DRAFT

NC 96 (Arendell Avenue) Access Management Plan

Prepared For:

Town of Zebulon
1003 N. Arendell Avenue
Zebulon, NC 27597

Prepared By:

ENGINEERS
PLANNERS
ECONOMISTS
WilburSmith
ASSOCIATES

421 Fayetteville Street, Suite 1303
Raleigh, NC 27601
(919) 755-0583

October 7, 2009
(WSA Project No. 103365)

Table of Contents

Page No.

I. Introduction 1

II. Inventory of Traffic Conditions 1

A. Study Area 1

B. Traffic Counts 1

C. Existing Conditions 4

D. Area Roadway Improvements 6

E. Crash Analysis 8

III. Environmental Screening 8

IV. Public Involvement 8

V. Existing Traffic Analysis 8

VI. Future Traffic Volumes 11

A. Background Growth 11

B. Development Projections 12

C. Alignment Alternatives 12

VII. Recommendations 16

VIII. Summary 17

IX. References 17

APPENDICES

Appendix A Crash and Traffic Data

Appendix B Traffic Data Analysis

Appendix C Public Meeting Minutes

Table of Contents

LIST OF FIGURES

Fig No.	Title	Page No.
1	Study Area Map	2
2	Existing AM and PM Peak Hour Traffic Volumes	3
3	Existing Lane Configurations and Traffic Control	7
4	Future Traffic Volumes	13
5	Conceptual Design	15

LIST OF TABLES

Table No.	Title	Page No.
1	Level of Service Criteria	10
2	2009 Existing Level of Service	11
3	2035 Future Level of Service Option A	14
4	2035 Future Level of Service Option B	16

I. Introduction

WSA was commissioned by the Town of Zebulon to develop an access management plan for Arendell Avenue (NC 96). This plan calls for safe and efficient access to Arendell Avenue while maintaining the ability of the facility to serve as a regional roadway providing access to the central business district of Zebulon as well as US 64.

II. Inventory of Traffic Conditions

A. Study Area

The study area for this report focused on Arendell Avenue from the US 64 eastbound ramps in the south to Riley Hill Road/Proctor Street in the north.

The specific intersections included in the analysis include:

- Arendell Avenue / Riley Hill Road / Proctor Street
- Arendell Avenue / Green Pace Road
- Arendell Avenue / Pearces Road
- Arendell Avenue / Hendricks Drive
- Arendell Avenue / Dogwood Drive / US 64 Ramps
- Pearces Road / Proctor Street (AM Peak Hour Only)

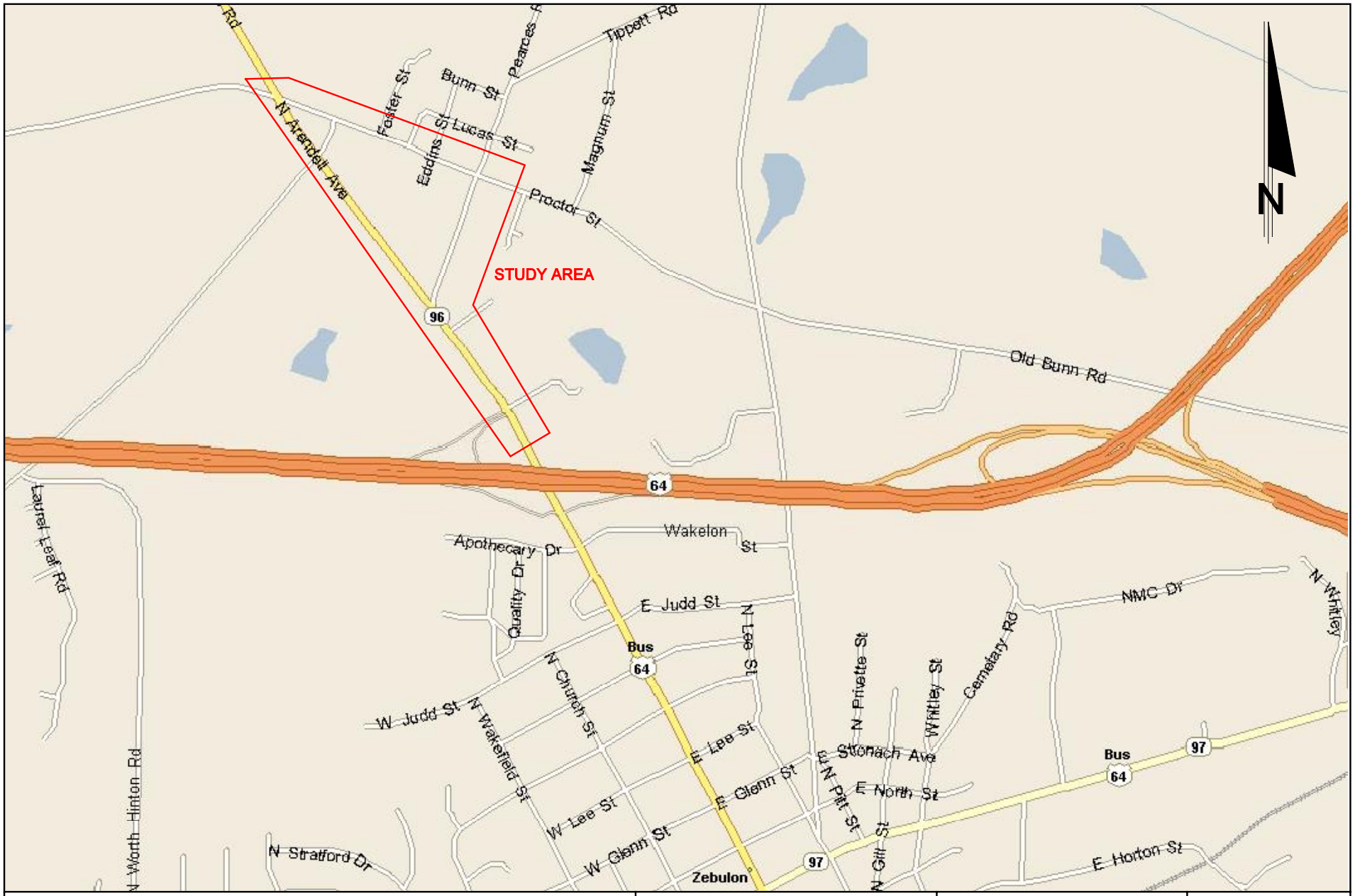
The study area is shown in Figure 1 on Page 2.

B. Traffic Counts

To provide the baseline for existing conditions analysis as well as a starting point for future traffic projections, WSA collected weekday morning (7AM – 9AM) and afternoon (4PM – 6PM) peak hour traffic counts at the following locations between 1/26/2009 and 3/11/2009.

- Arendell Avenue / Riley Hill Road / Proctor Street
- Arendell Avenue / Green Pace Road
- Arendell Avenue / Pearces Road
- Arendell Avenue / Hendricks Drive
- Arendell Avenue / Dogwood Drive
- Pearces Road / Proctor Road

The morning and afternoon peak hour traffic counts are shown in Figure 2. Traffic count data can be found in Appendix A.



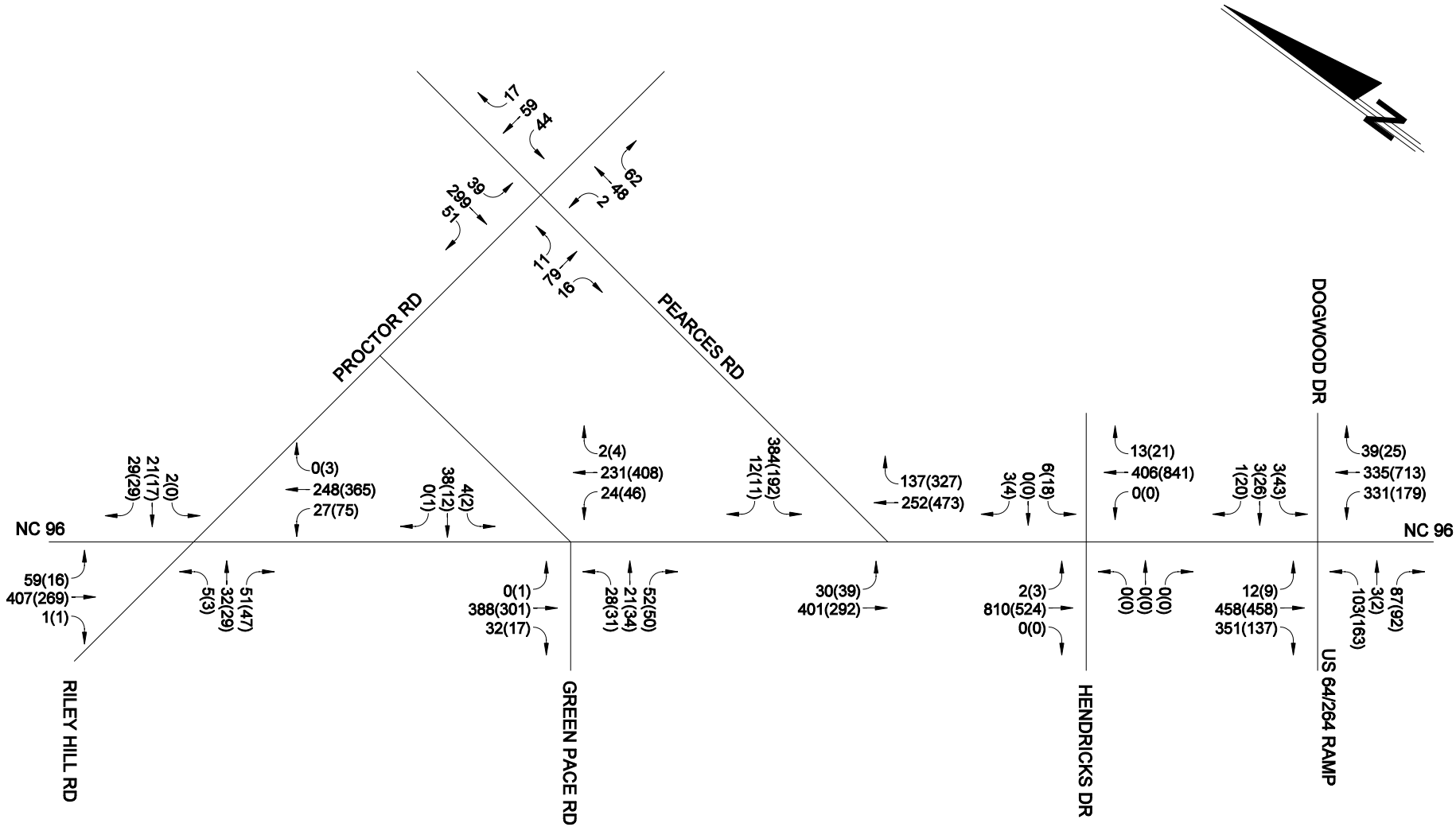
ENGINEERS PLANNERS ECONOMISTS
WilburSmith ASSOCIATES
421 FAYETTEVILLE STREET, SUITE 1303
RALEIGH, NORTH CAROLINA 27601
TELEPHONE: (919) 755-0583
FAX: (919) 832-8798

NC 96
CORRIDOR STUDY
ZEBULON, NORTH CAROLINA

VICINITY MAP

FIGURE: 1

SCALE: NONE



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR TRAFFIC
(XX)	PM PEAK HOUR TRAFFIC

ENGINEERS PLANNERS ECONOMISTS
WilburSmith ASSOCIATES

421 FAYETTEVILLE STREET, SUITE 1303
RALEIGH, NORTH CAROLINA 27601
TELEPHONE: (919) 755-0583
FAX: (919) 832-8798

NC 96
CORRIDOR STUDY
ZEBULON, NORTH CAROLINA

2009 EXISTING AM & PM
PEAK HOUR TRAFFIC
VOLUMES

FIGURE: 2

SCALE: NONE

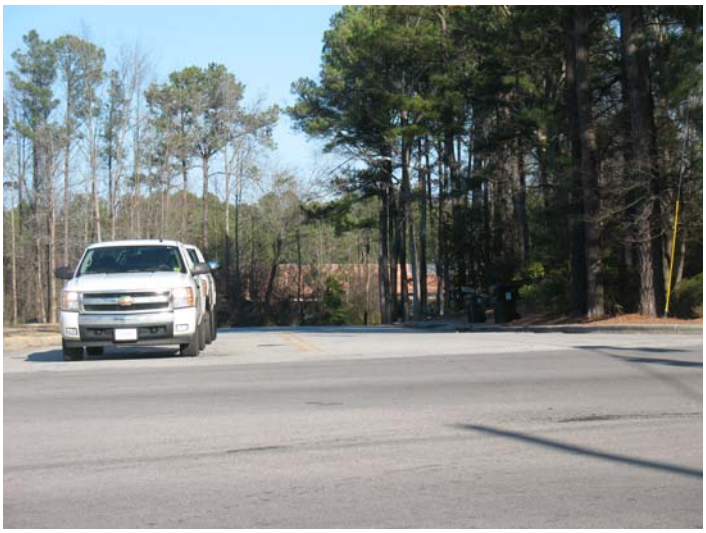
C. Existing Conditions

WSA staff travelled through the study area to examine the existing conditions. The following section briefly describes the roadways in the study area.

Arendell Avenue (NC96) is mainly a two-lane undivided roadway on 100 feet of right of way with a posted speed limit of 35 miles per hour in the study area. The 2007 Annual Average Daily Traffic (AADT) as counted by the North Carolina Department of Transportation (NCDOT) was 9,500 Vehicles per Day (vpd)[1] north of Pearces Road and 8,200 vpd just south of Hendricks Drive.

Arendell Avenue *at Dogwood Drive looking North*

Dogwood Drive is a two-lane, 30 foot wide curb and gutter section of roadway on approximately 60 feet of right of way that runs east-north east from the US 64 ramps. Its main purpose is to provide access to the Wake County Eastern Regional Center and a Wake County Public Library.



Dogwood Drive at Arendell Avenue *looking East*

Hendricks Drive is a 24 foot wide two-lane roadway with curb and gutter on 60 feet of right of way that connects to Arendell Avenue and provides access to the Capital Bank, the Church of Jesus Christ of Latter-Day Saints, and the Coastal Station.

Hendricks Drive at Arendell Avenue
looking East

Pearces Road is a two-lane undivided roadway on 60 feet of right of way, that serves as the major connector to Arendell Avenue from the residential areas east of Arendell Avenue and south of Pippin Road. The 2007 AADT as counted by the NCDOT was 5,500 vpd[1] just south of Lucas Street. The posted speed limit is 35 mph.

Pearces Road at Arendell Avenue
looking East

Green Pace Road is a two-lane, 20 foot wide shoulder section roadway on approximately 60 feet of right of way. Green Pace Road runs perpendicular to Arendell Avenue and heads south across US 64 towards both residential and commercial areas. The 2007 AADT as counted by the NCDOT was 2,500 vpd just west of Arendell Avenue. The posted speed limit is 45 mph.

Green Pace Road looking West

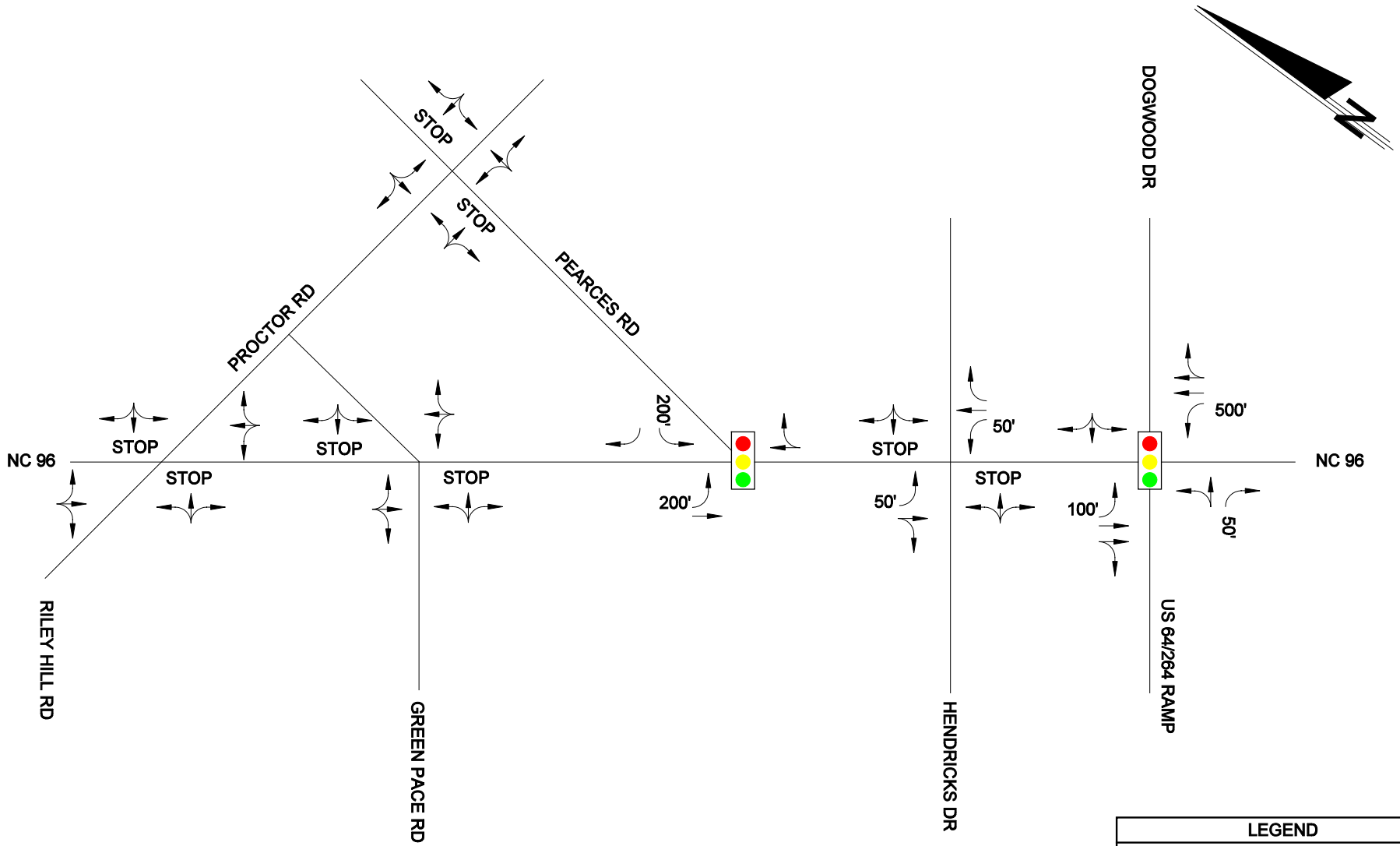
Riley Hill Road / Proctor Street is a two-lane, 20 foot wide shoulder section roadway on approximately 60 feet of right of way. Riley Hill runs west from Arendell Avenue out into a mostly agricultural area and Proctor runs east from Arendell Avenue through the northern part of the study area. The land uses along Riley Hill Road are primarily residential and agricultural and runs through a watershed district that will prevent future intense development. Riley Hill Road is often used for access to North Raleigh. Proctor Street primarily serves residntial areas in Zebulon north of Arendell Avenue. The 2007 AADT as counted by the NCDOT was 2,000 vpd[1] just east of Watsonia Drive. The posted speed limit is 45 mph heading west from Arendell Avenue and 35 mph heading east from Arendell Avenue.

Riley Hill Road looking West

Existing Lane Configurations and Traffic Control for the study area intersections are illustrated on Figure 3.

D. Area Roadway Improvements

Discussions with Town staff and an inspection of the North Carolina Department of Transportation (NCDOT) Transportation Improvement Program (TIP) indicate that there are no roadway projects planned for the area that would have a significant affect on this corridor.



LEGEND	
←	EXISTING TRAVEL LANE
	SIGNAL CONTROLLED
STOP	STOP SIGN CONTROLLED

WilburSmith ASSOCIATES
ENGINEERS PLANNERS ECONOMISTS

421 FAYETTEVILLE STREET, SUITE 1303
RALEIGH, NORTH CAROLINA 27601
TELEPHONE: (919) 755-0583
FAX: (919) 832-8798

NC 96
CORRIDOR STUDY
ZEBULON, NORTH CAROLINA

EXISTING LANE CONFIGURATIONS & TRAFFIC CONTROL

FIGURE 3

SCALE: NONE

E. Crash Analysis

WSA contacted NCDOT to obtain crash information for the past three years at the study area intersections. No intersections exhibited a very high amount of crashes that would be easily corrected by a specific improvement. A crash summary for each of the study area intersections can be found in Appendix A.

III. Environmental Screening

In an effort to identify potential environmental constraints to a potential widening of Arendell Avenue from the US 64 eastbound ramps in the south to Riley Hill Road/Proctor Street in the north, an environmental screening was performed. The purpose of the screening is to identify known and documented environmental features within the Arendell Avenue corridor that could be "project stopping." Existing Geographic Information System (GIS) data from various state and federal sources, augmented with limited field reconnaissance, was used to perform this analysis. No "project stopping" features were found within the immediate vicinity of Arendell Avenue.

IV. Public Involvement

Public involvement was an integral part of this project, including the development of various study area alternatives and the selection of the preferred alternative. The public involvement process for this project consisted of a series of stakeholder meetings with Town staff and property owners in the study area, and a series of public meetings to gather information from the public and to present the study findings. As part of this project the study team held the following meetings:

1/7/09 – Meeting with NCDOT to discuss study process and alternatives
2/5/09 – Stakeholder meeting #1 to discuss study process and alternatives
3/12/09 – Stakeholder meeting #2 to discuss alternatives and selection of preferred alternative
4/16/09– Public meeting to discuss study process and alternatives
10/21/09 – Meeting with Town Board of Aldermen to discuss preferred alternatives, final conceptual design, and final report

Sign-in sheets and meeting notes from the stakeholder and public meetings can be found in Appendix C.

V. Existing Traffic Analysis

The study area intersections were analyzed using the methods outlined in the ***Highway Capacity Manual***[2] and Synchro Version 7.0 Software. The ***Highway Capacity Manual***[2] defines capacity as "the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per hour or persons per hour".

Level of service (LOS) is a term used to represent different traffic conditions, and is defined as a "qualitative measure describing operational conditions within a traffic stream, and their perception by motorist/or passengers". Level of Service varies from Level A, representing free flow, to Level F where traffic breakdown conditions are evident. Level B represents good progression with minimal congestion. At Level C, the number of vehicles stopping is significant, although many still pass through the intersection without stopping. Level D represents more congestion, but the overall operations are acceptable. At Level E, freedom to maneuver within the traffic stream is extremely difficult with driver frustration being generally high.

For signalized intersections, service levels pertain to each approach as well as an overall value. The unsignalized intersection analysis method in the Highway Capacity Manual assigns LOS values for each movement that yields the right-of-way, but not to the overall intersection. This movement is generally a secondary movement from a minor street. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall level of service is usually much greater than what is represented by the results of the minor street movements. Synchro Version 7.0 will calculate an amount of delay for the overall intersection, but will not assign a LOS value.

Generally, Level of Service D is considered acceptable for signalized intersections in suburban areas during peak periods. With the current method of reporting levels of service for unsignalized intersections, it is not uncommon for some of the minor street movements to be operating at a LOS F during the peak hours.

Table 1 presents criteria of each level of service as indicated in the ***Highway Capacity Manual***[2].

TABLE 1: LEVEL OF SERVICE CRITERIA

SIGNALIZED INTERSECTIONS

Level of Service	Stopped Delay Per Vehicle (sec)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

UNSIGNALIZED INTERSECTIONS

Level of Service	Average Total Delay (sec/veh)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Source: ***Highway Capacity Manual***[2], Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 1998

Table 2 shows the 2009 existing level of service and overall delay for the study area intersections. This table indicates that the existing intersections are operating with reasonable levels of service and delay in the AM and PM peak hour. While this is true at the specific study area intersections, WSA personnel viewed several conflicts while observing traffic, primarily due to the multiple driveways along the corridor and their interaction with traffic flowing along Arendell Avenue. These traffic operations contribute to a higher delay and lower level of safety than those predicted by the traffic analysis models.

Table 2 Zebulon Corridor Study 2009 Existing LOS		
Intersection	**Peak Hour**	
	AM	**PM**
US 64/264 Ramp / Arendell Avenue	B (11.9)	B (10.6)
Arendell Avenue / Hendricks Drive	# (0.1) A (0.0) EB C (15.3) WB	# (0.3) A (0.0) EB C (18.8) WB
Arendell Avenue / Pearces Road	B (10.3)	B (10.6)
Arendell Avenue / Green Pace Road	# (3.4) C (14.0) EB C (18.3) WB	# (3.5) C (20.5) EB C (19.5) WB
Arendell Avenue / Proctor Street	# (3.8) C (17.6) EB C (15.5) WB	# (3.5) C (15.8) EB B (14.8) WB
Pearces Road / Proctor Road	# (5.9) C (17.9) NB C (16.4) SB	N/A
# - No letter value assigned by Synchro, only overall intersection delay		

VI. Future Traffic Volumes

A. Background Growth

Background traffic is traffic generated by unknown developments within and outside of the project study area. Considering the amount of residential growth expected in the areas north and east of the study, it was important to consider background growth in this study. To determine the amount of background growth that is expected to occur in the corridor, WSA examined historical NCDOT traffic counts as well as the Capitol Area MPO (CAMPO) transportation planning model. The CAMPO model indicated that 2035 traffic volumes on Arendell Avenue would be approximately 20,000 vehicles per day. The 2007 AADT as counted by NCDOT was 9,500 vpd in the same section of roadway. This equates to an annual growth rate of 2.7 percent per year. Given that the trip generation of specific developments needed to be considered to more accurately predict future turning movement volumes, WSA used a background growth rate of 1.0 percent per year to grow the existing traffic volumes to 2035 background volumes.

B. Development Projections

In addition to the growth in background traffic along the corridor, WSA examined the specific parcels immediately adjacent to the Arendell Avenue corridor. Information was gathered from Town staff and local landowners regarding the development potential of these parcels. The majority of the growth in the study area is expected to be attributed to a large commercial development located on the west side of Arendell Avenue that is currently in the preliminary planning stages. To estimate the future development-related traffic, WSA developed a trip generation matrix that considers the available parcels in the study area. This matrix can be found in Appendix B. These traffic volumes were then added to the background volumes based on the alignment alternatives discussed below. Future traffic volumes are shown in Figure 4 for the two final alternatives.

C. Alignment Alternatives

Potential future alignment alternatives were developed through a highly iterative process involving Town staff, stakeholders, and the public. Several issues were prominent in this process and include:

The projected future traffic volumes in the CAMPO regional model clearly indicate that Arendell Avenue needs to be a 4-lane facility in 2035. A two-lane undivided facility located in an urban area with between 2 and 4.5 signalized intersections per mile has a capacity of approximately 16,300 vehicles per day. Additionally the Town of Zebulon's thoroughfare plan indicates that Arendell Avenue is planned to be a 4-lane divided facility.

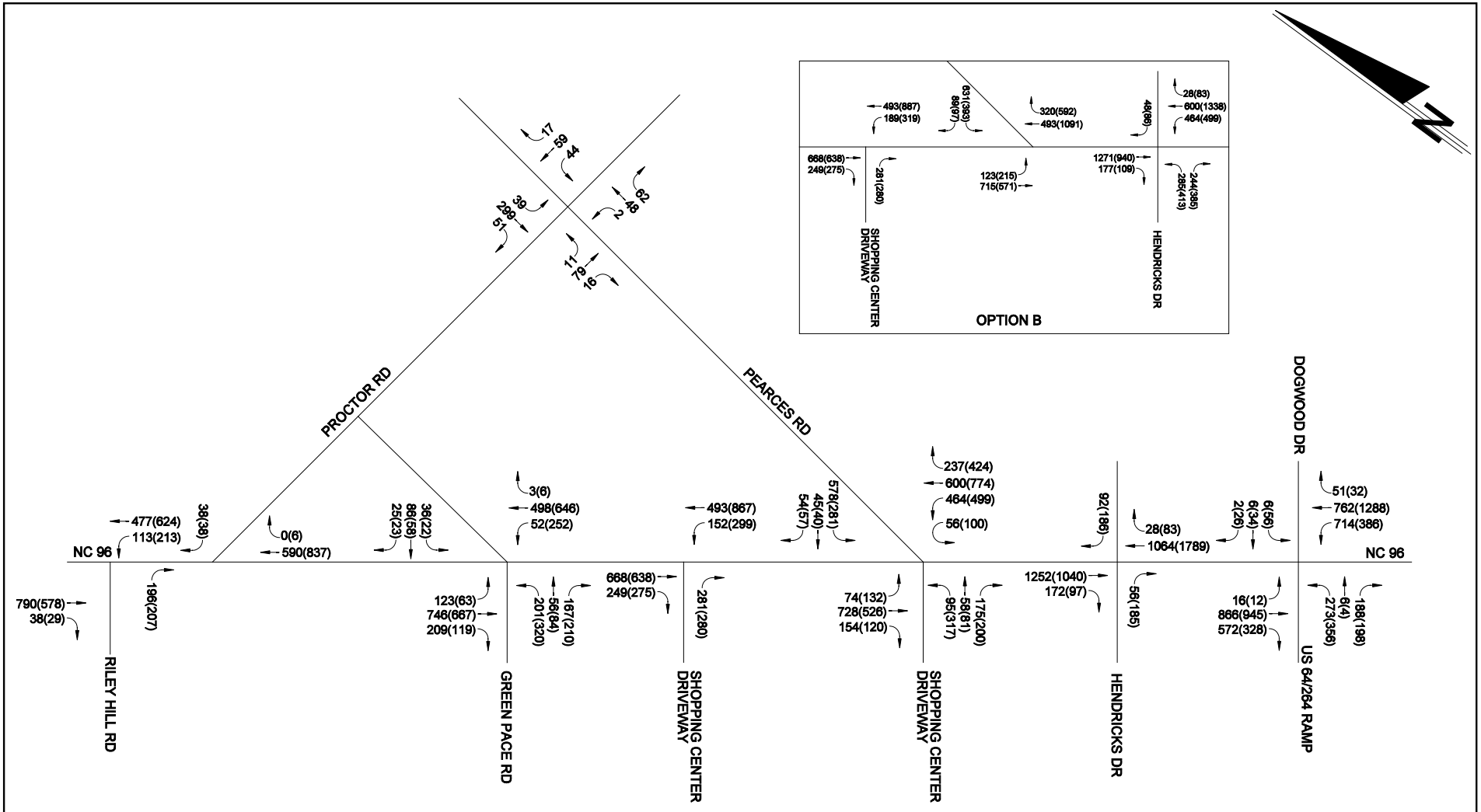
Pearces Road serves not only the parcels immediately adjacent to Arendell Avenue , but a variety of residential areas north of Arendell Avenue as well as Zebulon Elementary School via Proctor Street. Pearces Road's intersection with Arendell Avenue is of strategic importance along the corridor given the developed and undeveloped land that it serves.

Along with an access in the vicinity of Pearces Road, Green Pace Road is expected to serve as one of the main access points for any big-box type development that occurs west of Arendell Avenue. Green Pace Road also serves developments west of Zebulon. The portion of Green Pace Road east of Arendell Avenue is a narrow subdivision-quality roadway not currently suitable for heavy automobile traffic.

Development along Riley Hill Road is expected to be limited due to the future Litter River Reservoir watershed. This watershed will prohibit dense commercial development and will only allow for less dense single family-type development, which should have minimal impact on traffic at the intersection of Riley Hill Road and Arendell Avenue.

The Town has already required construction of a connector or access road that parallels Arendell Avenue between Dogwood Street and Hendricks Drive. This road sets the stage for additional developments east of Arendell Avenue between Pearces Road and US 64/264.

While many alternatives were considered, based on these constraints, two final alternatives were developed. Both alternatives shared the following common elements:



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR TRAFFIC
(XX)	PM PEAK HOUR TRAFFIC

ENGINEERS PLANNERS ECONOMISTS
WilburSmith ASSOCIATES

421 FAYETTEVILLE STREET, SUITE 1303
RALEIGH, NORTH CAROLINA 27601
TELEPHONE: (919) 755-0583
FAX: (919) 832-8798

NC 96
CORRIDOR STUDY
ZEBULON, NORTH CAROLINA

2035 FUTURE AM & PM
PEAK HOUR TRAFFIC
VOLUMES FOR ALT A & B

FIGURE: 4

SCALE: NONE

- Dual northbound left turn lanes at the intersection of Arendell Avenue and the US 64/264 Ramps
- An access to the potential big box development located between Green Pace Road and Pearces Road that prohibits vehicles from turning left or going straight from the side streets via channelization
- Signalization of the intersection of Green Pace Road and Arendell Avenue
- Limiting the Arendell Avenue / Proctor Street intersection via channelization to prohibits vehicles from turning left or going straight from the side streets.
- Relocation of Riley Hill Road to the north to allow for left turns into and out of Riley Hill Road.

The differences in the Alternatives were related to the Arendell Avenue / Pearces Road intersection. The preferred Alternative (Option A) creates a full movement 4-leg intersection. This alternative will depend heavily on the redevelopment of the properties immediately west of Arendell Avenue at Pearces Road. This alternative is preferred due to its simpler design and more efficient traffic flow. Option B assumes that these properties do not redevelop and that the shopping center access occurs immediately across from Hendricks Drive south of Pearces Road. This creates a signalized offset intersection that operates as a single intersection. These alignments are shown in the conceptual design in Figure 5.

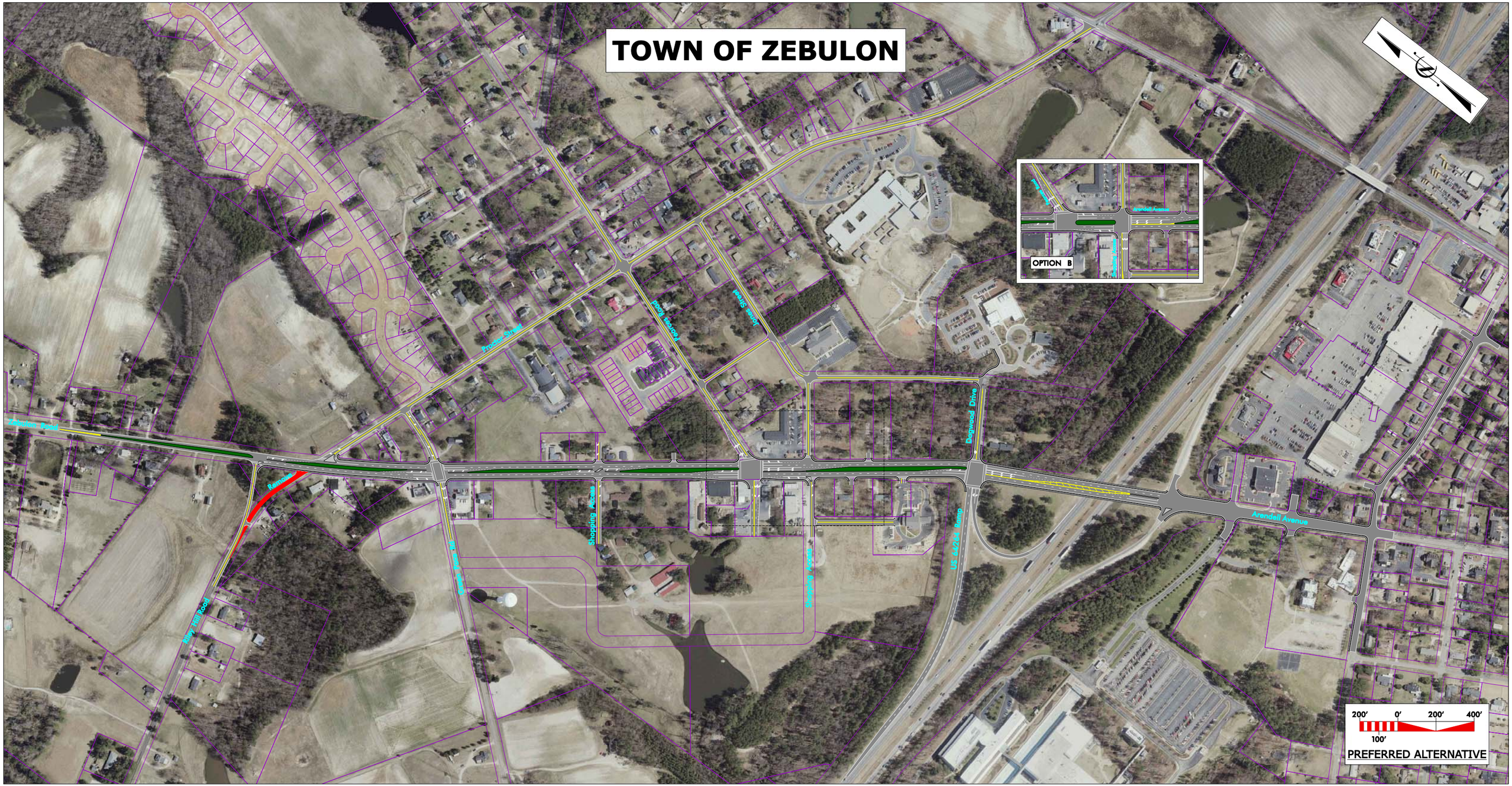
The future level of service and delay are shown in the Table 3 and 4 below:

Table 3
Zebulon Corridor Study
2035 Future LOS Option A

Intersection	Peak Hour	
	AM	PM
US 64/264 Ramp & Arendell Avenue	D (43.0)	D (35.7)
Hendricks Drive / Arendell Avenue	# (0.6) B (10.3) EBL B (12.2) EBT	# (1.2) B (11.9) EBL B (10.4) EBT
Pearces Road / Arendell Avenue	D (36.0)	C (28.7)
Green Pace Road / Arendell Avenue	B (11.1)	C (24.6)
Riley Hill / Arendell Avenue	# (4.2) D (26.7) EBL	# (3.8) C (19.3) EBL
Proctor Street / Arendell Avenue	# (0.4) B (14.0) WBL	# (0.5) C (19.5) WBL
Pearces Road / Proctor Road	# (5.9) C (17.9) EBR C (16.4) WBL	N/A

- No letter value assigned by Synchro, only overall intersection delay

TOWN OF ZEBULON



For Option B, all levels of service and delay remain the same with the exception of Arendell Avenue / Hendricks Drive and Arendell Avenue / Pearces Road.

Table 4
Zebulon Corridor Study
2035 Future LOS Option B

Intersection	Peak Hour	
	AM	PM
Hendricks Drive / Arendell Avenue	C (24.8)	C (29.5)
Pearces Road / Arendell Avenue	C (20.8)	B (18.8)

- No letter value assigned by Synchro, only overall intersection delay

These tables indicate that the Arendell Avenue, as shown in the conceptual designs, should operate with a reasonable level of service and delay in 2035 even with the significant growth that is projected for the area. Additionally, conflicts from individual development driveways should also be minimized due to the center median.

VII. Recommendations

Based on significant input from Town staff, landowners and the public, current and projected future development, existing Town plans, historical and future projected traffic volumes, and the crash history of the area, WSA has developed a conceptual design for Arendell Avenue from the US 64/264 ramps to just north of Riley Hill Road. With regard to this design, WSA recommends the following:

- Arendell Avenue be planned to be a 4-lane divided facility with wide outside lanes and sidewalks on each side of the roadway.
- Dual northbound left turn lanes be added at the US 64/264 westbound ramps and US 264/64 westbound ramps be widened to two lanes
- Development that occurs on the east side of Arendell Avenue between Dogwood Drive and Hendricks Drive be required to share driveways and access the existing service road to the rear of the properties
- Pearces Road be extended to the west side of Arendell Avenue to serve development on the west side of Arendell Avenue. This new 4-leg intersection should be served via signal control
- The existing Hendricks Drive intersection be converted to right-in/right out
- No driveways be allowed on Arendell Avenue between Hendricks Drive and Pearces Road
- Undeveloped parcels on the west side of Arendell Avenue between Hendricks Drive and the US 64/264 Ramps be served by one shared driveway and a service road be connected to tie Hendricks Drive with the State Employees Credit Union
- Hendricks Drive be extended to connect Proctor Street to Arendell Avenue
- A two-lane connector be constructed between Pearces Road and Hendricks Drive

- One median break be allowed between Pearces Road and Green Pace Road. This access should be served by channelized left turn lanes along Arendell Avenue, ie: left turning and through traffic should not be allowed from the side streets
- Limit driveways in the section of Arendell Avenue between Pearces Road and Green Pace Road by requiring shared driveways and/or access to the side streets
- Widen the portion of Green Pace Road between Arendell Avenue and Proctor Street to a 3-lane section
- Signalized the intersection of Green Pace Road and Arendell Avenue
- Convert the intersection of Proctor Street and Arendell Avenue to right-in/right-out operations
- Relocate the intersection of Riley Hill Road and Arendell Avenue northward to form a T-intersection. Begin the 4-lane section at this intersection. No signalization is required.
- Require future large developments to perform traffic impact analyses to determine the specific lane geometry for the study area intersections, particularly the specific storage requirement for the auxiliary left and right turn lanes.
- Provide adequate pedestrian crosswalk to warn approaching vehicles
- Provide adequate lighting for pedestrian safety at night
- Provide adequate pedestrian facilities to meet the requirements of the Americans with Disabilities Act (ADA)
- Provide audible pedestrian crosswalk signals to accommodate visually impaired pedestrians
- Design and maintain landscaping to provide good visibility between pedestrians and approaching vehicles
- Investigate partnering with local retailer and organizations to provide street furniture such as benches and trash bins for pedestrians

VIII. Summary

WSA was commissioned by the Town of Zebulon to develop and access management plan for Arendell Avenue (NC 96). This plan calls for safe and efficient access to Arendell Avenue while maintaining the ability of the facility to serve as a regional roadway providing access to the central business district of Zebulon as well as US 64.

To determine potential options for access management in the study area, WSA developed trip generation estimates for the vacant parcels in the study area, examined the layout of the parcels, and developed several options for roadway alignments that could serve the parcels considering NCDOT, AASHTO, and other requirements and design criteria, as well as input from the Town, NCDOT, landowners in the study area, and the general public. The alternatives have many common elements, primarily the widening of Arendell Avenue to a 4-lane divided facility with sidewalks. This plan also involves the consolidation and sharing of driveways and the relocation of several study area intersections.

IX. References

[1] ***2007 Annual Average Daily Traffic Counts,*** North Carolina Department of Transportation, 2007.
[2] ***Highway Capacity Manual,*** Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 1998.