Old Zebulon Road)	(SB-C)	(SB-B)	(SB-B)
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(EB-A)	(EB-A)	(EB-A)

** Roundabout analysis performed in SIDRA 5.0*

LEGEND

(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

SCALE
not to scale

Build (2020) Alternative 5A Peak Hour Turning Movement Volumes

Wendell Boulevard
Intersection Study
Wake County

MARTIN ALEXIOU BRYSON

Figure
5-7

5.8 BUILD (2020) ALTERNATIVE 5B CONDITIONS

This alternative is identical to Alternative 5A with the exception of the relocation of SR 2359 (Old Zebulon Road) to form a fourth leg of the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) roundabout. NC 231 (N. Selma Road) is not realigned. The volumes used in this alternative analysis are shown in Figure 5-8.

As shown in Table 5-9, the peak hour operations at all the study area intersections are all expected to remain acceptable under Alternative 5B, given the recommended geometric improvements.

Table 5-9 Intersection LOS Summary – Build (2020) Alternative 5B

Intersection	Build (2020) Alt 5B		
	AM	Noon	PM
US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road)/SR 2359 (Old Zebulon Road)*	(WB-B)	(NB-B)	(NB-B)
US 64 Business (Wendell Boulevard) and SR 2353 (Old Wilson Road) Relocation	(NB-B)	(NB-B)	(NB-B)
SR 2353 (Old Wilson Road) and Existing Relocation	(EB-A)	(EB-A)	(EB-A)

***** *Roundabout analysis performed in SIDRA 5.0*

LEGEND

(XX-X) = (lowest operating approach for unsignalized intersection – LOS)

SCALE
not to scale

Build (2020) Alternative 5A Peak Hour Turning Movement Volumes

Wendell Boulevard Intersection Study
Wake County

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Figure 5-8

6. CONCLUSIONS AND RECOMMENDATIONS

It is recommended that Alternative 4 be implemented to address the existing geometric and traffic issues within the study area. This alternative can be implemented in phases to address specific issues and spread out the total cost and impacts.

Phase 1 is recommended as the construction of the left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road). This improvement is simple, relatively inexpensive and can be constructed within the existing right-of-way by widening only three to four feet of additional pavement on each side and replacing the curb and gutter to provide three eleven-foot lanes.

Phase 2 includes the closure of SR 2353 (Old Wilson Road) at US 64 Business (Wendell Boulevard) and the realignment SR 2353 (Old Wilson Road) such that it connects to US 64 Business (Wendell Boulevard) approximately 800 feet east of the existing intersection, allowing the westbound movement to operate under free flow; eastbound SR 2353 (Old Wilson Road) would form a T-intersection with the realigned segment. This improvement will address the confusing geometry that is currently present at the US 64 Business (Wendell Boulevard) at SR 2353 (Old Wilson Road) and NC 231 (N. Selma Road) intersection.

Phase 3 includes the relocation of SR 2359 (Old Zebulon Road) such that it ties in to the existing US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection. The need for this relocation should be evaluated based on the effectiveness of the left-turn lane at SR 2359 (Old Zebulon Road) constructed in the first phase of improvements.

Phase 4 includes the construction of a roundabout at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection. The roundabout could be implemented prior to the relocation of SR 2359 (Old Zebulon Road) as a three legged roundabout with the option of adding a fourth leg when the relocation is implemented or it could be placed after the relocation has taken place. This roundabout would require some additional land for construction beyond the conventional intersection, but the additional land would be minimal.

7. OPINION OF PROBABLE CONSTRUCTION COST

An opinion of probable construction costs were developed for the individual phases of Alternative 4, which is the recommended alternative. The cost estimates below, in Table 7-1, do not include the cost of acquiring necessary right of way or other non-construction costs such as relocation assistance.

Phase 1 of Alternative 4 includes the construction of a left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road). This improvement can be constructed within the existing right-of-way and without disturbing the existing sidewalks. This improvement, however, will require some new pavement and new curb and gutter. The cost of constructing of this turn-lane is estimated at $65,000.

Phase 2 improvements of this alternative include the closure of the existing connection between SR 2353 (Old Wilson Road) and the US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection and the realignment of SR 2353 (Old Wilson Road) such that it ties into US 64 Business (Wendell Boulevard) approximately 800 feet east of the existing connection. The cost of these improvements is estimated at $310,000.

Phase 3 of this alternative includes the relocation of SR 2359 (Old Zebulon Road) such that it ties into US 64 Business (Wendell Boulevard) across from the existing NC 231 (N. Selma Road) to form a four-legged intersection. The cost of these improvements is estimated at $255,000.

Phase 4 includes the potential construction of a roundabout at the US 64 Business (Wendell Boulevard) and NC 231 (N. Selma Road) intersection at some point in the future. This roundabout could be constructed to accommodate three legs, with an option for SR 2359 (Old Zebulon Road) to be tied into the roundabout in the future or the roundabout could be constructed after that relocation has taken place. The estimated cost of the roundabout would be similar regardless of when the roundabout is constructed. The cost of these improvements is estimated at $220,000.

Table 7-1 Estimated Construction Costs, by Project

Proposed Improvement	Estimated Construction Cost
Construct eastbound left-turn lane along US 64 Business (Wendell Boulevard) at SR 2359 (Old Zebulon Road)	$65,000.00
Close existing SR 2353 (Old Wilson Road) connection to US 64 Business (Wendell Boulevard) and construct new two-lane connector	$310,000.00
Realignment of SR 2359 (Old Zebulon Road)	$255,000.00
Implement a roundabout at the US 64 Business (Wendell Boulevard) at NC 231 (N. Selma Road) intersection	$220,000.00