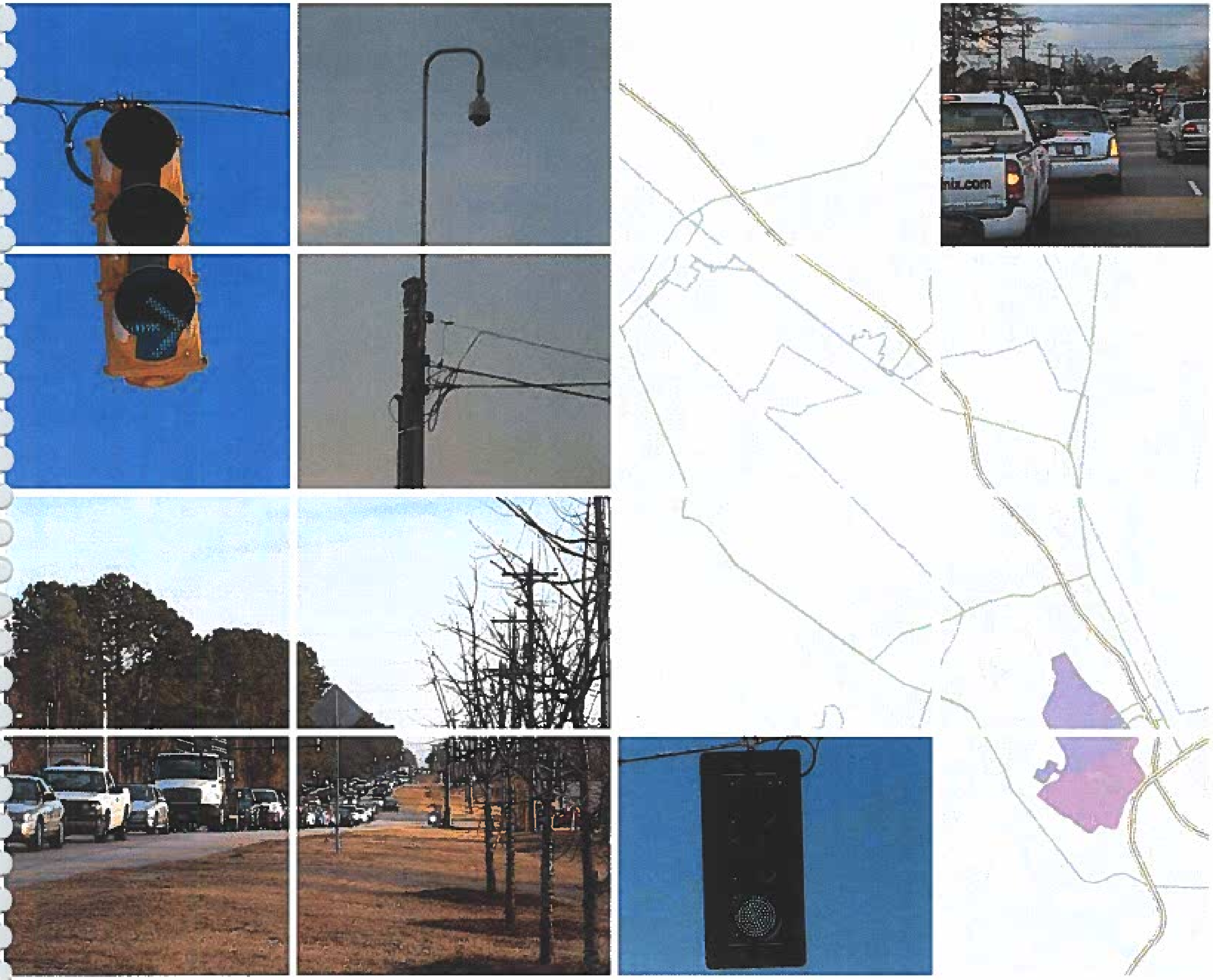

North CHATS Area Traffic Signal Master Plan

July 2013

SCDOT

JACOBS

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Appendix

Appendix A- Existing Signal Equipment A-1

Executive Summary

Jacobs Engineering Group (Jacobs) was retained by the South Carolina Department of Transportation (SCDOT) to prepare a Traffic Signal Master Plan for the North CHATS (Charleston Area Transportation Study) Area. The objective of this study is to:

- Assess existing traffic signal systems and regionally significant corridors
- Develop a list of recommended improvements for each corridor
- Develop cost estimates for proposed improvements

This Master Plan identifies requirements that will become the basis for the SCDOT planned system upgrades and will identify traffic signal equipment upgrades and assesses existing and new traffic signal control systems. New traffic signal control systems (traffic-responsive and traffic adaptive) have been evaluated as to how they could improve traffic flow along these corridors during peak traffic conditions and to respond to changes in traffic flow due to incidents along I-26 as well as other major corridors.

The study area has been divided into eight zones, which contain regionally significant corridors. Within each zone Jacobs has identified roadway characteristics, traffic volumes and flow characteristics, traffic signal and communications equipment and, major traffic generators for each of the corridors. The existing corridors within the study area listed as follows:

- **US 52 (North Goose Creek Boulevard, 2 Locations)** Cypress Gardens Road to US 52, Old Mount Holly Road to Red Bank Road
- **US 17A (North Main Street)** – St. James Avenue (US 176) to Berlin G. Myers Parkway (SC 165)
- **Berlin G. Myers Parkway (SC 165)** – US 17A to East Carolina Avenue
- **East Carolina Avenue/Old Trolley Road** – US 17A to Midland Parkway
- **Ladson Road** – SC 642 (Dorchester Road) to University Boulevard (US 78)
- **US 176 (St. James Avenue)** – US 52 (North Goose Greek Boulevard) to Devon Boulevard
- **Red Bank Road** – US 52 (North Goose Greek Boulevard) to Charleston Naval Weapons Station
- **US 78 (University Boulevard)** – College Park Road to Fernwood Drive/Wannamaker Park
- **Ashley Phosphate Road** – SC 642 (Dorchester Road) to Rivers Avenue
- **Rivers Avenue** – I-526 to Otranto Boulevard
- **SC 642 (Dorchester Road)** – Orangeburg Road to Rivers Avenue
- **Aviation Avenue** – Fain Street/Core Avenue to Rivers Avenue
- **Remount Road** – I- 26 EB to Rivers Avenue
- **N Rhett Avenue/Spruill Avenue** – Meeting Street to Tanner Ford Boulevard

A list of improvements for each corridor was developed and recommendations for either traffic-responsive or traffic-adaptive control was made based on the characteristics of each corridor. Construction cost estimates for the improvements were also developed.

Traffic-adaptive signal control was recommended on the following corridors where traffic flow and conditions are variable and change rapidly due to land uses and incidents in the area.

- **Ashley Phosphate Road**
- **Rivers Avenue**
- **Aviation Avenue**
- **Remount Road**
- **SC 642 (Dorchester Road)**
- **US 78 (University Boulevard)**

Traffic-responsive signal control was recommended on the corridors where traffic flow and conditions are generally more stable and predictable and include:

- **US 52 (North Goose Creek Boulevard) (two locations)**
- **US 6 (Main Street)**
- **US 52 Bypass (Rembert Dennis Boulevard)**
- **US 17A (North Main Street)**
- **Central Avenue**
- **SC 165 (Berlin G. Myers Parkway)**
- **Carolina Avenue/Old Trolley Road**
- **Old Trolley Road**
- **Ladson Road**
- **College Park Road**
- **SC 642 (Dorchester Road)**
- **US 176 (St. James Avenue)**

In addition to the traffic signal control system recommendations, other improvements including fiber optic interconnect cable, vehicle detection, traffic signal controller and cabinet upgrades, CCTV cameras and variable message signs (VMS) were identified.

Although the District 6 personnel currently have the ability to connect to some of its devices, the limited space in the current Traffic Engineering Tech Shop requires expansion. In the short term, expanding this facility would provide the space to properly monitor traffic control devices with the introduction of multiple monitors and servers. SCDOT District 6 personnel in the North CHATS area would have the ability to connect to and monitor all field devices from a single location.

Long-term recommendations would be to incorporate the TCC with the TMC. Traffic engineers need the full capabilities of freeway and signalized arterial real-time monitoring to be responsive to current incidents. Re-routing of freeway to signalized arterials (as well as the reverse) should be a joint effort between the TCC and the TMC. ITS devices on and off freeway need to work in tandem to display complimentary VMS messages, monitor diversion routes, and place arterial systems into event plans.

Improvement recommendations to enhance traffic flow have been prioritized into four tiers. Tier One recommended improvements should be expedited, constructed and made operational within one year. The improvement projects focused on upgrading signal cabinet equipment and communications on major high volume corridors. Tier Two recommended improvements focused on traffic adaptive or traffic responsive on several trial corridors included in Tier One with additional signal cabinet and communications equipment upgrades. Tier Two recommended improvements should be constructed and made operational within three years. Tier Three recommended improvements focused on communications equipment upgrades on lower volume corridors and the implementation of traffic adaptive or traffic responsive along several additional corridors. Tier Three recommended improvements should be constructed and made operational within three to five years. All other improvements are considered part of Tier Four and should be implemented as funding is available.

1.0 Introduction

The South Carolina Department of Transportation (SCDOT) retained Jacobs Engineering Group (Jacobs) in order to prepare a Traffic Signal Master Plan for the North Charleston Area Transportation Study (CHATS) Area. The purpose of this study is to develop a comprehensive traffic signal system master plan for study intersections located within the CHATS urban boundary within Dorchester, Berkeley, and Charleston Counties. The study area is shown on Figure 1.1 and consists of the Moncks Corner, North Charleston, Summerville, and Goose Creek areas. The objective of this study is to:

- Assess existing traffic signal systems and regionally significant corridors
- Develop a list of recommend improvements for each corridor
- Develop cost estimates for proposed improvements

This Master Plan identifies requirements that will become the basis for the SCDOT planned system upgrades. The Master Plan also identifies traffic signal equipment upgrades and assesses existing and new traffic signal control systems. New traffic signal control systems (traffic-adaptive and traffic-responsive) have been reviewed in order to evaluate how they could improve traffic flow along the study corridors during normal traffic conditions and respond to changes in traffic flow due to incidents along major corridors such as I-26 and I-526. SCDOT has the goal to develop, maintain and operate a network of advanced signal systems that meet the demands of the traveling public and commercial interests of the northern metropolitan area. This Master Plan will serve as a "blue print" for SCDOT as it continues to improve and update signal system components and timing plans over the next several years. This Master Plan focuses on the functional requirements for traffic signal system components and how those components can be integrated with the other ITS components that are regionally and locally important to maintain traffic flow. This North CHATS Area Traffic Signal Master Plan also addresses staffing needs.

1.1 Project Overview

The North CHATS Area Traffic Signal Master Planning effort was developed in two phases. The first phase of the study focused on the existing conditions inventory. The data collected during the first phase included a comprehensive signals field equipment inventory; in addition to performing interviews and observations needed to determine the traffic flow patterns, roadway characteristics, problem locations, incident management strategies, and typical seasonal variations throughout the study area. The existing conditions data was also used to establish logical traffic signal control subsystems based on signal spacing, corridor length, equipment type and municipal boundaries. The data was then evaluated during the second phase of the study provided the basis for identifying regionally significant corridors; recommending traffic signal equipment and communication upgrade requirements, and traffic signal control systems. Additionally, recommendation cost estimates were developed for each of the study area corridors. The following describes in more detail the basic elements that went into the development of the Traffic Signal Master Plan.

North CHATS Area Traffic Signal Master Plan

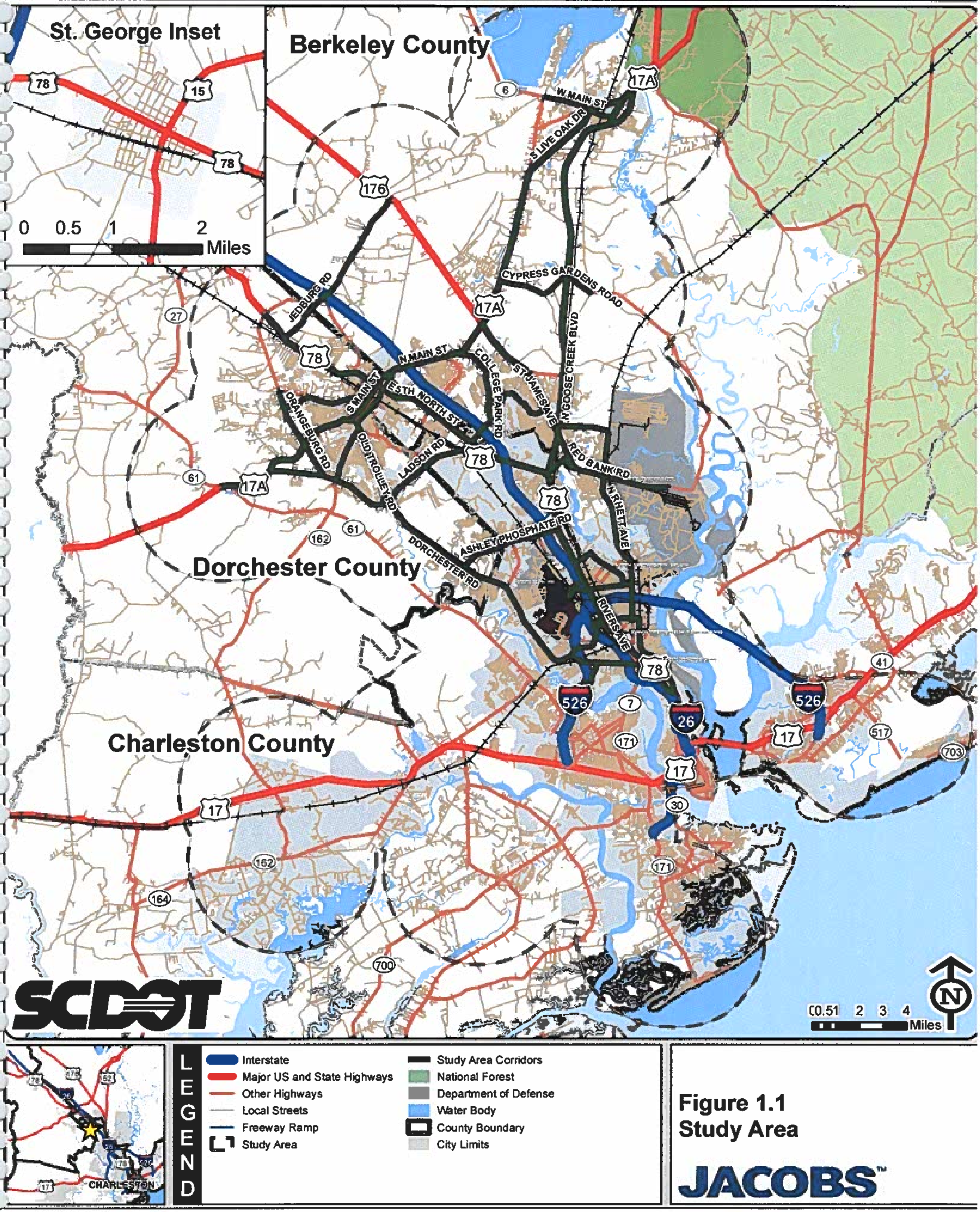


Figure 1.1
Study Area

1.1.1 Existing Conditions Inventory

Jacobs obtained and reviewed the traffic signal inventory for each of the assigned signal systems included in the study area provided by SCDOT, shown in Figure 1.1. SCDOT had a comprehensive field equipment inventory of existing signals and signal systems conducted for the project area. This existing SCDOT data was used by Jacobs as a foundation for the data collection effort for this Traffic Signal Master Plan. Controller types, traffic signal control systems and communications capabilities within the study area have been located. SCDOT also provided available traffic count information located on major roadways throughout the study area. Traffic volume figures were developed for the major roadways to understand 'normal' traffic flow characteristics and to aid in evaluation of corridor determination, traffic signal control systems and corridor prioritization. Traffic volume figures are presented by corridor zones in the following sections. Jacobs collected supplemental data including the adjacent land use, lane configuration of the major corridors, locations of schools, hospitals, major traffic generators, police and fire facilities and response routes for preemption. Corridor speed limits, route signing, evacuation route signing and locations of ITS devices including variable message signs (VMS) and incident response cameras were inventoried. Jacobs also obtained locations of existing incident response cameras and VMS along the I-26 and I-526 corridors.

1.1.2 Major Corridors and Traffic Flow Pattern Identification

Jacobs personnel met with SCDOT personnel to determine the major corridors, traffic flow patterns, roadway characteristics, problem locations, incident management strategies, and typical seasonal variations. Observations of traffic flow during the peak periods were conducted to fully understand the "normal" traffic conditions within the study area and identify potential anomalies in SCDOT data. A "windshield" survey of all corridors was undertaken to understand conditions along the identified corridors and to locate anticipated detour routes for motorists assuming potential incidents along I-26 and I-526.

1.1.3 Existing Traffic Control System Assessment

The existing traffic control system components were assessed for the capability and compatibility to provide the necessary traffic control and management functions including:

- Use of different timing plans to meet the traffic and travel demands along major corridors
- Selection of timing plans based on traffic data provided by the traffic signal control system
- Use of traffic signals to reduce impacts due to incidents along major corridors
- Implementation of motorist information for incident management via ITS devices
- Data collection for development of signal timing plans
- Evaluation of system performance

1.1.4 Existing Communication Equipment Evaluation

Jacobs obtained existing SCDOT fiber optic cable routing plans as well as private utility pole/fiber optic cable conduit information available from the utility companies. This information was supplemented with field surveys and used to determine fiber optic or copper cable routing, spread spectrum radio placement and video camera placement for use in interconnecting signals and connecting the future traffic signal control systems.

1.1.5 Develop Improvement Recommendations

Based on information obtained during the existing conditions inventory, improvement recommendations were developed based on the needs of each corridor. Jacobs identified signal equipment, communications and signal timing coordination improvement recommendations throughout the study area. Signal equipment modifications/upgrades included controllers, vehicle detection, communications (dial-up and wireless), interconnection (fiber optic, copper, spread spectrum radio, etc) and system detection. Additionally, new video camera locations were identified and recommendations for their integration into the communication network were developed. Other findings identified in this study include appropriate traffic signal control system (adaptive, responsive, etc) to be implemented based on input from SCDOT.

1.1.6 Construction Cost Estimates

Jacobs has developed engineering and construction cost estimates for recommended upgrades and traffic signal timing plan development for each corridor. Cost estimates are broken down based on recommended signal equipment, communications, and signal coordination needs for each corridor. Cost estimates are included in section, 4.0 Traffic Control Systems and Operations Recommendations, of this study.

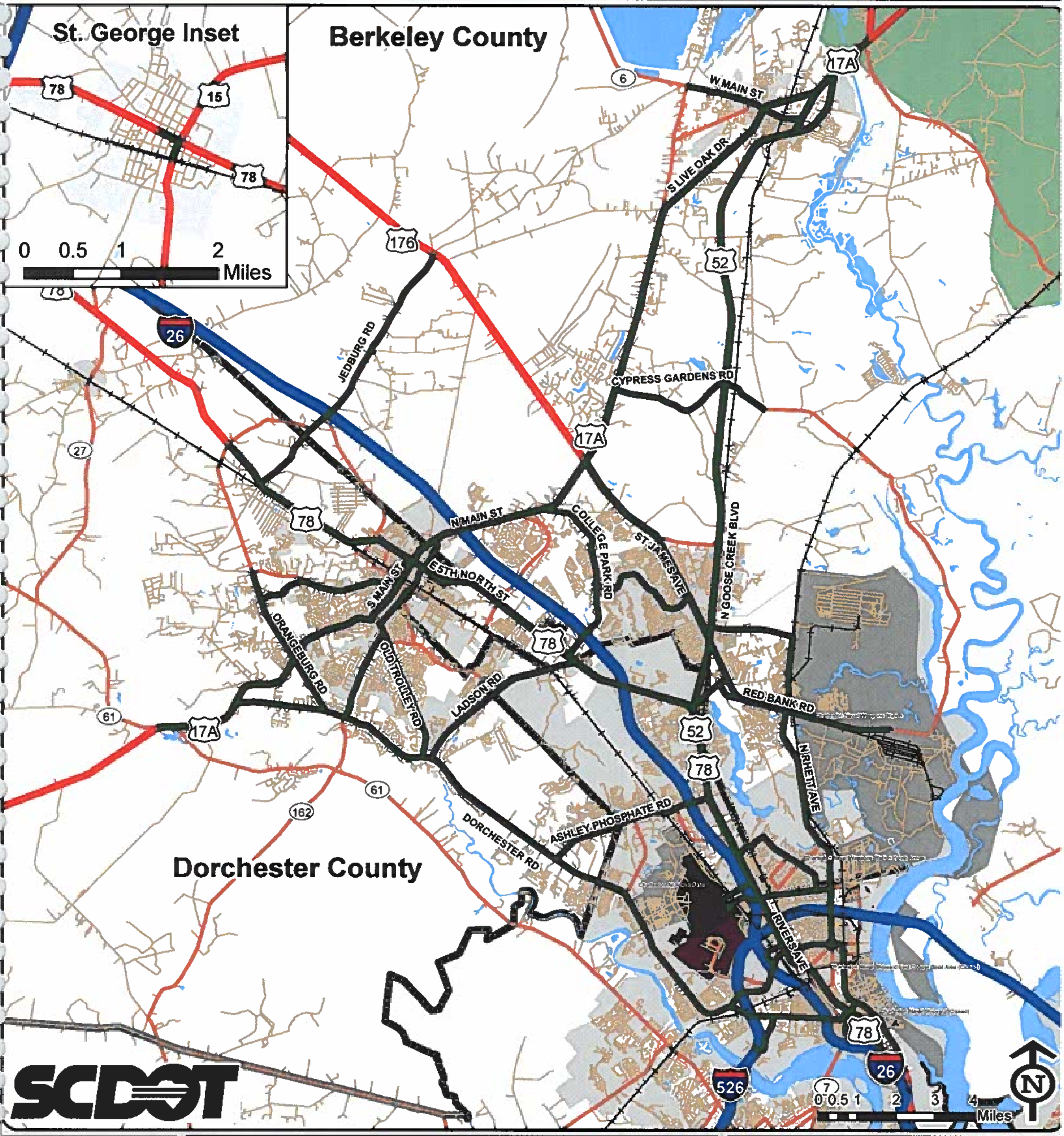
1.2 Project Goals

The North CHATS area is faced with increasing traffic congestion due to increasing local population and popularity of the area based on its proximity to major tourist destinations. The overall goal of this Traffic Signal Master Plan is to provide recommendations to improve the performance of the existing transportation system during both peak and off-peak periods by dynamically adjusting signal timings to changing traffic volumes. This Traffic Signal Master Plan will provide a "blue print" for the design and implementation of an advanced transportation management system of local traffic signals integrated with other ITS devices. Components of the system will form a flexible architecture that allows for expandability, easy maintenance, and supports a phased plan of implementation.

2.0 Existing Conditions Inventory

The study area reviewed as part of the North CHATS Area Traffic Signal Master Plan includes the identified corridors within Dorchester, Berkeley and Charleston Counties in the northern metropolitan area within the CHATS urban boundary. The CHATS urban boundary includes the Moncks Corner, North Charleston, Summerville and Goose Creek areas. The North CHATS study area contains 263 signals and has been sub-divided into eight distinct zones; both geographically, and corridor based. The study area corridors are shown in Figure 2.1. The zones are shown in Figure 2.2. The identified major corridors within the study area are listed by zone as follows:

North CHATS Area Traffic Signal Master Plan



L E G E N D	
Interstate	Study Area Corridors
Major US and State Highways	National Forest
Other Highways	Department of Defense
Local Streets	Water Body
	County Boundary
	City Limits

Figure 2.1
Study Area Corridors

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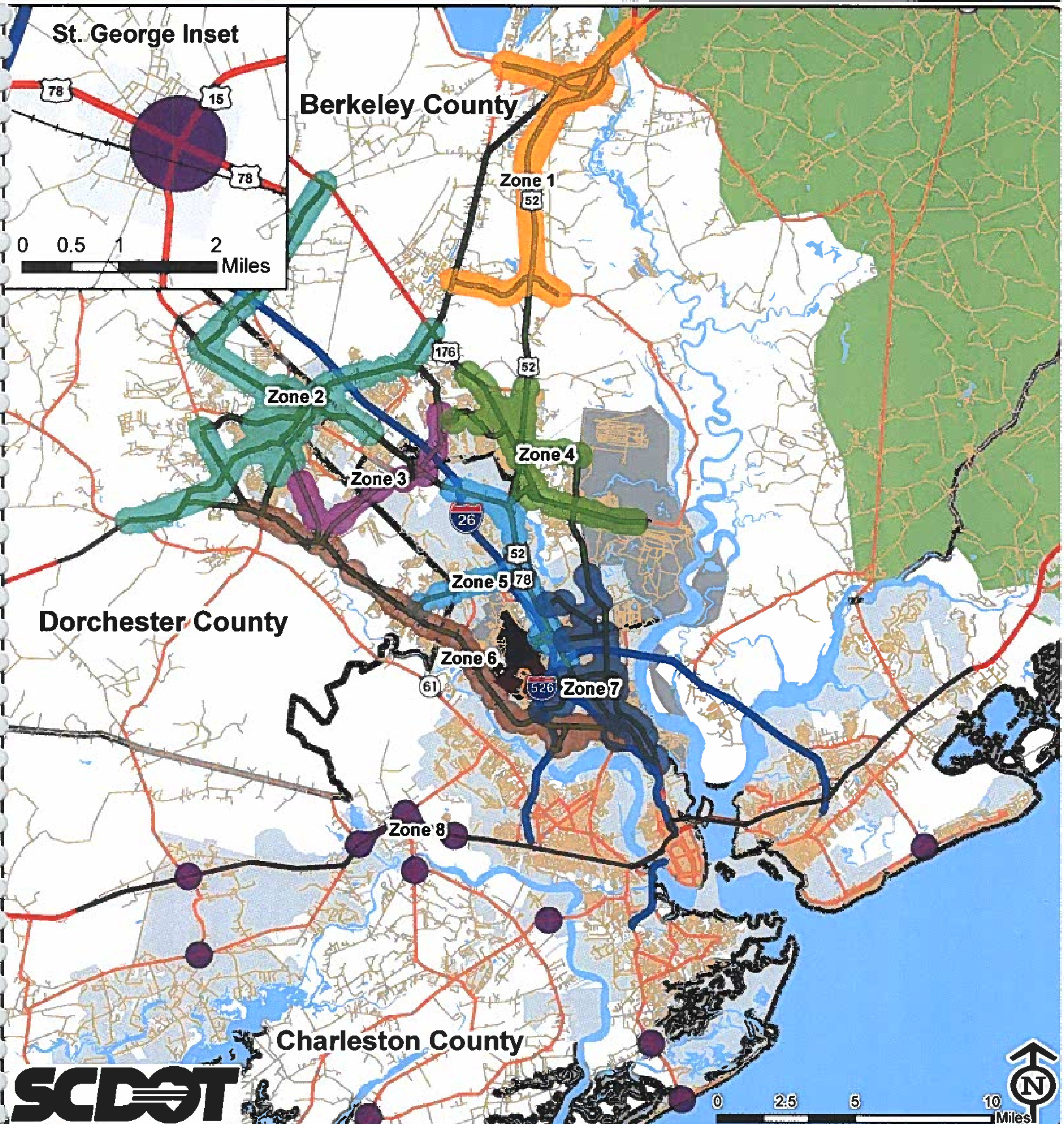
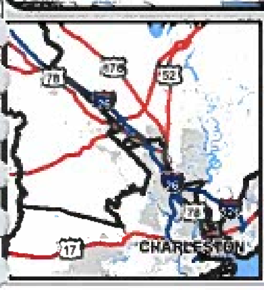
North CHATS Area Traffic Signal Master Plan





LEGEND

Zone 1	Interstate	Study Area Corridors
Zone 2	Major Highways	National Forest
Zone 3	Other Highways	Department of Defense
Zone 4	Local Streets	Water Body
Zone 5		County Boundary
Zone 6		City Limits
Zone 7		
Zone 8		

Figure 2.2
Study Area Zones

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ZONE 1 – Moncks Corner
Zone 1 encompasses Moncks Corner and extends from Cypress Gardens Road in the south to the US 52 at US 17A intersection in the north.

ZONE 2 – Downtown Summerville
Zone 2 includes US 17A, Old Trolley Road (to Miles Jamison Road), SC 165, US 78 (between Jedburg Road and Royle Road) and Berlin Myers Parkway in downtown Summerville. Jedburg Road, Orangeburg Road and Cedar Street are also included in Zone 2.

ZONE 3 – Summerville
Zone 3 is located to the south and east of southeastern Summerville. The major corridors in Zone 3 include Old Trolley Road (from Miles Jamison Road to Dorchester Road), College Park Road, Dorchester Road (from Orangeburg Road to Wescott Boulevard), and Ladson Road.

ZONE 4 – Goose Creek
Zone 4 encompasses Goose Creek and includes the US 176 and US 52 corridors from the US 176/US 52/Red Bank Road intersection to the north. Zone 4 also includes the Red Bank Road, Liberty Hall Road and Henry E. Brown Boulevard corridors.

ZONE 5 – Ashley Phosphate Road/Rivers Avenue
Zone 5 includes the major corridors of Ashley Phosphate Road, University Boulevard (from I-26 to Rivers Avenue), Aviation Avenue and Remount Road. Zone 5 also includes Rivers Avenue from the US 176/US 52/Red Bank Road intersection in the north to I-526 in the south.

ZONE 6 – SC 642 (Dorchester Road)
Zone 6 predominately includes the Dorchester Road corridor from Club Course Drive to Meeting Street. Zone 6 also includes Paramount Drive, Leeds Avenue, and Azalea Drive.

ZONE 7 – North Charleston and Hanahan
Zone 7 encompasses North Charleston and Hanahan. The major corridors in Zone 7 include North Rhett Avenue, Rivers Avenue (from I-526 to Azalea Drive) Murray Avenue, East Montague Avenue, International Boulevard and Spruill Avenue.

ZONE 8 – South of US 17
Zone 8 contains the remaining isolated intersections within the study area south of US 17 and has locations in Ravenel, Hollywood, West Ashley, Johns Island and Folly Beach.

As previously detailed, the existing conditions information was compiled from the SCDOT signal inventory database and signal design plans supplied by SCDOT, as well as additional field investigations and interviews with SCDOT staff. For the purposes of this master plan, major corridors have been identified as roadways that accommodate high volumes of traffic and have a significant number of relatively closely-spaced signalized intersections.

Jacobs has compiled the land uses, traffic volumes and flow characteristics, the major traffic generators and other land uses that affect traffic flow. Documented land uses include major retail centers, schools and colleges, churches, and parks. The significant land uses for each of the corridors are graphically depicted in Figure 2.3. Several police and fire stations as well as hospitals are located along a number of the major corridors, as shown in Figure 2.4. These service land uses depend on reliable travel times to respond to emergencies.

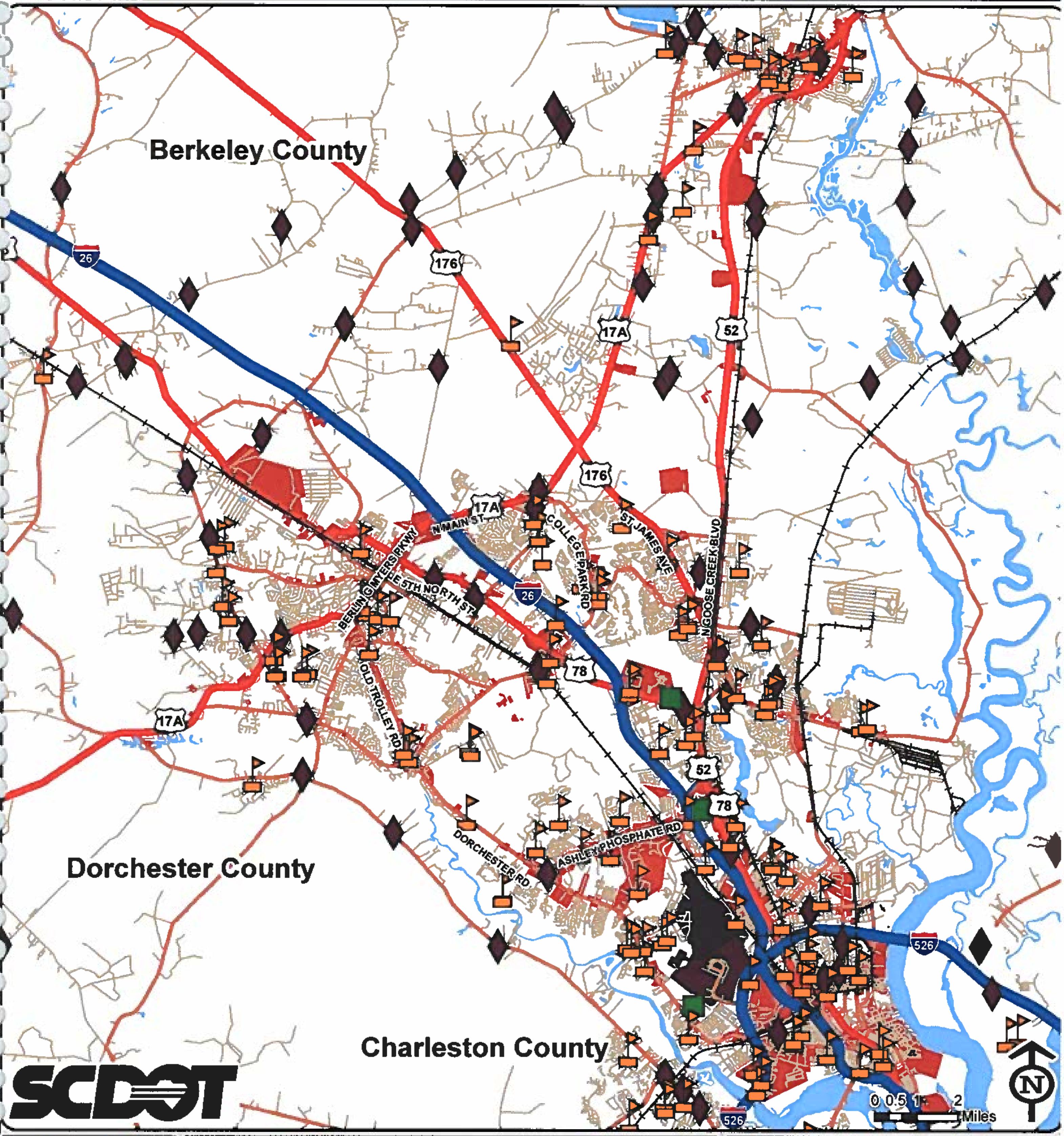
The traffic signal and communications equipment for each corridor were also compiled as part of this document. This information is summarized by corridor as well as presented in tabular form in Appendix A.

The traffic signal equipment data for the study area corridors was obtained from the SCDOT signal inventory database, signal design plans supplied by SCDOT and supplemented with field investigations and interviews with the SCDOT staff. The majority of the traffic signal controllers (136) are Naztec 2070 that are six years old or newer, (118) are type 170 controllers (Dynamic, Signal Control or Safe-Tran) and (five) NEMA which are generally seven years or older. Four locations are intersections controlled by equipment also operating another intersection. Appendix A – Existing Signal Equipment contains an inventory of existing equipment at each of the study intersections. Information includes, but is not limited to, an inventory of existing controller type, communications, cabinet type, and installation date.

For the existing traffic signal systems, the signal interconnect and communications between the Traffic Control Center (TCC) and the intersections was also determined. Figure 2.5 shows the interconnection methodology and communications in the study area. The following sections detail each corridor and present an understanding of the overall traffic flow characteristics. (Within the study area, I-26 is referenced as having an east-west orientation.)

Recent Average Annual Daily Traffic volumes (2011 AADT) were obtained from SCDOT for the study area corridors. While AADT volume counts are not adequate to develop specific timing plans, they provide insight into traffic flow characteristics. In addition, hourly data provided by SCDOT was reviewed to determine whether spikes in traffic volumes occur during peak periods or whether the traffic volumes are consistent during the day. The AADT volumes also help indicate whether there may be available capacity within each corridor. To supplement this information, Jacobs personnel also observed traffic flow during the peak periods as well as interviewed SCDOT personnel regarding traffic flow characteristics.

North CHATS Area Traffic Signal Master Plan



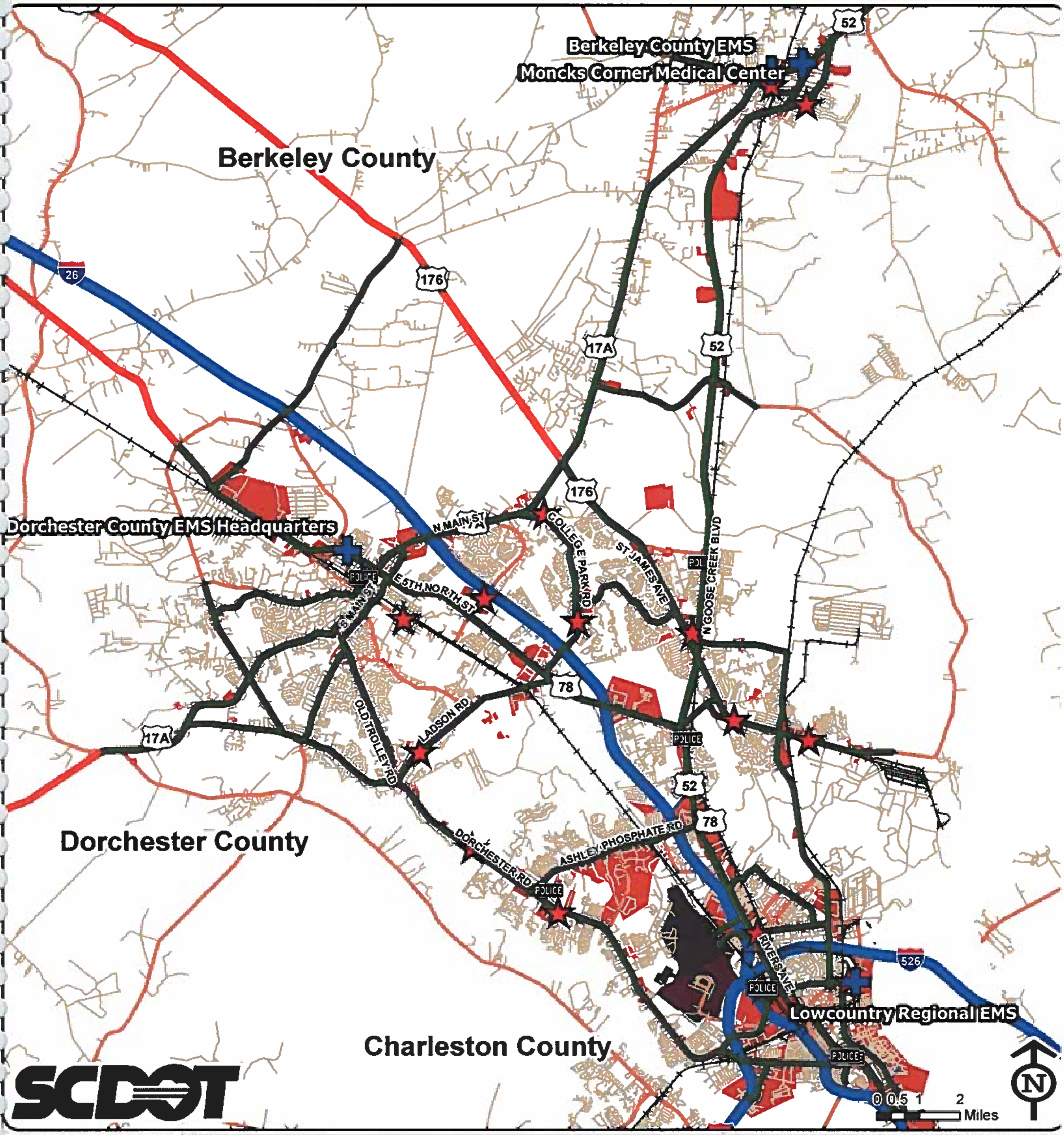
LEGEND

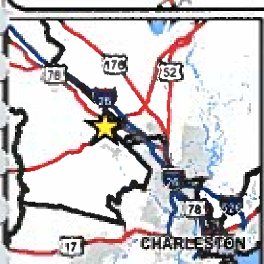
- Park
- Church
- School
- Major Commercial Area
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets

Figure 2.3
Land Uses and Major Traffic Generators

JACOBS

North CHATS Area Traffic Signal Master Plan





LEGEND

- POLICE Police
- Fire Station
- Medical Center
- Commercial Area
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.4
Police, Fire, and Emergency Services

JACOBS

North CHATS Area Traffic Signal Master Plan

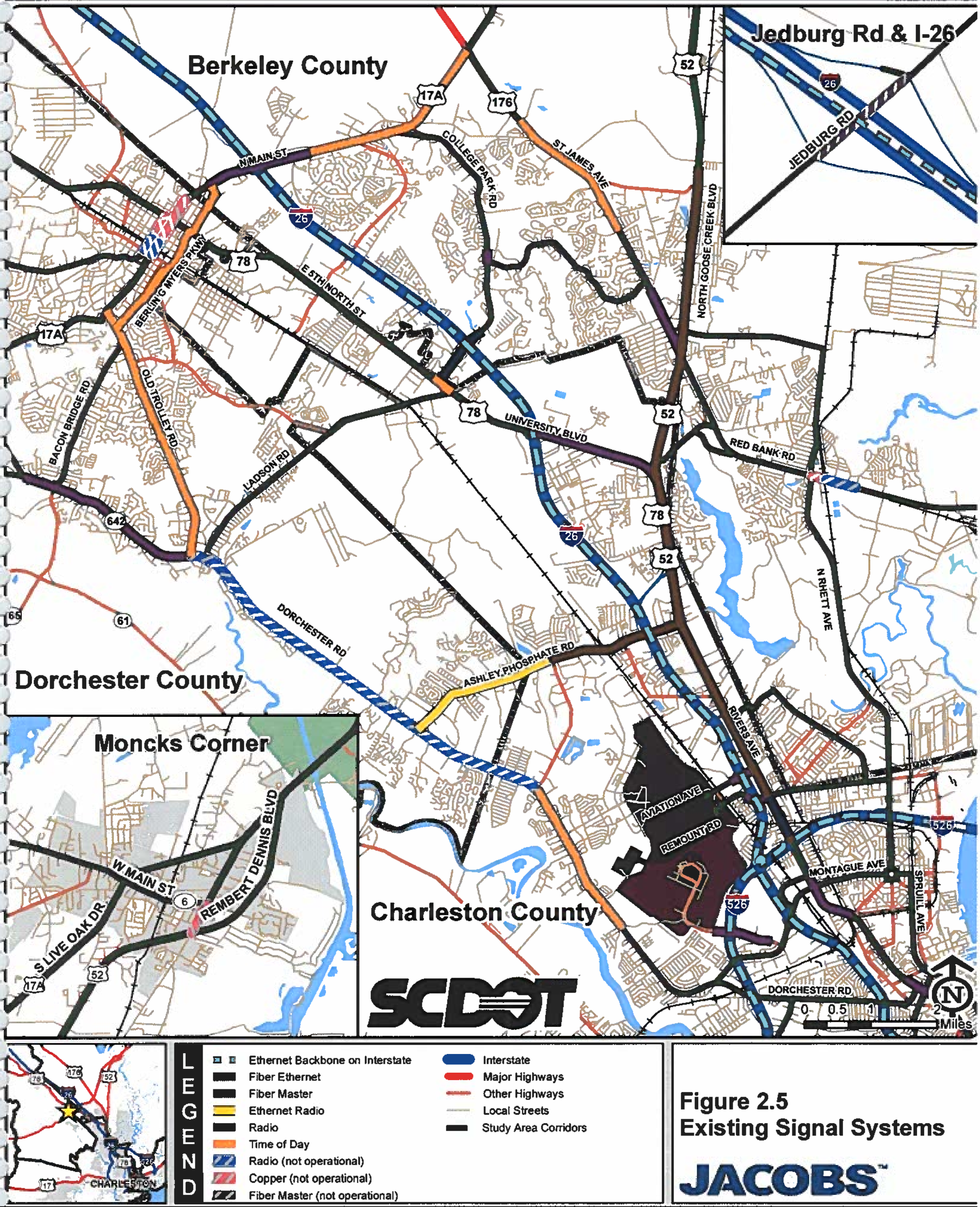


Figure 2.5
Existing Signal Systems

2.1 Zone 1 - Moncks Corner

Zone 1 encompasses Moncks Corner and extends from Cypress Gardens Road (south) to the US 52/US 17A intersection in St. Stephen (north). The following sections describe the roadway, land use, traffic volume and traffic signal characteristics of Zone 1; Figure 2.6 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.7 shows the SCDOT 2011 AADT volumes along the study corridors.

2.1.1 US 52 (North Goose Creek Boulevard)

US 52 (North Goose Creek Boulevard) is a north-south arterial that connects Moncks Corner to Goose Creek to the south and St. Stephen to the north. South of Moncks Corner, US 52 is a four-lane median divided roadway (two though lanes in each direction with grass median) with turn lanes provided at most intersecting side streets and a posted speed limit of 60 mph. Upon entering Moncks Corner from the south, vehicles following US 52 must turn left and Rembert Dennis Boulevard (a bypass around Moncks Corner) continues straight. North of its intersection with Rembert Dennis Boulevard, US 52 is a five-lane cross-section (two through lanes in each direction with a two-way left-turn lane). The five-lane cross-section on continues through St. Stephen.

South of Moncks Corner the adjacent land use along US 52 is a mix of vacant parcels and some commercial development. Within Moncks Corner US 52 primarily serves commercial development. However, several intersecting collector roadways serve local residential roadways north of Rembert Dennis Boulevard.

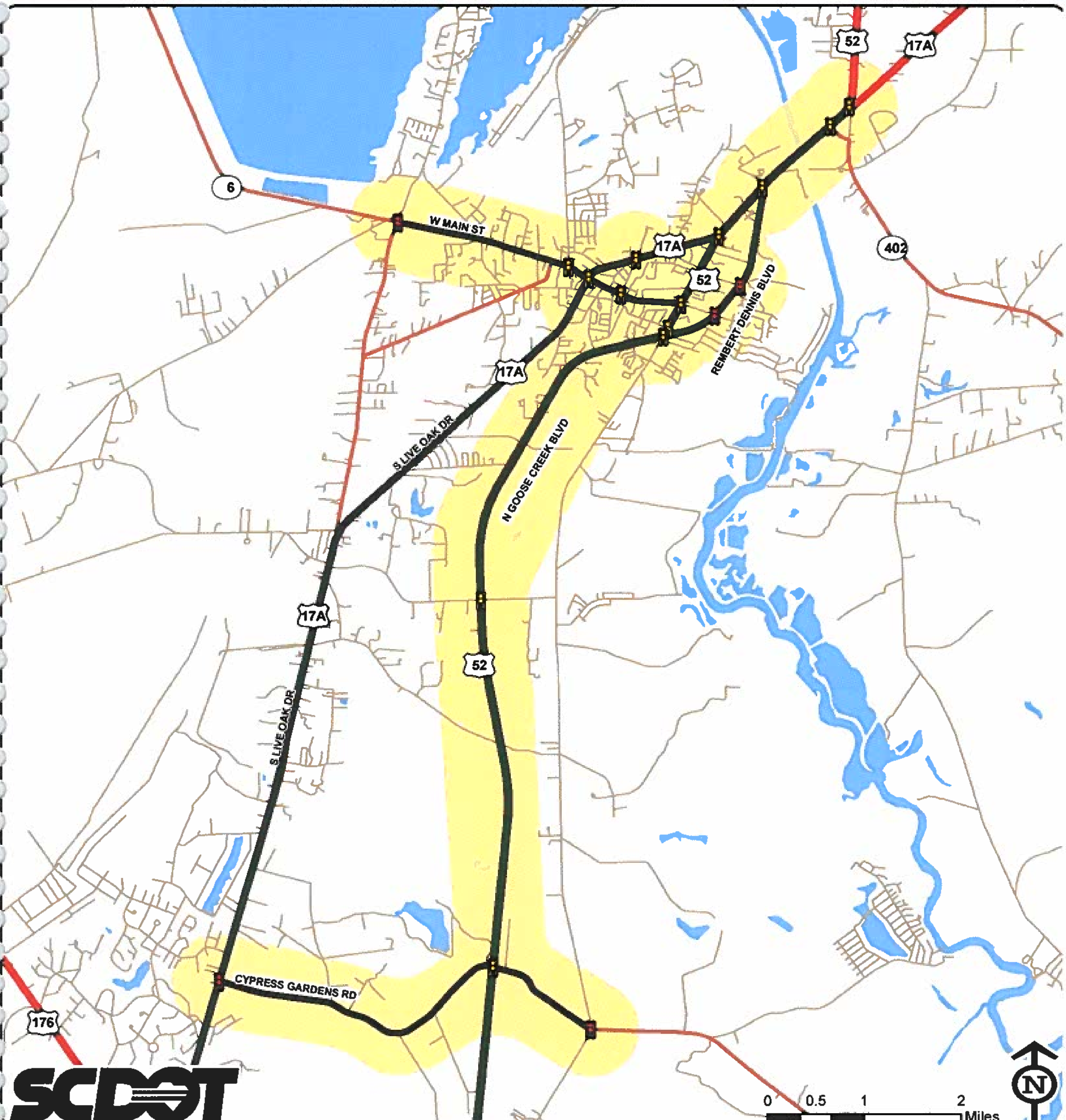
2011 AADT volumes along US 52 (N Goose Creek Blvd) are shown on Figure 2.7 at the following locations:

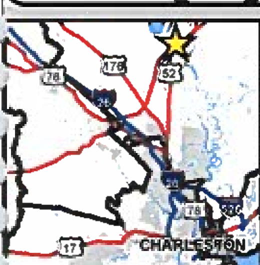
- Count Station 124: 20,400 vehicles per day (vpd) between Cypress Gardens Road and Gaillard Road
- Count Station 125: 17,700 vpd between Gaillard Road and Rembert Dennis Boulevard
- Count Station 127: 19,500 vpd between E Main Street and US 17A

The heaviest traffic occurs along the US 52/US 17A segment.

There are ten signalized intersections along this stretch of US 52 with the majority located within Moncks Corner. Three of these signals along US 52 (Rembert Dennis Boulevard, Heatley Street, and Main Street) have communication with a dial-up connections that are currently offline. All of the signals locations from Cypress Gardens Road to US 17A are being operated by Naztec 2070 controllers that are between three and six years old. The signal of US 52 at SC 45 is isolated and operated by a Signal Control 170 that is over sixteen years old.

North CHATS Area Traffic Signal Master Plan





LEGEND

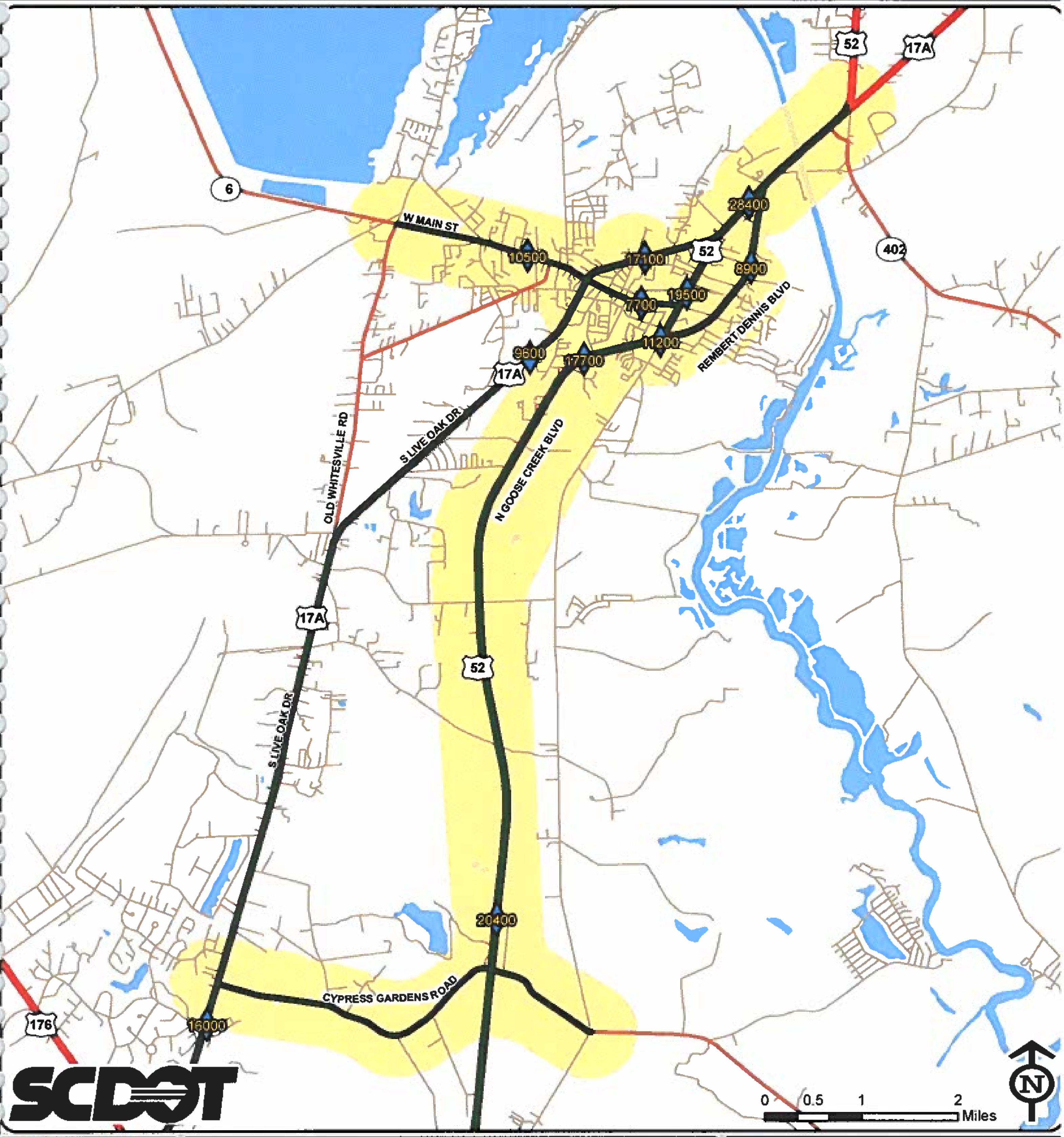
Traffic Signals Controller Type
- 170
- 2070
- NEMA

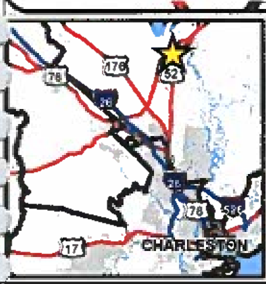
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors
- Selected Zone

Figure 2.6
Zone 1: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan





LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.7
Zone 1: Average Annual Daily Traffic Volumes

JACOBS

There are currently two posted evacuation routes along this corridor. The first designates northbound US 52 to make a left onto Gaillard Road westbound. The second directs the westbound SC 402 approach to make a right onto US 52 and follow US 52 beyond US 17A.

2.1.2 US 17A (Live Oak Drive)

US 17A (Live Oak Drive) is a major north-south arterial (posted at 45 mph) in the study area with a variable number of travel lanes. The facility has a five-lane cross-section (two lanes in each direction with a two-way left-turn lane) around Cypress Gardens Road. North of Cypress Gardens US 17A is currently under construction until a tie-in with the five-lane section just south of SC 6 (Main Street). Based on field observations it appears that the five-lane cross-section will be continuous with turning lanes at major intersection. The five-lane cross-section then continues through Moncks Corner (posted speed 40 mph) and runs concurrently with US 52 for almost 2 miles. US 17A then diverges from US 52, which turns toward the east; US 17A changes to a two-lane cross-section (one lane each direction) north of this diverge point.

South of Moncks Corner, land use adjacent to this roadway is predominantly residential with some vacant parcels and few commercial uses. From SC 6 (Main Street) to Rembert Dennis Boulevard is intensified commercial development and shopping with a few collector streets that link to residential areas. In this segment between SC 6 and Rembert Dennis Boulevard, there are also schools, a medical center, and a county Emergency Medical Services center. North of Rembert Dennis Boulevard, US 17A land uses are primarily residential and vacant parcels.

As shown in Figure 2.7 US 17A (Live Oak Drive) carries the following traffic volumes:

- Count Station 103: 16,000 vpd south of Cypress Gardens Road
- Count Station 105: 9,600 vpd between Cypress Gardens Road and SC 6
- Count Station 107: 17,100 vpd between SC 6 and the US 52 junction
- Count Station 109: 28,400 vpd between the US 52 junction and Rembert Dennis Boulevard (northern)

The heaviest traffic occurs along the US 52/US 17A segment.

From Cypress Gardens Road to the US 52 diverge, US 17A has seven signalized intersections. All of the controllers are Naztec 2070 with the exception of the intersection of Cypress Gardens Road, which is a Dynamic Traffic Systems 170. These intersections do not have existing communication equipment.

2.1.3 SC 6 (Main Street)

SC 6 (Main Street) is an east-west arterial (posted at 45 mph) with one lane in each direction. There is also a two-way left-turn lane between Pinopolis Road and US 17A (Live Oak Drive). Only the major intersections have turning bays. Land use is primarily residential or undeveloped between Broughton Road and US 17A. E Main Street between US 17A and US 52 is more developed with local shops. There are schools and the Moncks County Fire Department along the corridor.

As shown in Figure 2.7 SC 6 (W Main Street/E Main Street) carries the following traffic volumes:

- Count Station 145: approximately 10,500 vpd between S-8-315 and BUS 17A
- Count Station 147 approximately 7,700 vpd between US 17A and US 52

From Old Whitesville Road to Rembert Dennis Boulevard there are six (6) signalized intersections. There are four Naztec 2070 controllers, one Safetran 170 controller, and one Signal Control 170 Controller. These controllers range from twelve years to two years old. The two 170 controllers are at the eastern and western most signals. The only signal for this corridor that has communication equipment is located at the intersection of SC 6 (Main Street) and US 52; however, the signal at this location is set up to coordinate with signals along US 52 and is not currently working.

2.1.4 US 52 Bypass (Rembert Dennis Boulevard)

US 52 Bypass (Rembert Dennis Boulevard) is a north-south arterial (posted at 45 mph) that is a bypass for US 52 through Moncks Corner. Rembert Dennis Boulevard has a two-lane cross-section (one lane in each direction with turn lanes at major intersecting roadways. Land uses adjacent to this roadway are characterized by some commercial developments and vacant parcels. Intersecting collector streets provide access to large residential areas.

Rembert Dennis Boulevard carries 8,900 vpd between US 52 and 17A (Count Station 171). There are four signals on Rembert Dennis Boulevard from and the southern intersection with US 52 to the northern intersection of US 52, which is the entire length of Rembert Dennis Boulevard. The two intersections with US 52 are controlled by Naztec 2070 controllers that are less than three years old. The intersections at Stoney Landing Road/Santee Cooper and Main Street Extension/Sterling Oaks Drive are operated by 170 controllers that are sixteen and seven years old, respectively.

The only signal on the Rembert Dennis Boulevard corridor that has communication equipment is at the southern intersection with US 52. However, as discussed in section 2.1.3, this signal is set up to coordinate with signals along US 52 and is not currently working. None of the other intersections along Rembert Dennis Boulevard has existing communication equipment.

2.2 Zone 2 – Downtown Summerville

Zone 2 includes Downtown Summerville and the major corridors of US 17A, Old Trolley Road (to Miles Jamison Road), SC 165, US 78 (between Jedburg Road and Royle Road) and Berlin Myers Parkway. Additionally Jedburg Road, Orangeburg Road and Cedar Street are in Zone 2. Figure 2.8 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller and Figure 2.9 shows the SCDOT 2011 AADT volumes along the study corridors.

North CHATS Area Traffic Signal Master Plan

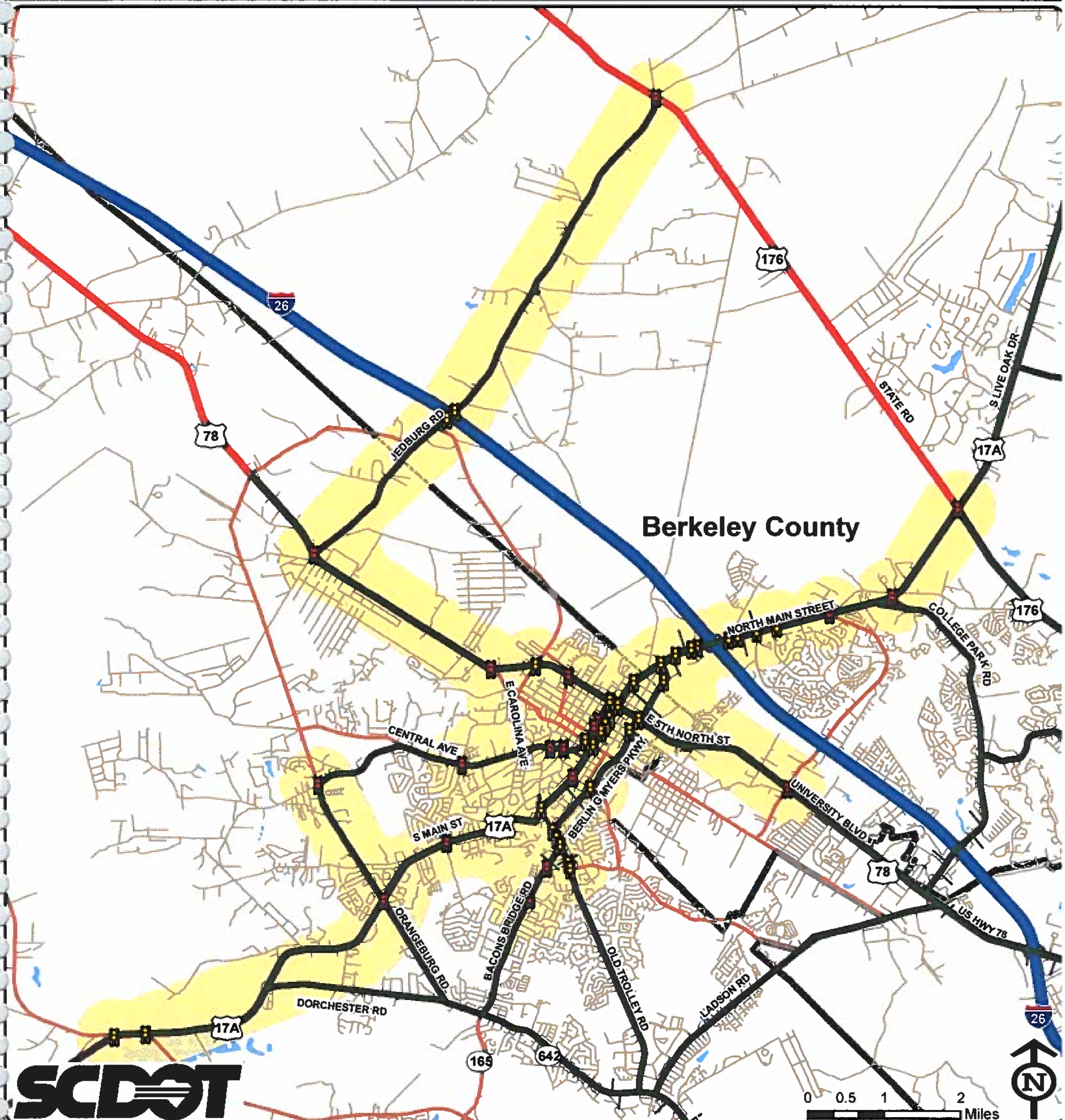
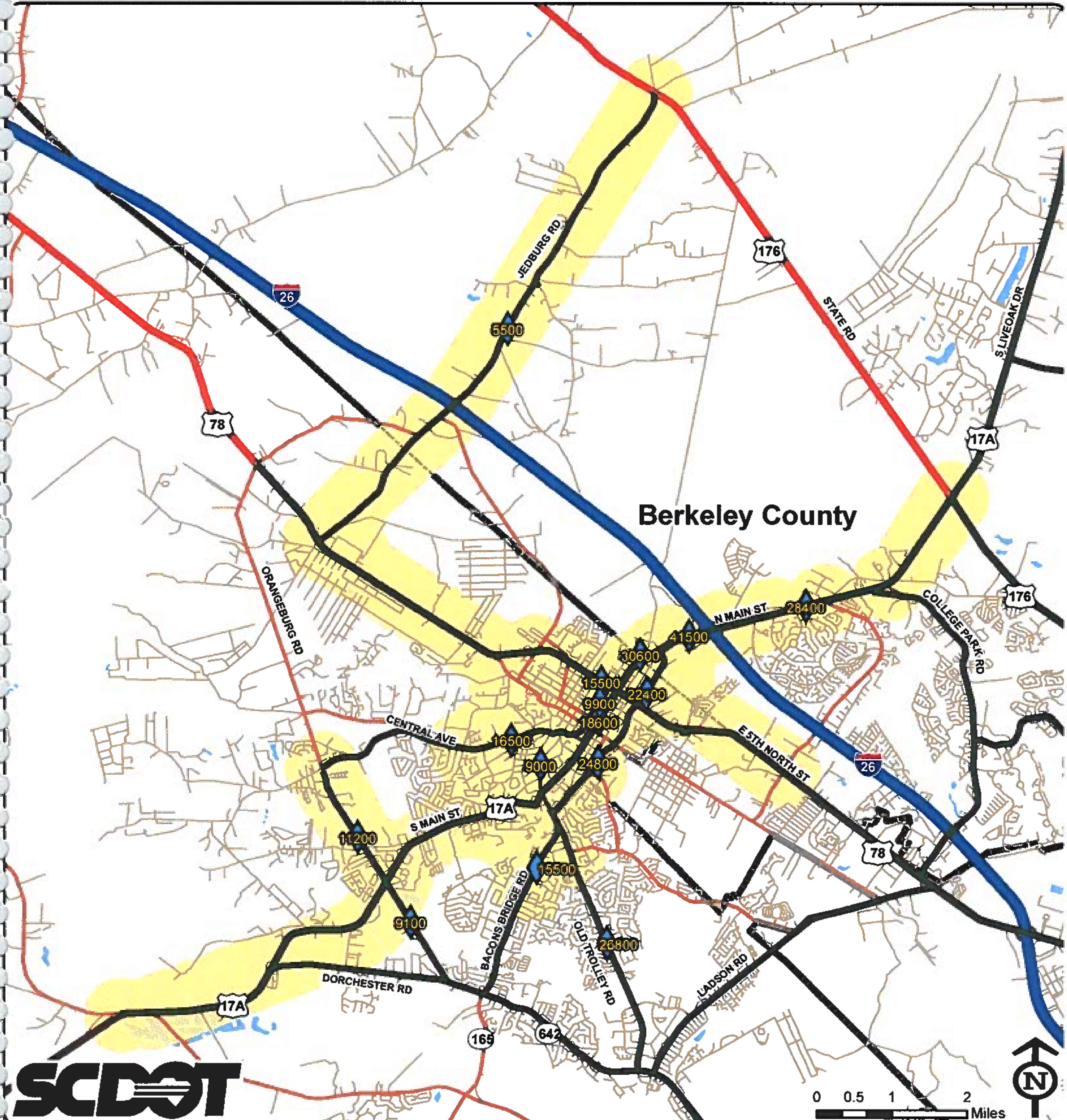
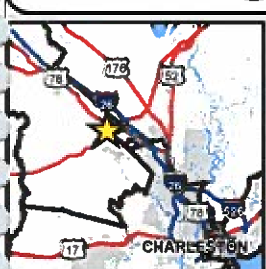


Figure 2.8
Zone 2: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan





LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.9
Zone 2: Average Annual Daily Traffic Volumes

2.2.1 US 17A (North Main Street)

US 17A (North Main Street) is a major north-south arterial (posted at 45 mph) in the study area and the number of travel lanes vary. The roadway has a five-lane cross-section (two lanes in each direction with a two-way left-turn lane) from US 176 to Sangaree Parkway. At Farmington Road, US 17A widens to three through lanes in each direction in order to accommodate traffic to and from I-26 while serving traffic from the adjacent commercial uses. The widened section extends from Farmington Road to Azalea Square Boulevard. South of Azalea Square Boulevard the number of through travel lanes reduces to two lanes in each direction as US 17A approaches Berlin G. Myers Parkway. US 17A has a five lane cross section from Berlin G. Myers Parkway to West Doty Avenue and the speed limit reduces to 35 mph.

Two travel lanes and a two-way left-turn lane are provided. At intersecting side streets, the two-way left-turn lane transitions to an exclusive left-turn lane. Entering downtown Summerville from West Doty Avenue to the south, US 17A narrows to a two-lane roadway with exclusive left and right turn lanes at intersecting side-streets and with a 30 mph speed limit. The character of the roadway changes significantly in Summerville, with stamped/colorized crosswalks at intersections as well as roadway medians. Parallel parking is also provided on both sides of this section of US 17A. South of West 2nd South Street, US 17A narrows further to a two-lane roadway with intermittent turn lanes. Land use adjacent to this roadway is a mix of predominantly commercial with some vacant parcels between West 2nd South Street and US 176. From West 2nd South Street, US 17A is predominately residential with five schools located between West 6th South Street and Orangeburg Road. Several collector roadways also intersect with US 17A that serve local residential communities to the east and west.

As shown in Figure 2.9, US 17A carries the following traffic volumes:

- Count Station 101: 28,400 vpd north of I-26
- Count Station 100: 41,500 vpd south of I-26
- Count Station 117: 30,600 vpd south of Berlin G. Myers Parkway
- Count Station 115: 18,600 vpd south of US 78(E. 5th North Street)

The observations of traffic flow indicate that the peak direction of traffic is towards I-26 in the AM peak period and away from I-26 in the PM peak period.

South of I-26, traffic volumes were observed to be heavier traveling towards I-26 in the AM peak and traveling away from I-26 in the PM peak (from the Dorchester/Charleston County Line). Traffic volumes increase beginning at 6 AM and stay elevated throughout the day to about 9 PM with little peaking at the normal AM and PM peak periods. This finding is consistent with the roadway characteristics of a commuter arterial that provides access to I-26 and the commercial/retail development along the corridor.

There are three signals on the US 17A segment between Royale Road and US 176. The signalized intersections have 170 controllers that were installed between 2000 and 2003. All signals along this corridor are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main street left-turn bays and the minor-street approaches. At the US 17A/US 176 intersection there are advance loops for both US 17A and US 176.

Between Royle Road and Berlin G. Myers Parkway there are eight interconnected/coordinated signals on US 17A. The signals are controlled by Naztec 2070 controllers that are between four and five years old. Currently the master controller is located at the US 17A at Farmington Road intersection. The detection schemes for these fully actuated signals generally follow standard SCDOT protocol with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn and side street approaches. This detection scheme is altered at the US 17A intersections with Beauregard Street and Sangaree Parkway. At these two locations advance loops on the Main Street are located about 100 feet from the stop bar. A series of system loops are also located downstream of the US 17A intersections at the I-26 EB and WB interchange ramps, Holiday Drive and Perkins/Azalea Square.

The signals on US 17A between Royle Road and SC 165 (Berlin G. Myers Parkway) are coordinated and interconnected with a fiber optic cable. Communications between these intersections and TCC is via a dial-up modem located at the master controller. The remaining intersections are operating in time-based coordination with the master intersection.

Between SC 165 (Berlin G. Myers Parkway) and Richardson Avenue there are six signalized intersections along US 17A. The signals include Naztec 2070 controllers that are less than five years old and have a combination of twisted pair and radio interconnection. The twisted pair copper interconnect is disconnected at each signal, but the interconnect cable is present along the utility pole line between Berlin G. Myers Parkway and West 1st South Street. Radio interconnect is provided between West 1st South Street and Richardson Avenue as there are no overhead utilities that cross the existing railroad grade crossing to carry an interconnect cable. No current communication exists between the signals from SC 165 (Berlin G. Myers Parkway) and Richardson Avenue and the TCC. The detection schemes for the fully- actuated signals on this section of US 17A also generally follow standard SCDOT protocol with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn and side-street approaches.

The remaining six Zone 2 intersections along US 17A (from East 6th South Street to SC 61 West) have no coordination or interconnection/communications and operate as isolated locations, with the exception of the US 17A at Carolina Avenue intersection. This location operates with time-based coordination that operates with the Carolina/Old Trolley Road system. Three of the six intersections (East 6th South Street, Luden Drive and Orangeburg Road) are operated by 170 controllers that were installed in January 2006 or earlier. The remaining three intersections are operated by Naztec 2070 controllers that were installed between September 2006 and February 2010. The detection scheme for the fully actuated signals again generally follows standard SCDOT protocol with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main street left-turn bay and side street approaches.

2.2.2 SC 165 (Berlin G. Myers Parkway)

SC 165 (Berlin G. Myers Parkway) is a north-south arterial (posted at 45 mph) that is a bypass for US 17A through Summerville. SC 165 (Berlin G. Myers Parkway) has a four-lane cross-section (two lanes in each direction) with additional turn lanes at major intersecting roadways. Land use adjacent to SC 165 (Berlin G. Myers Parkway) is characterized by light commercial except near the intersection with US 17A which has adjacent dense commercial development. Access to these commercial developments is provided from the intersecting side streets rather than directly from SC 165 (Berlin G. Myers Parkway).

As shown in Figure 2.9, SC 165 (Berlin G. Myers Parkway) carries the following traffic volumes:

- Count Station 170: 22,400 vpd south of US 17A
- Count Station 168: 24,800 vpd just north of East Carolina Avenue

Observations of traffic flow indicate that the peak direction of traffic is towards East Carolina Avenue in the AM peak period and towards US 17A in the PM peak period.

There are four signals on SC 165 (Berlin G. Myers Parkway) from US 17A to East Carolina Avenue. All signals along this corridor are operated by Naztec 2070 controllers that vary in age from three years to seven years. These four signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches.

The signals on the SC 165 (Berlin G. Myers Parkway) corridor operate in time-based coordination. No interconnection exists for controller synchronization with the exception of a fiber optic interconnect cable that runs between the US 17A and Marymeade Drive intersections. However, no connection currently exists on this fiber optic cable. The intersections along the SC 165 (Berlin G. Myers Parkway) corridor have no communications with the TCC.

2.2.3 North Cedar Street/Central Avenue

North Cedar Street/Central Avenue is a north-south local collector (generally posted with a 30 mph speed limit) that parallels US 17A one block to the west. This corridor is a two-lane roadway that widens at intersecting side streets to allow left-turn lanes. On-street parking areas (both angle and parallel) are provided between West 1st North Street and West 3rd North Street. Land use adjacent to this roadway is characterized by light commercial between West 5th North Street and West 2nd North Street in downtown Summerville. South of downtown Summerville, land use is predominately residential with some commercial development.

As shown in Figure 2.9, North Cedar Street/Central Avenue carries the following traffic volumes:

- Count Station 229: 9,900 vpd south of US 78 (E. 5th North Street)
- Count Station 231: 16,500 vpd just south of West Carolina Avenue

There are four signals on North Cedar Street between West 5th North Street and Central Avenue and four signals on Central Avenue between North Cedar Street and Orangeburg Road. Two of the four signals on North Cedar Street (Richardson Avenue and West 5th North Street) in downtown Summerville are operated by Naztec 2070 controllers that are four to five years old. The other two signals (West 2nd North Street and West 1st North Street) are operated by 170 controllers that are 16 to 18 years old. The signals between West 5th North Street and Central Avenue have a combination of twisted pair and radio interconnection. The twisted pair copper interconnect is disconnected at each signal; however, the interconnect cable is present along the utility pole line. Radio interconnect is provided between West 1st South Street and Richardson Avenue as there are no overhead utilities that cross the existing railroad grade crossing. There are no communications between these signals and the TCC.

The remaining four signals along Central Avenue are operated by 170 controllers. The controller at the Central Avenue at Parsons Road intersection is about four years old, while the remaining three locations have controllers that are about 12 to 14 years old. These four signals do not have interconnection, coordination or communications to the TCC.

All signals along the North Cedar Street/Central Avenue corridor are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches. Additionally, there are system loops on three of the four departures at the North Cedar Street at West 5th North Street intersection and two of the four departures at the North Cedar Street at Richardson Avenue intersection.

2.2.4 East Carolina Avenue/Old Trolley Road

East Carolina Avenue is a north-south collector (posted at 45 mph) between S Main Street to the north and Bacons Bridge Road to the south. The number of travel lanes varies. The corridor has a two-lane section from Central Avenue to Pine Grove Avenue (one through lane in each direction) and widens to include an exclusive left-turn lane on the northbound approach to the signalized intersection at US 17A. East Carolina Avenue widens to a five-lane cross-section (two lanes in each direction and two-way left-turn lane) between Pine Grove Avenue and Bacons Bridge Road. Land use adjacent to this roadway is predominantly residential north of Berlin G. Myers Parkway and predominantly commercial east to Bacons Bridge Road.

As shown in Figure 2.9, the East Carolina Avenue/Old Trolley Road corridor carries the following traffic volumes:

- Count Station 263: East Carolina Avenue carries approximately 9,000 vpd west of SC 165(Berlin G. Myers Parkway).
- Count Station 237: Old Trolley Road carries 26,800 vpd between SC 642 (Dorchester Road) and Bacons Bridge Road

Observations and review of the adjoining properties/street networks indicate that this is a commuter route with traffic headed towards Charleston International Airport and the Charleston Air Force Base (as well as other destinations along Dorchester Road) during the AM peak and towards the residential areas in Summerville during the PM peak.

There are seven traffic signals on the Carolina Avenue/Old Trolley Road corridor between Central Avenue and Miles Jamison Road. Six of the seven have Naztec 2070 controllers that vary in age from three years to seven years. The Carolina Avenue at Central Avenue intersection is operated by a 170 controller that is around 12 years old. These signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches.

The Carolina Avenue/Old Trolley Road corridor operates with a time-based coordination system. The system consists of six signals from US 17A to Miles Jamison Road, which is operating in time-based coordination with no interconnection for controller synchronization. The intersections along the East Carolina Avenue/Old Trolley Road corridor have no communications with the TCC.

2.2.5 SC 165 (Bacons Bridge Road)

SC 165 (Bacons Bridge Road) is a north-south collector (posted at 45 mph) that has a five-lane cross-section (two lanes in each direction with a two-way left-turn lane) between Old Trolley Road and SC 642 (Dorchester Road). The two-way left-turn lane transitions to an exclusive left-turn lane at major intersections between Old Trolley Road and Dolphin Drive. Land use adjacent to the roadway on this portion of SC 165 (Bacons Bridge Road) is commercial. South of Dolphin Drive, SC 165 (Bacons Bridge Road) transitions to a two-lane roadway extending to SC 642 (Dorchester Road) and land use is predominately residential with pockets of commercial development.

Bacons Bridge Road carries 15,500 vpd between Old Trolley Road and Dorchester Road (Count Station 161). The two signals along SC 165 (Bacons Bridge Road) are located at the Stallsville loop and Mikel Drive/Edisto Drive. Both signals are operated by 170 controllers that are about 18 to 20 years old. These signals have no coordination and no communications to the TCC. These signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches.

2.2.6 US 78 (West 5th N Street)

US 78 (West 5th North Street) between Jedburg Road and College Park Road is an east-west collector (posted at a 45 mph speed limit) that parallels I-26 approximately two miles to the south. US 78 is predominately rural with one lane in each direction. This section of US 78 also widens to provide exclusive left-turn bays at major signalized intersections. Land uses along this roadway are a mix of residential, commercial, and vacant parcels.

US 78 (West 5th North Street) carries 15,500 vpd between Old Trolley Road and Dorchester Road (Count Station 139). US 78 has nine signals from Jedburg Road to College Park Road. The signals at the intersections of US 78 at North Cedar Street, US 78 at US 17A, US 78 at Berlin G. Myers Parkway and US 78 at College Park Road are described in sections for the respective cross-streets of North Cedar Street, US 17A, Berlin G. Myers Parkway and College Park Road. The remaining US 78 signals within this study corridor are operated by 170 controllers that range for 8 years to 15 years old. Each of these five remaining signals operates as an isolated location with no coordination. There are no communications to the TCC. These signals are fully-actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.2.7 Jedburg Road

Jedburg Road is north-south collector that runs between US 78 to the south and US 176 to the north. Jedburg Road is a generally rural roadway that has one lane in each direction and widens to provide left-turn lanes at major signalized intersections. Land uses along this roadway are a mix of residential, commercial and vacant parcels.

Jedburg Road carries 5,500 vpd between I-26 and SC 176 (Count Station 177). There are four signals on Jedburg Road from US 78 to US 176. The signals at the I-26 interchange (Eastbound and Westbound Ramps) have 2070 controllers that are about 3 years old. Fiber optic cable runs between the two intersections but there is no active connection. The intersection of Jedburg Road and US 176 is operated by 170 controller installed in October 2011. Each of these four signals operates as an isolated location with no coordination. The intersections along the Jedburg Road corridor have no communications with the TCC. These signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.2.8 Orangeburg Road

Orangeburg Road is a north-south collector that runs between SC 642 (Dorchester Road) to the south and US 78 to the north. Orangeburg Road is a generally rural roadway that has one lane in each direction and widens to provide exclusive left-turn lanes at major-signalized intersections. Land uses along this roadway are a mix of residential, commercial and vacant parcels.

As shown in Figure 2.9, Orangeburg Road carries the following traffic volumes:

- Count Station 209: 9,100 vpd south of S Main Street
- Count Station 211: 11,200 vpd north of S Main Street

The signals at the intersections of Central Avenue at Orangeburg Road, US 17A at Orangeburg Road and SC 642 (Dorchester Road) at Orangeburg Road are described in sections 2.2.1 US 17A (North Main Street), 2.2.3 North Cedar Street/Central Avenue, and 2.6.1 SC 642 (Dorchester Road).

2.3 Zone 3 – Summerville

Zone 3 is generally located within Summerville. The major corridors in Zone 3 include Old Trolley Road (from Miles Jamison Road to Dorchester Road), College Park Road, Dorchester Road (from US 17A to Wescott Boulevard), and Ladson Road. Figure 2.10 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.11 shows the SCDOT 2011 AADT volumes along the study corridors.

2.3.1 Old Trolley Road

Old Trolley Road is an east-west collector (posted at 45 mph) that has a five lane cross-section (two lanes in each direction with a two way left turn lane) with additional turn lanes provided at major intersecting roadways. Land use adjacent to this roadway is a mainly commercial. There are also several intersecting residential roadways to neighborhoods north and south of the corridor.

Old Trolley Road carries approximately 26,800 vpd between Bacons Bridge Road and SC 642 (Dorchester Road) (Count Station 237). Although there is no hourly data available for review, field observations and review of the adjoining roadway networks indicate that this is commuter route with traffic headed towards Charleston International Airport and the Charleston Air Force Base as well as other destinations along SC 642 (Dorchester Road) in the AM and towards the residential areas in Summerville in the PM.

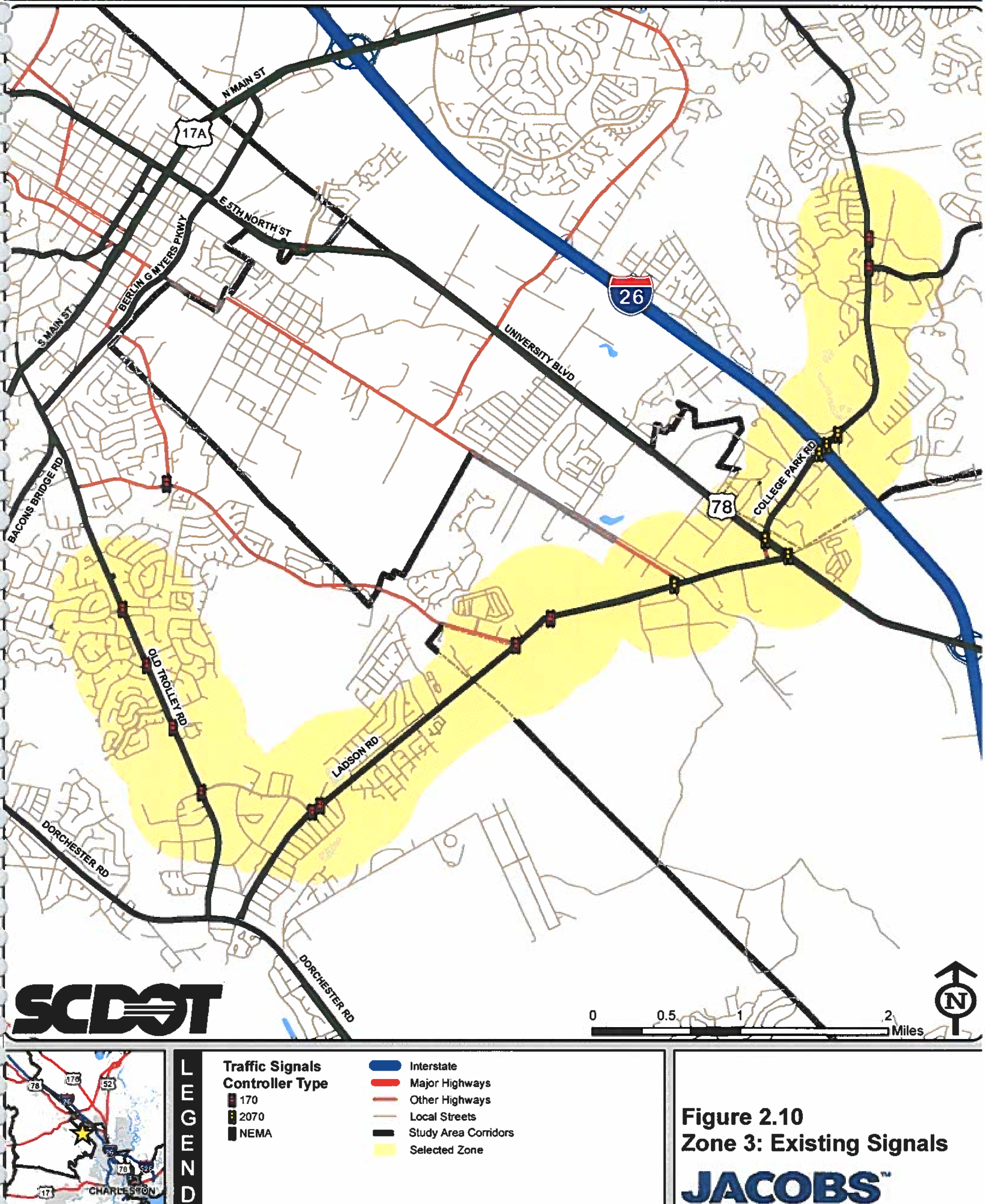
There are four traffic signals on the Old Trolley Road corridor between Miles Jamison Road and SC 642 (Dorchester Road) that are operated by 170 controllers that were installed between 1993 and 2002. All signals along this corridor are fully actuated with standard SCDOT loop layout advance loops on the main street approach and stop-bar detection (quadrupole) on the main street left turn and the minor street approaches.

The four signals (Old Trolley Road/Crestview Drive Arbor to Trolley Road/Midland Parkway) along this corridor are running in time-based coordination with no interconnection for controller synchronization. The intersections along the East Carolina Avenue/Old Trolley Road corridor have no communications with the TCC.

2.3.2 Ladson Road

Ladson Road is a five-lane (two though lanes in each direction with a two-way left-turn lane) arterial roadway (posted at 45 mph) between University Boulevard (US 78) and SC 642 (Dorchester Road). Exclusive left and right turn bays are provided at intersecting side streets. Bicycle lanes are also provided in each direction. Between SC 642 (Dorchester Road) and Midland Parkway, land use is a mix of commercial and residential. Between Midland Parkway and Palmetto Commerce Parkway, land use is predominantly residential with some pockets of commercial development. Northeast of Palmetto Commerce Parkway to Lincolnville Road, the land around Ladson Road is mainly undeveloped. Northeast of Lincolnville Road to University Boulevard, the land use is a mix of undeveloped and commercial land uses. Ladson Elementary School is located along this segment of roadway.

North CHATS Area Traffic Signal Master Plan



LEGEND

Traffic Signals Controller Type
- 170
- 2070
- NEMA

- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors
- Selected Zone

Figure 2.10
Zone 3: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan

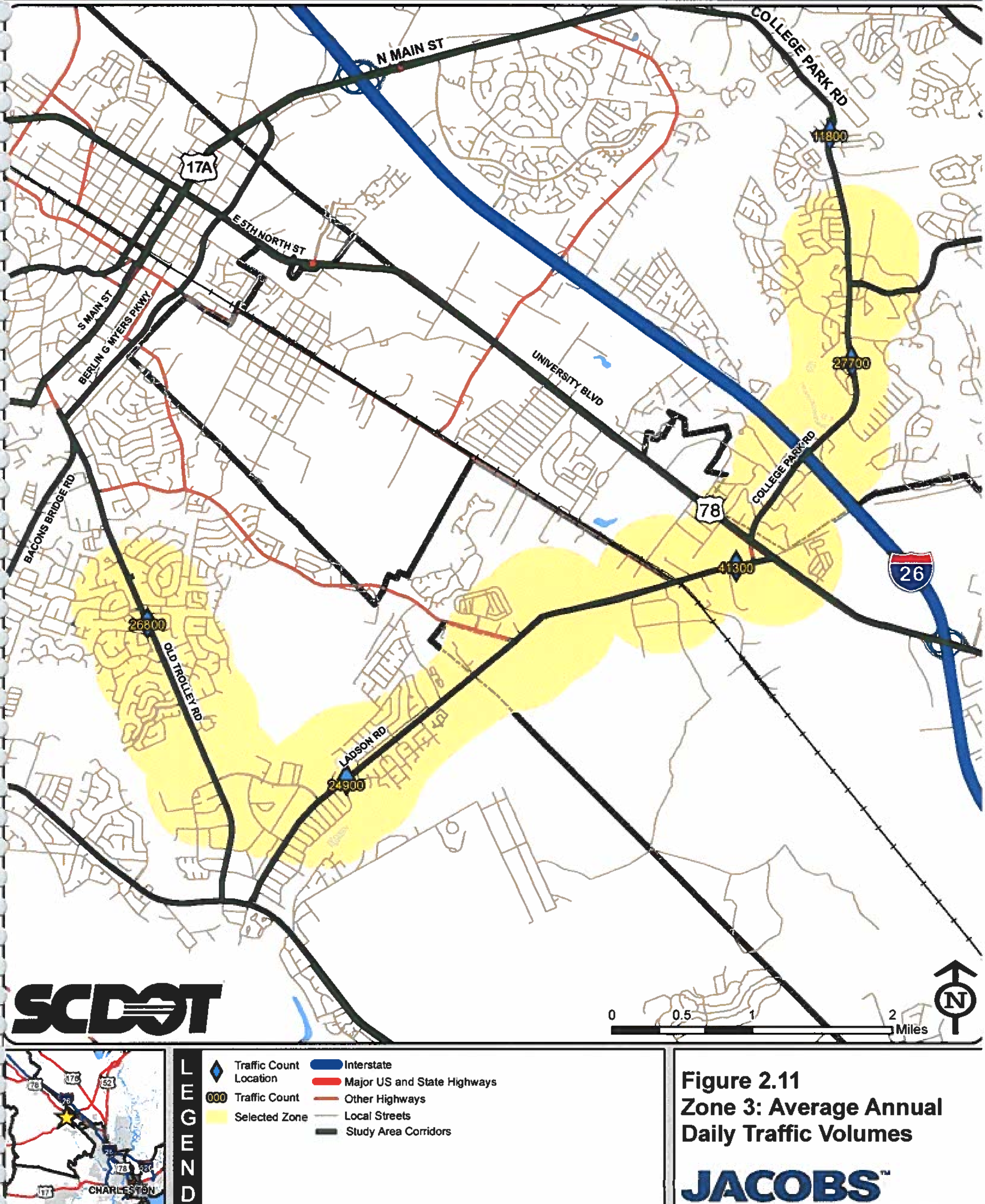


Figure 2.11
Zone 3: Average Annual Daily Traffic Volumes

JACOBS

As shown in Figure 2.11, Ladson Road carries the following traffic volumes:

- Count Station 244: 24,900 vpd northeast of SC 642 (Dorchester Road)
- Count Station 531: 41,300 vpd between Lincolnville Road and University Boulevard

The peak travel patterns observed during the AM period was northeast and southwest during the PM peak period. There are five traffic signals (four stop-and-go and one emergency signal) along Ladson Road between SC 642 (Dorchester Road) and College Park Road. The signals currently operate as isolated intersections with the distance signals ranging between 0.75 miles to 1.75 miles. The only exception is between Jamison Road and Palmetto Commerce Parkway, which are located approximately 1,900 feet apart. All signals are operated by 170 controllers that are between five and ten years old with the exception of the signal at Lincolnville Road which has a 2070 controller that is about two years old.

All signals along this corridor are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches.

2.3.3 College Park Road

College Park Road is a five-lane north-south arterial that has two lanes in each direction and a center two-way left-turn lane between Ladson Road and Savannah Road. Additional turn lanes are provided at major intersecting roadways. In this area, College Park Road is characterized by commercial/retail and some residential/recreational land uses adjacent to the roadway. Stratford High School is located on the corridor near the intersection of College Park Road at Crowfield Boulevard.

Several intersecting collector roadways serve local residential communities east and west of the College Park Road. North of Savannah Road, College Park Road narrows to a two-lane roadway to its terminus at US 17A. Land uses along this portion of College Park Road are mainly residential.

As shown in Figure 2.11, College Park Road carries the following traffic volumes:

- Count Station 281: 11,800 vpd north of Crowfield Boulevard
- Count Station 282: 27,700 vpd between Crowfield Boulevard and I-26

Field observations and review of the adjoining properties/street networks indicate that College Park Road is a commuter route with traffic headed towards I-26 during the AM peak and away from I-26 during the PM peak. The two schools located along this roadway also generate traffic during school peak periods.

The College Park Road corridor has five signals. Three of the signals are located within approximately 1,000 feet of each other, are adjacent to I-26 and are operated by Naztec 2070 controllers with the master being located at the I-26 EB ramps. These three Naztec 2070 controllers are between three and six years old. The detection scheme for these fully-actuated signals generally follows standard SCDOT protocol with advance loops on the College Park Road (main street) approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. The College Park Road southbound approach at the I-26 EB ramps and the College Park Road northbound approach at the I-26 WB ramps are exceptions with no advance loops on the main street approaches due to the close proximity of the intersections. These approaches instead have stop-bar detection (quadrupole). The three signals at the College Park Road/I-26 interchange are coordinated and interconnected using spread spectrum radio, which is connected to the TCC office using a dial-up modem at the master controller.

The remaining two locations (College Park/Crowfield Boulevard and College Park/Corporate Parkway) are operated by 170 controllers that are six to nine years old. The detection scheme for the fully-actuated signals also follows standard SCDOT protocol with advance loops on the College Park Road (main street) approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. These two intersections are interconnected with a fiber optic cable and the two signals are coordinated. Communications between these two intersections and TCC is via a dial-up modem located at the master controller.

2.4 Zone 4 – Goose Creek

Zone 4 encompasses Goose Creek and includes the US 176 and US 52 corridors (from the US 176/US 52/Red Bank Road intersection to the north), Red Bank Road, Liberty Hall Road and Henry E. Brown Boulevard. Figure 2.12 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.13 shows the SCDOT 2011 AADT volumes along the study corridors.

2.4.1 US 176 (St. James Avenue)

US 176 (St. James Avenue) is a seven-lane (three though lanes in each direction with a two-way left-turn lane) east-west arterial (posted at 45 mph) between North Goose Creek Boulevard and Crowfield Boulevard. North of Crowfield Boulevard, US 176 (St. James Avenue) is five-lanes (two lanes in each direction with a two-way left-turn lane). Additional exclusive turn lanes are provided at intersecting side streets.

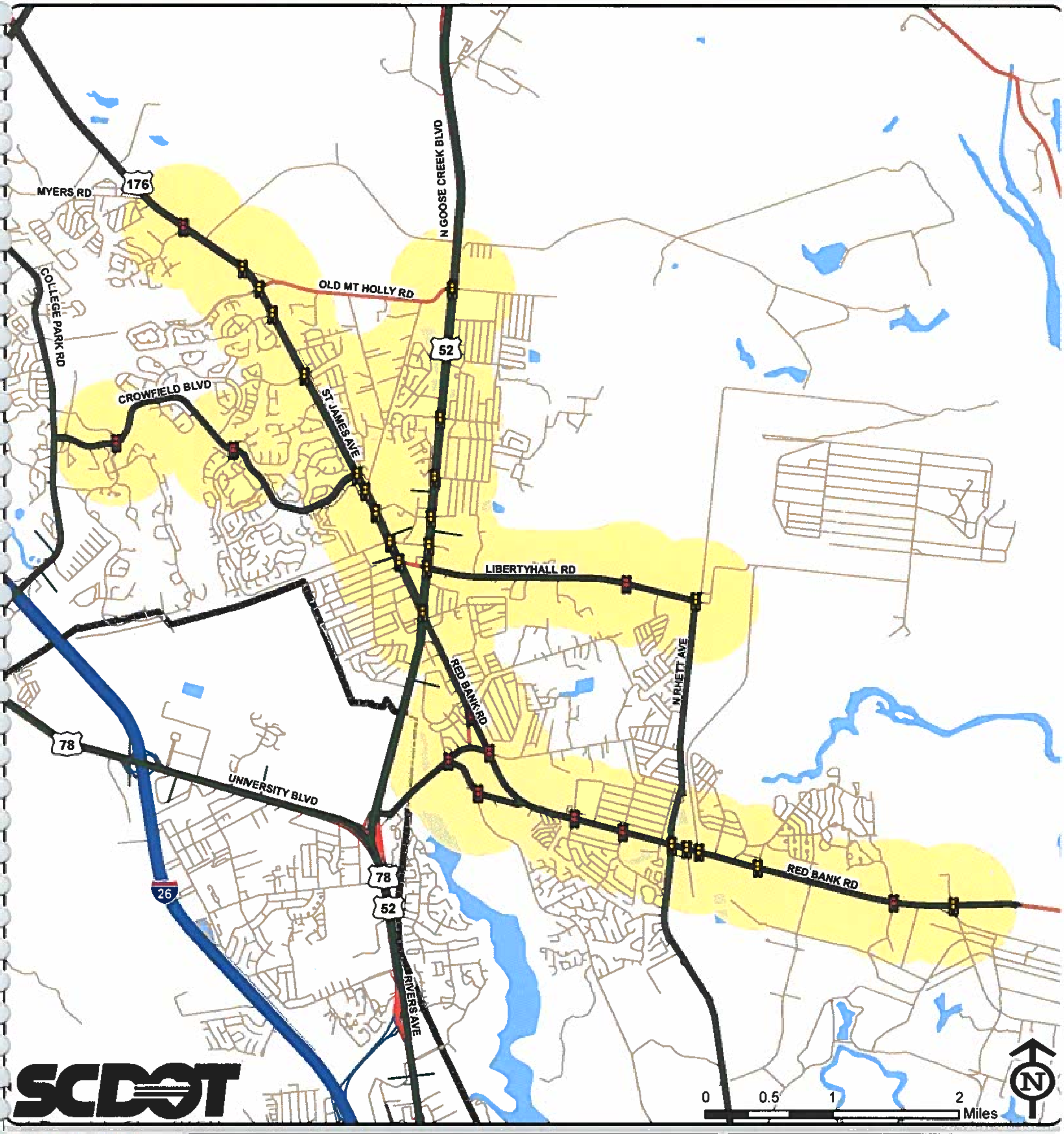
Adjacent land use between North Goose Creek Boulevard and Crowfield Boulevard is mainly commercial, while land use west of Crowfield Boulevard is a mix of residential and commercial. Several intersecting collector roadways also serve local residential roadways.

As shown in Figure 2.13, US 176 (St. James Avenue) carries the following traffic volumes:

- Count Station 136: 38,700 vpd west of the North Goose Creek Boulevard at St. James Avenue
- Count Station 138: 24,400 vpd west of Old Mount Holly Road

The peak travel patterns observed are eastbound during the AM period and westbound during the PM peak period. This travel pattern is consistent with the area roadway characteristics of US 176 (St. James Avenue) as an arterial between a population center and the employment destination.

North CHATS Area Traffic Signal Master Plan



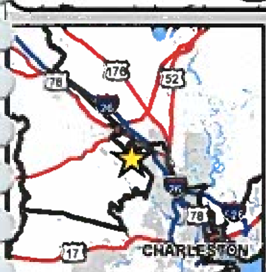
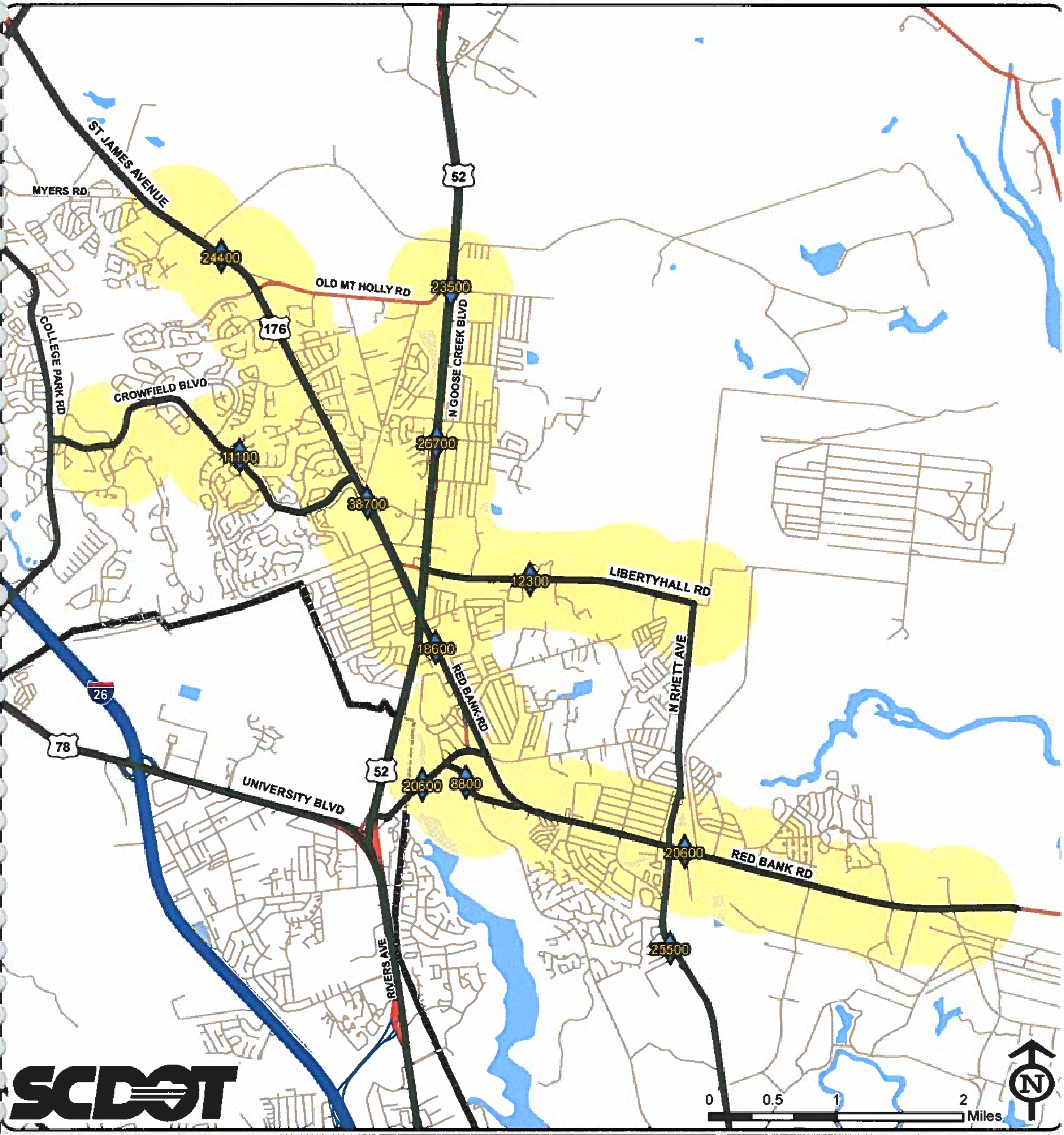
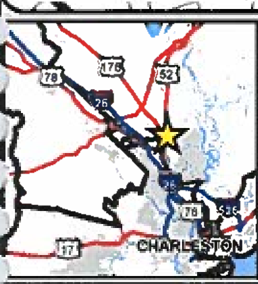


Figure 2.12
Zone 4: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan





LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.13
Zone 4: Average Annual Daily Traffic Volumes

JACOBS™

The nine signals along US 176 (St. James Avenue) from North Goose Greek Boulevard to Davenport Street are operated by Naztec 2070 controllers that are between one and five years old. The US 176 (St. James Avenue) at Devon Street intersection is operated by a 170 controller that is about 8 years old. All signals along this corridor are fully actuated with standard SCDOT loop layout, advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches. The US 176 (St. James Avenue) corridor signals operate in a coordinated system.

A fiber optic cable connects five of ten intersections along the US 176 (St. James Avenue) corridor. Communications between these intersections and TCC is via a dial-up modem located at the master controller shared with the N Goose Creek Boulevard corridor. The remaining five intersections at Gainesborough Drive, Fairfax Boulevard, Old Mt Holly Road, Davenport Street and Devon Boulevard operate in time-based coordination.

2.4.2 US 52 (North Goose Creek Boulevard)

US 52 (North Goose Creek Boulevard) is a north-south arterial (posted at 45 mph) with a six-lane divided cross-section (three though lanes in each direction with grass median) between US 176 and Brandywine Boulevard. North of Brandywine Boulevard, US 52 (North Goose Creek Boulevard) changes to a four-lane median-divided roadway with exclusive turn lanes provided at intersecting side streets. Additionally, a parallel rail line is located on the east side of US 52 (North Goose Creek Boulevard) and crosses each side-street approach with provided railroad preemption.

Adjacent land use adjacent to US 52 (North Goose Creek Boulevard) between Central Avenue and US 176 is mainly commercial, while land use north of Central Avenue is a mix of vacant parcels and commercial. Several intersecting collector roadways also serve local residential roadways from the corridor.

As shown in Figure 2.13, US 52 (North Goose Creek Boulevard) carries the following traffic volumes:

- Count Station 119: 26,700 vpd west of the north of the US 52/US 176
- Count Station 121: 23,500 vpd near Old Mount Holly Road

Based on SCDOT hourly data, peak travel patterns are southbound during the AM period and northbound during the PM period. A noticeable midday peak also occurs in both directions. In general, the midday travel demand is higher in the southbound direction on US 52 (North Goose Creek Boulevard). This finding is consistent with the roadway characteristics of US 52 (North Goose Creek Boulevard) in this area as an arterial between a population center and the employment destination.

There are seven signals along US 52 (North Goose Creek Boulevard) from US 176 (St. James Avenue) to Old Mount Holly Road. These locations are operated by Naztec 2070 controllers that are between four and six years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches.

Fiber optic cable connects six of the seven intersections on US 52 (North Goose Creek Boulevard). These six signals operate in a coordinated system. The US 52 (North Goose Creek Boulevard) at Old Mount Holly Road intersection operates in time-based coordination as it is not connected to the other six corridor intersections. Communications between these intersections and TCC is via a dial-up modem located at the master controller at US 176.

2.4.3 Red Bank Road

Red Bank Road is a north-south arterial roadway (posted at 45 mph) providing access to the Charleston Naval Weapons Station as well as businesses located adjacent to the roadway. Red Bank Road has a five-lane cross-section (two lanes in each direction with a two-way left-turn lane) between Howe Hall Road and US 52. Red Bank Road widens to seven-lanes (three though lanes in each direction with a two-way left-turn lane) south of Howe Hall Road to North Rhett Avenue/Henry E. Brown Boulevard. At the intersection, Red Bank Road narrows back to a five-lane cross-section to Deke Giles Avenue. Red Bank Road is a two-lane roadway with exclusive turn lanes provided at intersecting side streets from Deke Giles Avenue to NNPTC/Ordinance Avenue. Adjacent land use is mainly commercial, with some residential. Several intersecting collector roadways that serve local residential roadways are located along the study corridor.

As shown in Figure 2.13, Red Bank Road carries the following traffic volumes:

- Count Station 227: 18,600 vpd east of US 52 (North Goose Creek Boulevard)
- Count Station 233: 20,600 vpd east of N. Rhett Avenue

The peak travel patterns observed are southbound during the AM period and northbound during the PM peak period. This observation is consistent with the roadway characteristics of Red Bank Road as an arterial between a population center and the employment destination. Ten signals are located along Red Bank Road between the Charleston Naval Weapons Station and US 52. Five of the ten locations are operated by Naztec 2070 controllers that are between one and seven years old. The remaining signalized intersections along this corridor are operated by 170 controllers between 12 and 17 years old. The detection scheme for the fully actuated signals generally follows standard SCDOT protocol with advance loops on the main street approach and stop-bar detection (quadrupole) on the main street left-turn bays and side street approaches.

A copper interconnect cable runs from the North Rhett Avenue intersection to the Pomflant Access Road intersection along Red Bank Road. A spread spectrum radio is located at the Red Bank Road at Deke Giles Avenue intersection that is not connected at the controller. The signals in this corridor do not operate in a coordinated system. Communications between these intersections and TCC is via a dial-up modem located at the master controller at the North Rhett Avenue intersection.

2.4.4 Liberty Hall Road

Liberty Hall Road is an east-west collector that travels between US 52 (North Goose Creek Boulevard) to the west and Henry E. Brown Jr. Boulevard to the east. Liberty Hall Road is generally a rural roadway that has one lane in each direction, which widens to provide exclusive left-turn bays at major signalized intersections. The speed limit on Liberty Hall Road between US 52 (North Goose Creek Boulevard) and Lindy Creek Road is posted at 35 mph. Between and Lindy Creek Road and Henry E. Brown Jr. Boulevard, the speed limit is posted at 45 mph. Land uses along this roadway are predominately residential and vacant parcels, with pockets of commercial uses closer to US 52 (North Goose Creek Boulevard). Liberty Hall Road carries 12,300 vpd east of US 78 (N. Goose Creek Boulevard) (Count Station 297).

There are two signals on Liberty Hall Road at its eastern end. The signal at Wildberry Lane/Adler is about 6 years old and is operated by a 170 controller. The signal at Henry E. Brown Jr. Boulevard is about 2 years old and is operated by a 2070 controller. Each of these signals operates as an isolated location with no coordination. The intersections along the Liberty Hall Road have no communications with the TCC.

These signals are fully actuated with standard SCDOT loop layout with advance loops on the main street approach and stop-bar detection (quadrupole) on the main street left-turn bays (if present) and the minor-street approaches.

2.4.5 North Rhett Avenue/Henry E. Brown Jr. Boulevard

North Rhett Avenue/Henry E. Brown Jr. Boulevard is a north-south arterial (posted at 45 to 50 mph) that travels between Red Bank Road and Liberty Hall Road. Beyond Liberty Hall Road, North Rhett Avenue/Henry E. Brown Jr. Boulevard continues north for approximately one-half mile before reaching a dead end; this roadway serves residential uses. North Rhett Avenue/Henry E. Brown Jr. Boulevard is a rural roadway with one lane in each direction. Land uses along this roadway are predominately residential, with pockets of commercial uses.

North Rhett Avenue carries 25,500 vpd south of Red Bank Road (Count Station 236). There are two signals on North Rhett Avenue/Henry E. Brown Jr. Boulevard at either end, one at Liberty Hall Road and the other at Red Bank Road. Each of these signals operates as an isolated intersection with no coordination. The intersections have no communications with the TCC. These signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.4.6 Crowfield Boulevard

Crowfield Boulevard is an east-west collector (posted 45 mph) that runs between College Park Road and US 176 (Saint James Avenue). From its intersection with College Park Road to Corporate Parkway, approximately 2,500 feet, Crowfield Boulevard is a multilane roadway that has both exclusive left and exclusive right turn lanes to accommodate traffic associated with adjacent commercial land uses. From Corporate Parkway to Cherry Hill Avenue, Crowfield Boulevard is a local collector roadway with one lane in each direction. Crowfield Boulevard transitions to a four lane median divided roadway for approximately 2,500 feet between Cherry Hill Avenue and US 176 (Saint James Avenue). Land uses along this portion of the roadway are predominately residential, with pockets of commercial uses.

Crowfield Boulevard carries 11,100 vpd between US 176 (St. James Avenue) and College Park Road (Count Station 280). There are two signals on Crowfield Boulevard. Both signals are operated by 170 controllers that are 10 to 13 years old. The two signals operate as isolated intersections with no coordination between them or the TCC. These signals are fully-actuated with standard SCDOT loop layout with advance loops on the main street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.5 Zone 5 – Ashley Phosphate Road/Rivers Avenue

Zone 5 includes the major corridors of Ashley Phosphate Road (from Dorchester Road to Rivers Avenue), University Boulevard (from I-26 to Rivers Avenue), Rivers Avenue (from the US 176/US 52/Red Bank Road intersection south to the I-526), Aviation Avenue and Remount Road (from I-26 to Rivers Avenue). Figure 2.14 shows the traffic signal locations along each corridor and depicts the type of traffic signal controllers. Figure 2.15 shows the SCDOT 2011 AADT volumes along the study corridors.

2.5.1 US 78 (University Boulevard)

US 78 (University Boulevard) is a major north-south arterial with a five-lane cross-section (two through lanes in each direction and a two-way left-turn lane) posted at 45 mph. At major intersection roadways, US 78 (University Boulevard) also widens to provide additional exclusive turn lanes. Land use adjacent to US 78 (University Boulevard) is mainly commercial with some vacant parcels.

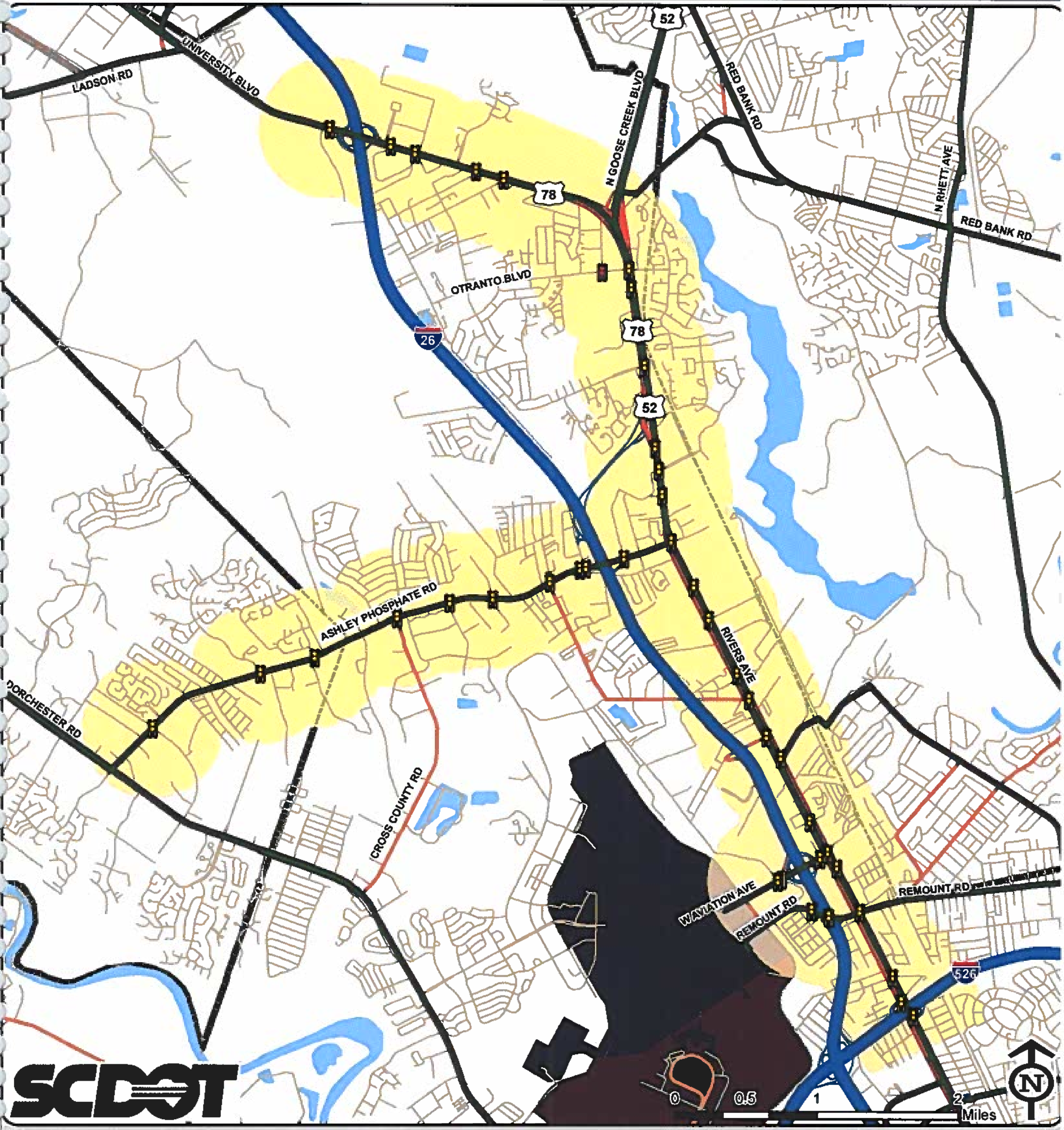
As shown in Figure 2.15 US 78 (University Boulevard) carries the following traffic volumes:

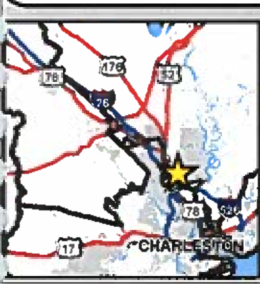
- Count Station 173: approximately 42,000 vpd south of I-26
- Count Station 175: 39,900 vpd north of I-26

Based on SCDOT supplied hourly data, the AM peak travel direction is towards I-26, and the PM peak travel direction is away from I-26. This finding is consistent with the characteristic of this roadway as an arterial being used by commuters to access I-26.

There are seven signals along US 78 (University Drive) between College Park Road to Fernwood Drive. The signals are operated by Naztec 2070 controllers that are between one and five years old. Currently the master controller is located at the University Boulevard at Fernwood Drive intersection. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. This detection scheme is altered at the US 78 intersections with I-26 and Medical Plaza (W). At these two locations, advance loops on the Main Street are located about 100 feet from the stop bar due to the approach slab of the bridge.

North CHATS Area Traffic Signal Master Plan





LEGEND

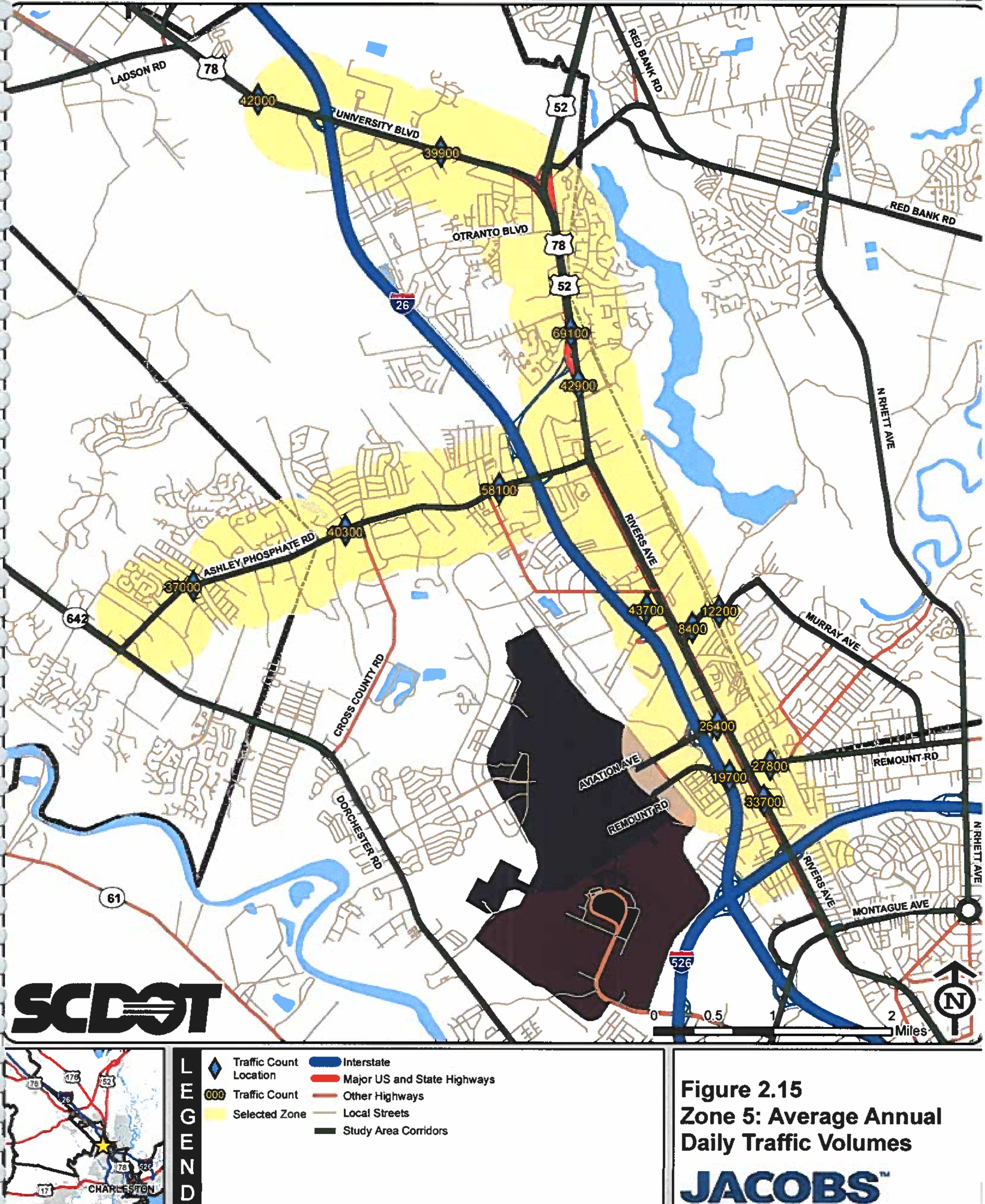
Traffic Signals Controller Type
- 170
- 2070
- NEMA

- Interstate
- Major Highways
- Other Highways
- Local Streets
- Selected Zone
- Study Area Corridors

Figure 2.14
Zone 5: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan



LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.15
Zone 5: Average Annual Daily Traffic Volumes

JACOBS

There are five signals that are coordinated and interconnected with fiber optic cable along US 78 (University Boulevard) between College Park Road to Fernwood Drive. Communications between these intersections and TCC is via a dial-up modem located at the master controller. The remaining intersections (University Boulevard /College Park Road and University Boulevard/Ladson Road) are operating in time-based coordination. Spread-section radio connection exists between the University Boulevard /College Park Road and College Park Road/I-26 EB intersection that provides connectivity to the TCC.

2.5.2 Ashley Phosphate Road

Ashley Phosphate Road is a major east-west arterial with variable design speeds: 40 mph from Pepperdam Avenue to Rivers Avenue and 50 mph from Dorchester Road to Pepperdam Avenue. Ashley Phosphate Road has a seven-lane cross-section (three lanes in each direction with a center two-way left-turn lane) with additional exclusive turn lanes provided at major intersecting roadways. At its interchange with I-26, Ashley Phosphate Road widens to four through travel lanes in each direction. Ashley Phosphate Road is characterized by commercial/retail land uses adjacent to the roadway with residential neighborhoods predominately south of Cross County Road. Several collector roadways also intersect with Ashley Phosphate Road. These collector roads connect with many residential communities located to the east and west of Ashley Phosphate Road.

As shown in Figure 2.15 Ashley Phosphate Road carries the following traffic volumes:

- Count Station 440: approximately 58,100 vpd between Stall Road and Rivers Avenue
- Count Station 441: 40,300 vpd just west of Cross County Road
- Count Station 299: 37,000 vpd east of SC 642 (Dorchester Road)

A review of available hourly data provided by SCDOT indicates that the traffic volumes east of I-26 (from US 52) show little peak directionality during the AM peak period, however traffic volumes increase slightly towards I-26 during the PM peak period. West of I-26, traffic volumes are heavier towards I-26 in the AM peak and away from I-26 in the PM peak. Traffic volumes increase beginning at 6 AM and stay elevated throughout the day to about 9 PM with little peaking at the normal AM and PM peak periods. These findings are consistent with the roadway characteristics of a commuter arterial that provides access to I-26 and the commercial/retail development along the corridor.

There are ten signals located along Avenue Ashley Phosphate Road between SC 642 (Dorchester Road) and Rivers. All signals along this route are operated by Naztec 2070 controllers. All but one of the controllers is three years old or less. The oldest controller is approximately five years old. All signals along this corridor are fully actuated with standard SCDOT loop layout with advance loops on Ashley Phosphate Road and stop-bar detection (quadrupole) on the main-street left-turn bays and minor-street approaches.

Between Northwoods Boulevard and Cross County Road, fiber optic cable connects seven signalized intersections, which connects to the Rivers Avenue at Ashley Phosphate intersection. From the Rivers Avenue at Ashley Phosphate intersection, a direct connection exists to the TCC via Rivers

Avenue/Remount/I-26. In addition to the fiber optic (Ethernet) cable, the Ashley Phosphate Road at Cross County Road intersection has Ethernet radio that communicates with the three intersections to the south along Ashley Phosphate Road, as well as the SC 642 (Dorchester Road) at Ashley Phosphate intersection.

2.5.3 US 52 (Rivers Avenue) – Otranto Boulevard to I-526

US 52 (Rivers Avenue) is a major north-south arterial (posted at 45 mph) that is generally three through lanes (occasionally widening to four through lanes) in each direction. US 52 (Rivers Avenue) also provides additional turn lanes at major intersecting roadways. Rivers Avenue is median-divided east of Ashley Phosphate Road and west of North River Market/Northwoods Mall to US 176 (St. James Avenue). Several median crossovers and u-turn lanes are provided east of Ashley Phosphate Road that can potentially disrupt progression along the corridor. The corridor is undivided between Ashley Phosphate Road and North River Market/Northwoods Mall. Land use adjacent to Rivers Avenue is mainly commercial. Several intersecting collector roadways also serve local residential roadways to neighborhoods primarily to the north and south.

Rivers Avenue is a major commuter route with dense development. The major shopping areas extend from Aviation Avenue to US 78 with numerous driveways serving commercial uses. Rivers Avenue is also used as a bypass of I-26 in the event of an incident.

As shown in Figure 2.15 Rivers Avenue carries the following traffic volumes:

- Count Station 157: 33,700 vpd Remount Road and I-526
- Count Station 159: 43,700 vpd between Midland Park Road and Eagle Drive
- Count Station 161: 42,900 vpd between Ashley Phosphate Road and North River Market/Northwoods Mall
- Count Station 163: 69,100 vpd west of the North River Market/Northwoods Mall

The peak directional flow is westbound in the AM peak period and eastbound in the PM peak period, reflective of commuter travel in the area, north of Aviation Avenue. A noticeable peak occurs between 12 Noon and 2 PM with the higher flow direction being in the westbound direction. South of Aviation Avenue, the peak directional flow is eastbound in the AM and westbound in PM peak. Based on field observations, high hourly volumes occur through the majority of the day, as there are numerous retail/commercial properties adjacent to this corridor.

There are 20 signals over a five and three quarter mile stretch of Rivers Avenue between Otranto Boulevard and I-526. All signals along this corridor are operated by Naztec 2070 controllers that vary in age from one year to seven years. All signals along this corridor are fully actuated with standard SCDOT loop layout with advance loops on the Rivers Avenue approaches and stop-bar detection (quadrupole) on the main-street left-turn bays and the minor-street approaches. Between I-526 and Otranto Boulevard, fiber optic (Ethernet) cable connects to all 20 signals along the corridor. These signals are linked back to the TCC via Rivers Avenue/Remount/I-26. A connection is currently planned from the Rivers Avenue at Otranto Boulevard intersection to I-26 trunk line (via US 78).

2.5.4 Aviation Avenue

Aviation Avenue is an east-west roadway that has two lanes in each direction with added turn lanes at each of the signalized intersections. Aviation Avenue has an interchange with I-26 and provides access between the Charleston International Airport /Charleston Air Force Base and I-26, as well as Rivers Avenue. Commercial properties near the Fain Street at Core Avenue intersection access Aviation Avenue from the intersecting side streets. Aviation Avenue carries 26,400 vpd west of US 52 (Rivers Avenue) (Count Station 661). The travel patterns observed in the field are towards I-26 during the AM peak period and away from I-26 in the PM peak period.

The three traffic signal locations along Aviation Avenue are being reconstructed as part of the I-26 widening project. The signals along this route will be operated by Naztec 2070 controllers and fully actuated with standard SCDOT loop layout with advance loops on the Aviation Avenue approaches and stop-bar detection (quadrupole) on the main-street left-turn bays. Video detection is being proposed for the side street approaches based on available plans. The three signalized intersections on Aviation Avenue will be connected via fiber optic Ethernet interconnect cable to the Rivers Avenue/Aviation Avenue intersection and the Rivers Avenue fiber optic cable. This master intersection connects to the TCC via Remount/I-26.

2.5.5 Remount Road – I-526 to Rivers Avenue

Remount Road is an east-west roadway that has two lanes in each direction with added turn lanes at each of the signalized intersections. Remount Road has an interchange with I-26 approximately one half mile east of Aviation Avenue. Similar to Rivers Road, Remount Road also provides access between the Charleston International Airport /Charleston Air Force Base and I-26. Remount Road is currently under construction as part of the I-26 widening project. There are no access points to adjacent properties within the study area.

As shown in Figure 2.15 Remount Road carries the following traffic volumes:

- Count Station 451: approximately 19,700 vpd west of US 52 (Rivers Avenue)
- Count Station 449: 39,900 vpd east of US 52 (Rivers Avenue)

Field observations show that the travel patterns on these roads have the heaviest traffic volumes traveling towards I-26 in the AM peak period and traveling away from I-26 in the PM peak period.

Remount Road is being reconstructed as part of the I-26 widening project. The two signals at the I-26 ramps will be operated by Naztec 2070 controllers and fully actuated with standard SCDOT loop layout with advance loops on the Remount Road Aviation Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays. The updated signals on Remount Road will be connected via fiber optic (Ethernet) cable to the TCC.

2.6 Zone 6 – SC 642 (Dorchester Road)

Zone 6 includes the SC 642 (Dorchester Road) corridor from Orangeburg Road to Rivers Avenue, through Summerville and North Charleston. Zone 6 also includes Paramount Drive, Leeds Avenue and Azalea Drive. Figure 2.16 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.17 shows the SCDOT 2011 AADT volumes along the study corridors.

2.6.1 SC 642 (Dorchester Road)

SC 642 (Dorchester Road) from US 17A to just north of Old Trolley Road is currently under construction which will be a four-lane cross-section (two lanes in each direction) median-divided roadway with additional exclusive turn lanes provided at major intersecting roadways. SC 642 (Dorchester Road) from just north of Old Trolley Road to Meeting Street is a major east-west arterial that is posted at 45 mph. SC 642 (Dorchester Road) in this section has a four-lane cross-section (two lanes in each direction) with additional exclusive turn lanes provided at major intersecting roadways. SC 642 (Dorchester Road) has a grass median to divide traffic between Parlor Drive/Shaftsbury Lane and Cross County Road and between Apartment Drive and Michaux Parkway. Land use adjacent to SC 642 (Dorchester Road) is a mix of vacant property, residential and commercial. Several intersecting collector roadways serve local residential communities both north and south of SC 642 (Dorchester Road). Access to both Charleston International Airport (via Michaux Parkway) and the Charleston Air Force Base (via West Hill Boulevard and Lawson Drive) is available from SC 642 (Dorchester Road). SC 642 (Dorchester Road) has interchanges with both I-526 and I-26.

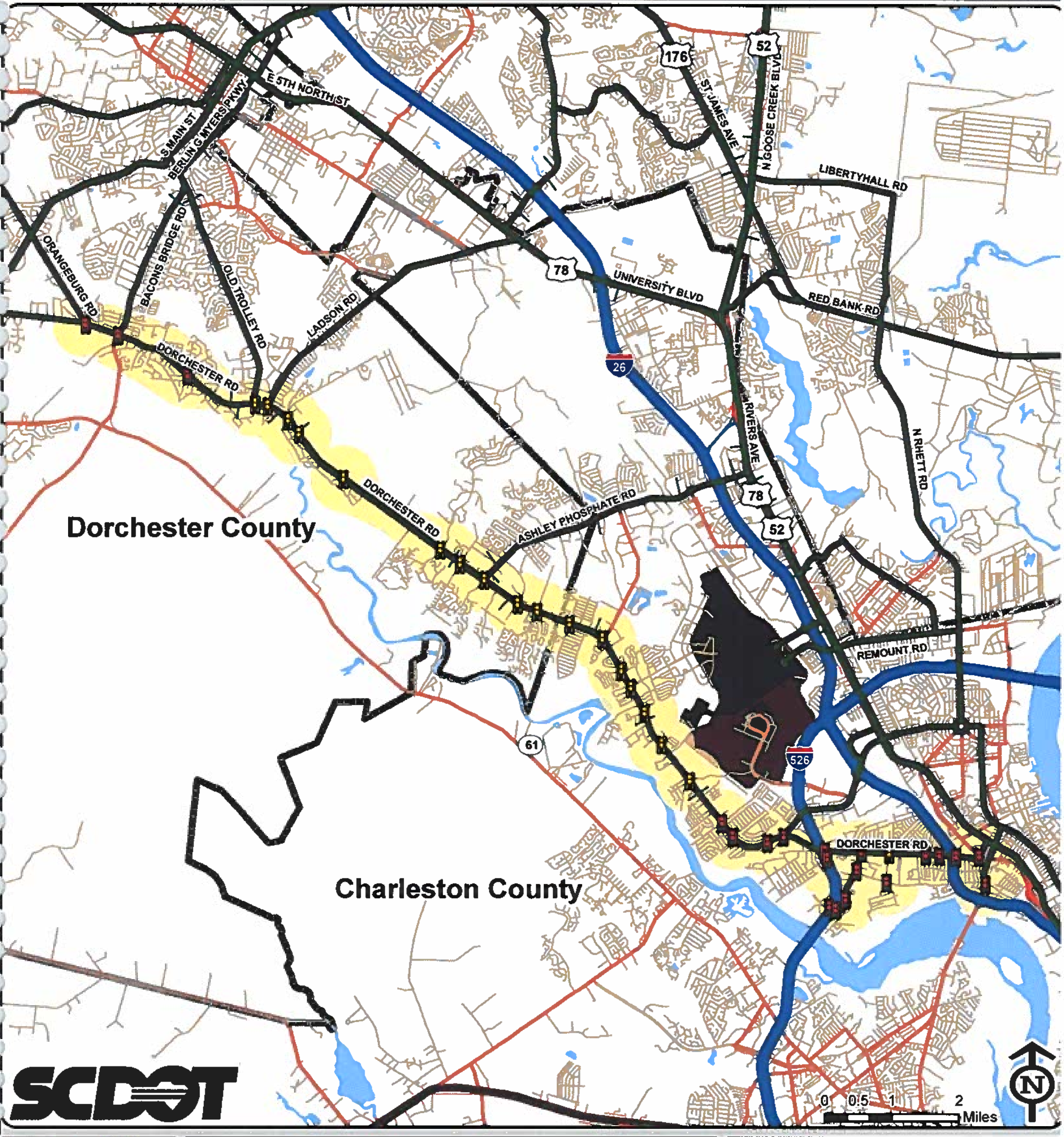
As shown in Figure 2.17 SC 642 (Dorchester Road) carries the following traffic volumes:

- Count Station 171: 34,100 vpd between south of Ladson Road
- Count Station 169: 20,900 vpd between Old Trolley Road and Ladson Road
- Count Station 255: 38,700 vpd south of Cross County Road
- Count Station 257: 23,400 vpd south of Michaux Parkway
- Count Station 259: 18,700 vpd south of Michaux Parkway

Traffic on SC 642 (Dorchester Road) is mainly comprised of commuter traffic with destinations to and from Charleston International Airport and the Charleston Air Force Base, as well as other destinations along SC 642 (Dorchester Road) and points south. Observations during the peak periods indicated the predominant flow is eastbound during the AM peak and westbound during the PM peak.

There are 34 signals over a 15 mile segment of SC 642 (Dorchester Road) from US 17A to Meeting Street. It is anticipated that the three traffic signals between US 17A and Trolley Road will be modified as part of the SC 642 (Dorchester Road) widening project. The traffic signal modifications on SC 642 (Dorchester Road) at Orangeburg, SC 165, and Middleton Boulevard include Naztec 2070 controllers with full actuation. The signals are also expected to include the new SCDOT loop configuration on the mainline with individual 6' X 6' loops provided in each lane. A new fiber optic interconnect cable is also being placed between Old Trolley Road and SC 165.

North CHATS Area Traffic Signal Master Plan



LEGEND

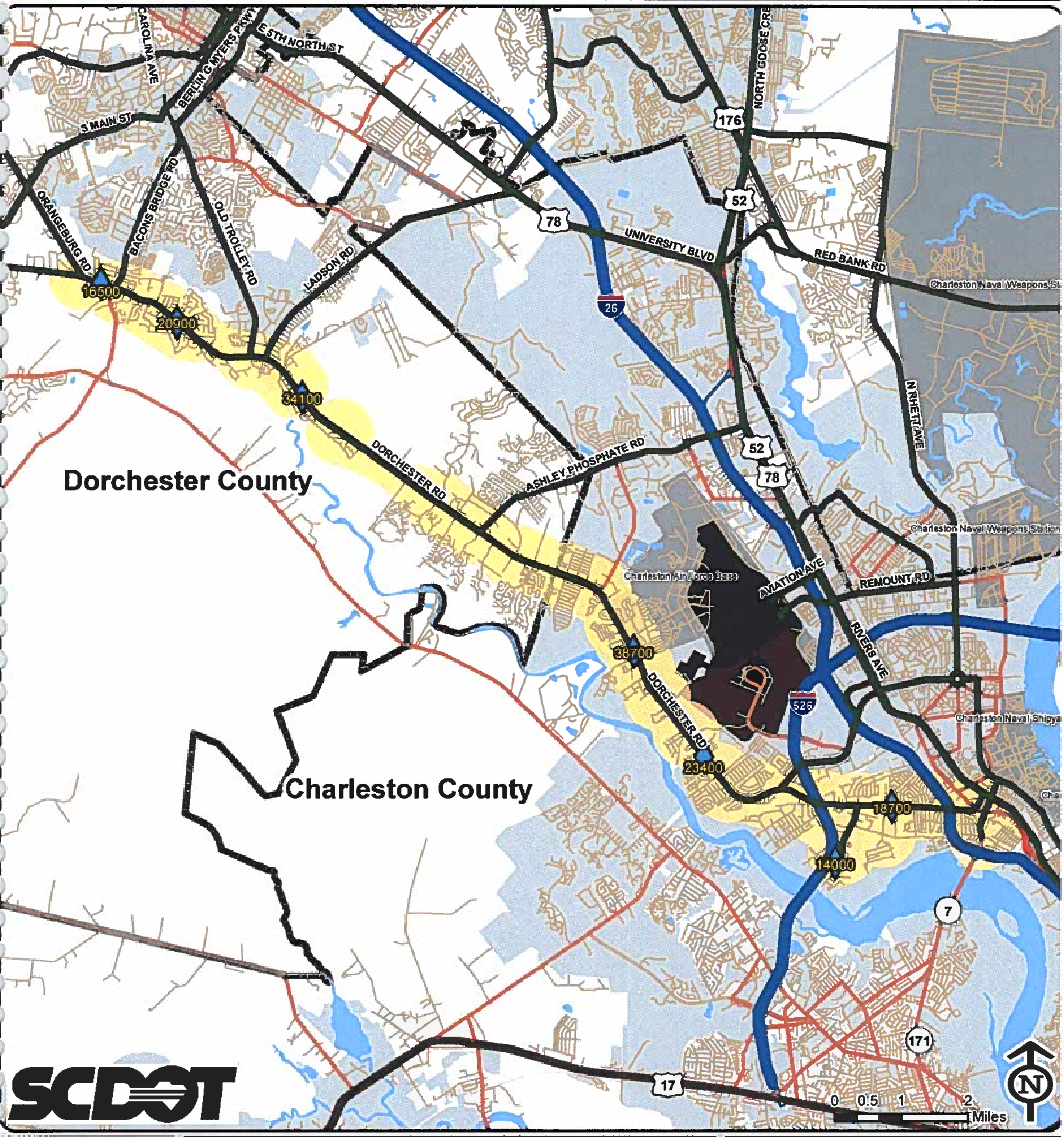
Traffic Signals Controller Type
- 170
- 2070
- NEMA

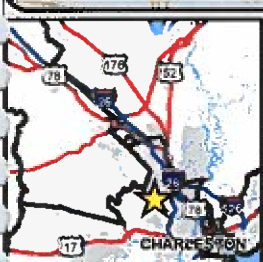
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors
- Selected Zone

Figure 2.16
Zone 6: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan





LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.17
Zone 6: Average Annual Daily Traffic Volumes

JACOBS™

The 17 existing signals from Old Trolley Road to Michaux Parkway are operated by Naztec 2070 controllers that are between four and seven years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the SC 642 (Dorchester Road) approach and stop-bar detection (quadrupole) on the main-street left-turn and side street approaches.

South of Michaux Parkway, 14 signalized intersections are maintained on SC 642 (Dorchester Road) by the City of North Charleston. The signals at these locations are operated by 170 controllers that range in age from five years to 17 years. The signal at Industrial Avenue is an exception and is operated by a 2070 controller that is approximately six years old.

The controller at the I-526 WB on and off ramps operates the I-526 EB on and off ramps as well as the Paramount Drive intersection. The controller at the I-26 WB on and off ramps also operates the I-26 EB on and off ramps.

Two time-based coordinated systems are located along SC 642 (Dorchester Road) from Old Trolley Road to Parlor Road/Shaftsbury Lane and from Beacon Hill Lane, just south of Parlor Road, to Michaux Parkway. The Old Trolley Road to Parlor Road system has spread-spectrum radio to maintain time synchronization with a dial-up modem located at the master controller. The Beacon Hill Lane system also has spread-spectrum radio to maintain time synchronization, however; the radios along both segments are currently inactive. The time clocks on each controller must therefore be synchronized to maintain proper coordination.

2.6.2 Leeds Avenue

Leeds Avenue is a north-south arterial (posted at 40 mph) that provides access to I-526 and terminates at SC 642 (Dorchester Road) at its northern end. Leeds Avenue Road is a four-lane roadway with exclusive turn lanes provided at its signalized intersections with the I-526 ramps and SC 642 (Dorchester Road). Land uses along this roadway are predominately commercial. Leeds Avenue carries 14,000 vpd south of SC 642 (Dorchester Road) (Count Station 578).

There are five signals along Leeds Avenue at the following intersections: SC 642 (Dorchester Road), Azalea Drive, Bridgeview Drive I-526 ramps (two locations). The signals at the I-526 ramps are operated by 170 controllers that are about five years old and are maintained by SCDOT. The remaining signals are also operated by 170 controllers that are about 15 years old and are maintained by the City of North Charleston. All Leeds Avenue corridor signals operate as isolated locations with no coordination and have no communications with the TCC. The signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.6.3 Paramount Drive

Paramount Drive is an east-west collector (posted at 30 mph) that provides access to I-526 and terminates at SC 642 (Dorchester Road) at its eastern end. Paramount Drive is a four-lane roadway with turn lanes provided at its signalized intersections with the I-526 ramps and SC 642 (Dorchester Road). West of I-526, Paramount Drive narrows to a two-lane collector that serves the neighborhoods from local intersecting streets. Land uses along this roadway are predominately residential and vacant parcels, with pockets of commercial uses closer to US 52.

Three signals are located along Paramount Drive: one at the eastern end at SC 642 (Dorchester Road) and two at the I-526 ramps. The signals at the I-526 ramps are operated by a single 170 controller that is approximately 11 years old. This signal operates as an isolated signal with no coordination and no communications with the TCC. The traffic signals on Paramount Drive are maintained by the City of North Charleston. The signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

2.6.4 Azalea Drive

Azalea Drive is an east-west collector (posted at 45 mph) that runs between Leeds Avenue and the King Street Extension. Azalea Avenue parallels SC 642 (Dorchester Road) and is a four -lane roadway with exclusive turn lanes provided at its signalized intersections at Industrial Avenue and Cosgrove Avenue. Land uses along this roadway are a mix of residential and commercial.

The two signals on Azalea Drive and the I-26 off ramps have 170 controllers that are between 9 and 12 years old. The signals on Azalea Drive are maintained by the City of North Charleston. The signals operate as isolated locations with no coordination and have no communications with the TCC.

These signals are fully actuated with standard SCDOT loop layout with advance loops on the main-street approach and stop-bar detection (quadrupole) on the main-street left-turn bays (if present) and the minor-street approaches.

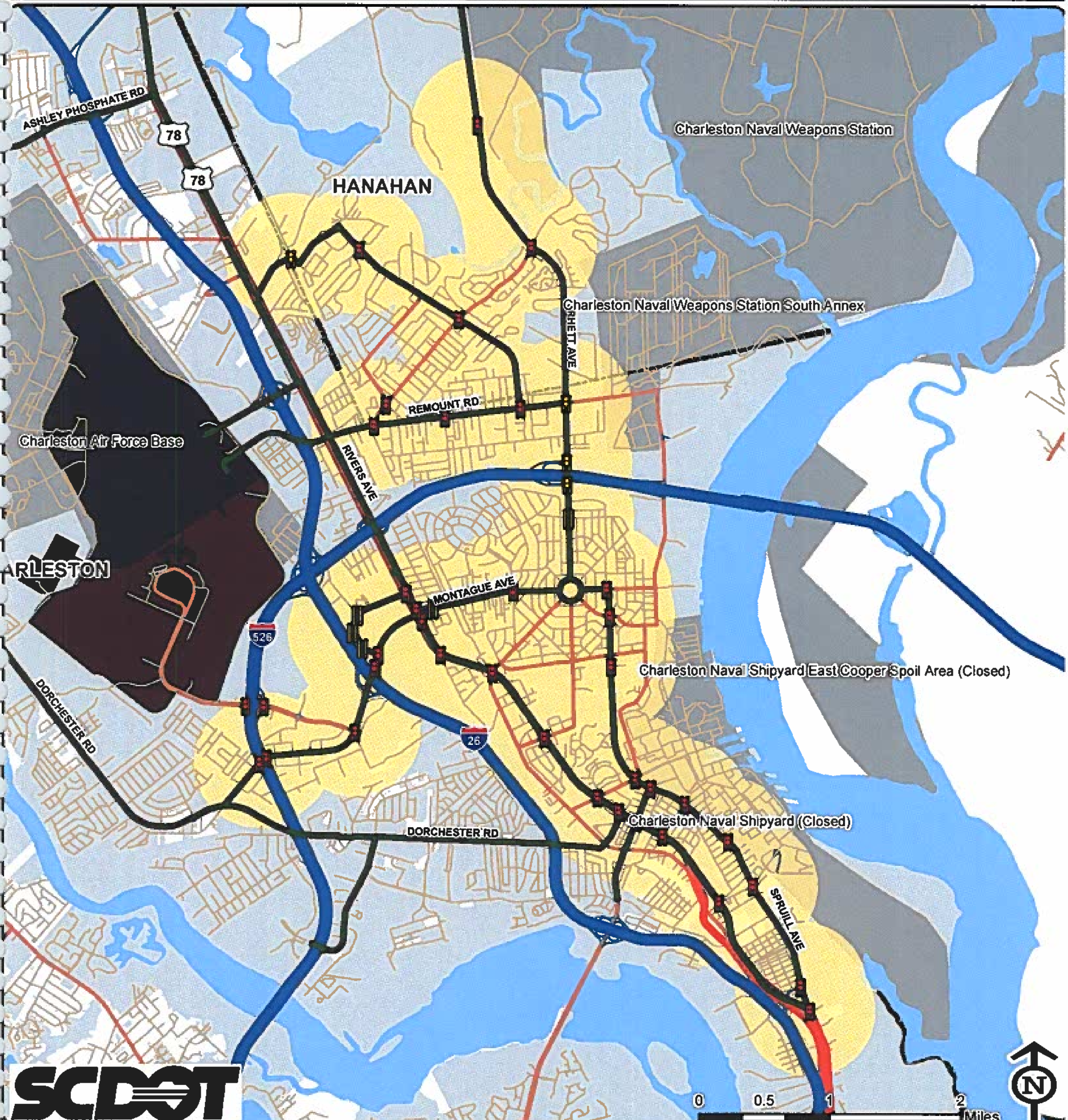
2.7 Zone 7 – North Charleston and Hanahan

Zone 7 encompasses North Charleston and Hanahan. The major corridors in Zone 7 include North Rhett Avenue, Rivers Avenue (from I-526 to Azalea Drive) Murray Avenue, East Montague Avenue, International, International Boulevard and Spruill Avenue. Figure 2.18 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.19 shows the SCDOT 2011 AADT volumes along the study corridors.

2.7.1 US 52 (Rivers Avenue) – Mall Drive to Reynolds Avenue

East of I-526, US 52 (Rivers Avenue) is a major east-west arterial (posted at 45 mph) that is generally three through lanes in each direction with additional exclusive turn lanes at major intersecting roadways to its intersection with Durant Avenue. US 52 (Rivers Avenue) is a divided roadway between I-526 and Dale Street by a grass median. West of Dale Street, the corridor is undivided. From Durant Avenue to the east, the Rivers Avenue cross-section reduces to five-lanes with two through lanes in each direction and a two-way left-turn lane.

North CHATS Area Traffic Signal Master Plan



LEGEND

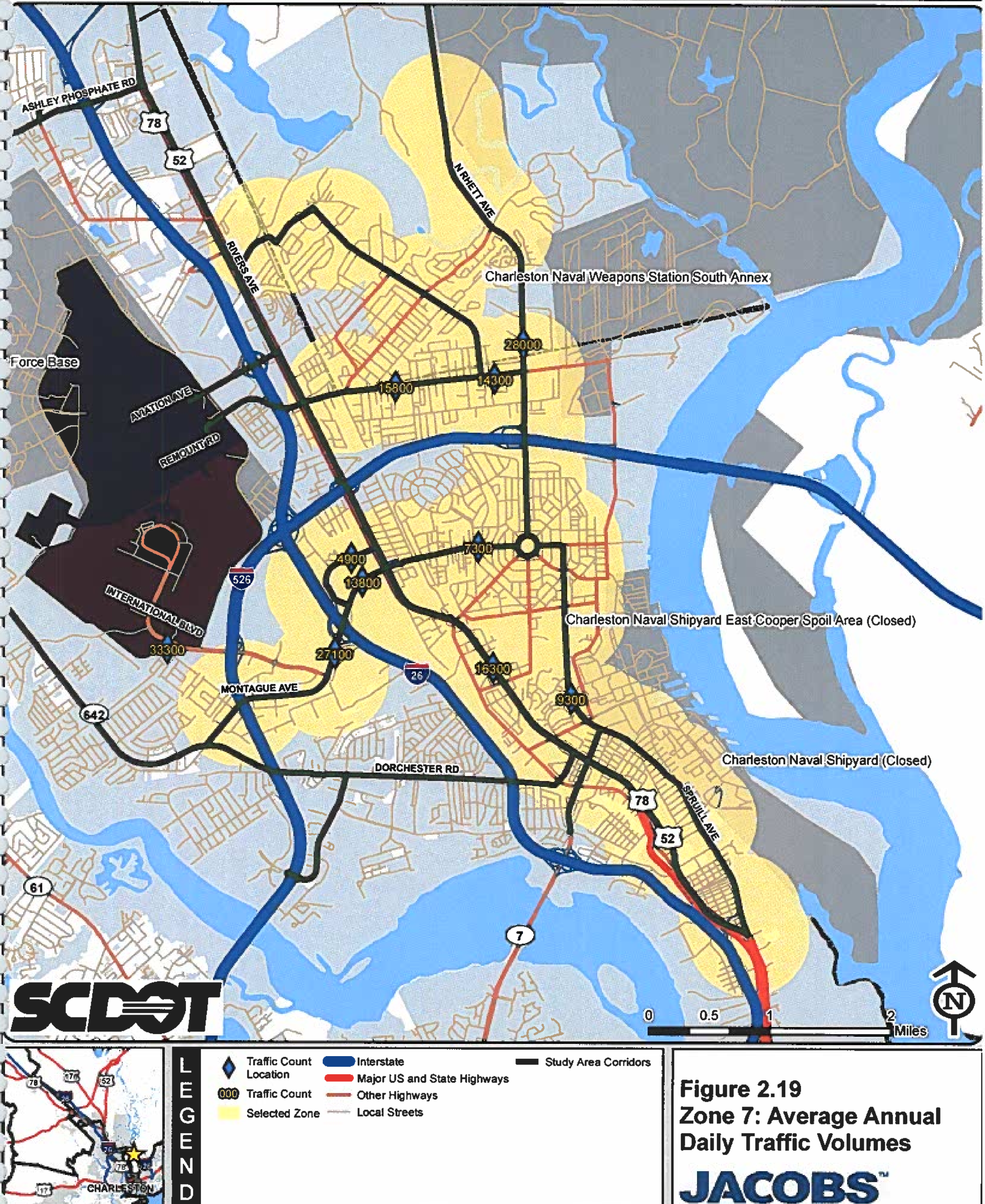
Traffic Signals Controller Type
- 170
- 2070
- NEMA

- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors
- Selected Zone

Figure 2.18
Zone 7: Existing Signals

JACOBS

North CHATS Area Traffic Signal Master Plan



LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.19
Zone 7: Average Annual Daily Traffic Volumes

JACOBS

Several intersecting collector roadways serve local residential roadways to neighborhoods primarily to the north and south. US 52 (Rivers Avenue) is a densely developed major commuter route. Land use adjacent to Rivers Avenue is mainly commercial. US 52 (Rivers Avenue) carries 16,300 vpd north of Helm Avenue (Count Station 153).

There are 10 signals over an approximately three mile long stretch of Rivers Avenue between Mall Drive and Reynolds Avenue. The signals on this portion of Rivers Avenue are maintained by the City of North Charleston. The traffic signals have 170 controllers are fully actuated and are between eight and twenty years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the Rivers Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches

Existing fiber optic cable runs from the Rivers Avenue at Mall Drive southbound intersection to the Rivers Avenue at Meeting Street/Durant Avenue intersection and from the Rivers Avenue at McMillan Avenue intersection to the Rivers Avenue at Reynolds Avenue intersection. The intersections of Rivers Avenue at Meeting Street/Durant Avenue and Rivers Avenue at McMillan Avenue do not have fiber optic cable. The Rivers Avenue at Helm Avenue intersection has a dial up modem. The signals along this portion of Rivers Avenue are coordinated, however there are no communications between these intersections and TCC as these signals are maintained by the City of North Charleston.

2.7.2 Spruill Avenue – East Montague Avenue to Meeting Street

Spruill Avenue is a north-south arterial (posted at 45 mph) that has a five-lane cross section, two through lanes in each direction and a two-way left-turn lane that changes to an exclusive left-turn lane at major intersecting roadways. Land use adjacent to Spruill Avenue is a mix of residential and commercial. Several intersecting collector roadways serve local residential roadways to neighborhoods to the east and west. Spruill Avenue parallels Rivers Avenue from the south to approximately McMillan Avenue. From there, Spruill Avenue turns in a more northerly direction (paralleling South Rhett Avenue) until its terminus at East Montague Avenue. Spruill Avenue carries 9,300 vpd between MacMillan and E. Montague (Count Station 471).

Spruill Avenue has 10 signals over an approximately four-mile segment between East Montague Avenue and Meeting Street. The signals on this portion of Rivers Avenue are maintained by the City of North Charleston. The traffic signals are operated by 170 controllers, are fully actuated and are between five and twenty years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the Spruill Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. All signals operate as isolated locations with no coordination and have no communications with the TCC.

2.7.3 East/West Montague Avenue – Dorchester Road to Spruill Avenue

East/West Montague Avenue is a major east-west arterial (posted at 45 mph) that has a five-lane cross section (two through lanes in each direction and a two-way left-turn lane) that changes to an exclusive left-turn lane at major intersecting roadways between SC 642 (Dorchester Road) and I-26. Near I-26, East/West Montague widens to three lanes in each direction with dual left-turn lanes provided at the interchange with the I-26 westbound ramps and at Mall Drive. West of Mall Drive, East Montague narrows to a four-lane section (two through lanes in each direction) to Rivers Avenue. Between Rivers Avenue and Park Circle, East Montague Avenue has a five-lane cross section with two through lanes in each direction and a two-way left-turn lane that changes to an exclusive left-turn lane at major intersecting roadways.

East of Park Circle, East Montague Avenue is a two-lane median-divided boulevard with turn lanes at major intersecting roadways.

Land use adjacent to East/West Montague Avenue is mainly commercial between SC 642 (Dorchester Road) and Rivers Avenue. East of Rivers Avenue land use adjacent to East/West Montague Avenue is predominately residential. Several intersecting collector roadways serve local residential roadways to neighborhoods to the north and south.

As shown in Figure 2.19 East/West Montague Avenue carries the following traffic volumes:

- Count Station 463: 7,300 vpd between Parkside Drive and Mixon Avenue
- Count Station 465: 13,800 vpd west of US 52 (Rivers Avenue)
- Count Station 467: 27,100 vpd west of I-26

East/West Montague Avenue is a densely developed major commuter route. The major shopping areas extend from SC 642 (Dorchester Road) to Mall Drive with numerous driveways serving commercial uses. East/West Montague Avenue also has an interchange with I-26 and allows access to major commuting routes in the area.

East/West Montague Avenue has seven signals over an approximately two and one-half mile long stretch of between SC 642 (Dorchester Road) and Spruill Avenue. The signals on this portion of East/West Montague Avenue are maintained by the City of North Charleston. The traffic signals are operated by 170 controllers, are fully actuated and are between 10 and 18 years old, with the exception of the signal at the East Montague Avenue at Piedmont Avenue/Morningside Drive intersection. The East Montague Avenue at Piedmont Avenue/Morningside Drive signal is controlled by a 27-year-old NEMA (Gammatronix) controller. The detection schemes for the fully actuated signals generally follow the standard SCDOT protocol with advance loops on the East/West Montague Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. All signals operate as isolated locations with no coordination and have no communications with the TCC.

2.7.4 International Boulevard – I-526 to West Montague Avenue

International Boulevard is an east-west arterial (posted at 45 mph) that has an interchange with I-526 and provides access to the Charleston International Airport to the west. East of I-26, International Boulevard provides access to the Charleston Coliseum and the Tanger Outlet Mall. International Boulevard has a four-to-five-lane cross-section with two through lanes in each direction. International Boulevard also has exclusive turn lanes at major intersecting roadways. Between I-526 and Tanger Outlet Boulevard, International Boulevard is divided. Land use adjacent to International Boulevard is mainly commercial. International Boulevard carries 33,300 vpd between Remount Road and I-526 (Count Station 713).

There are two signals between the I-526 westbound ramps and West Montague Avenue. The signals at the I-526 ramps are operated by 170 controllers, are fully actuated and are about 15 years old. The signals are maintained by the City of North Charleston. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the International Boulevard approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. All International Boulevard corridor signals operate as isolated locations with no coordination and have no communications with the TCC.

2.7.5 North Rhett Avenue – Braddock Avenue to Remount Road

North Rhett Avenue is a north-south west arterial (posted at 45 mph) that has two through lanes in each direction and widens to provide additional exclusive turn lanes at major intersecting roadways. Land use adjacent to North Rhett Avenue is a mix of residential, commercial and vacant parcels. Several intersecting collector roadways serve local residential roadways to neighborhoods east and west. The traffic volumes on North Rhett Avenue are about 28,000 vpd between Remount Road and Trident (Count Station 246).

There are six signals between the Braddock Avenue and Tanner Ford Boulevard. Two traffic signals at the North Rhett Avenue at Tanner Ford Boulevard and North Rhett Avenue at Yeamans Hall Road intersections that are operated by 170 controllers, fully-actuated, and about four and nine years old, respectively. The signals at the North Rhett Avenue intersections with Remount Road and I-526 are operated by 2070 controllers, are fully-actuated, and are between four and seven years old. The North Rhett Avenue/Braddock Avenue intersection is controlled by a NEMA (Gammatronix) controller that is about 40 years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the North Rhett Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. All North Rhett Avenue corridor signals operate as isolated locations with no coordination and have no communications with the TCC.

2.7.6 Remount Road – Yeamans Hall Road to North Rhett Avenue

Remount Road between Yeamans Hall Road and North Rhett Avenue is an east-west arterial (posted at 45 mph) that has a five-lane cross-section, two through lanes in each direction and a two-way left-turn lane, that changes to an exclusive left-turn lane at major intersecting roadways. Land use adjacent to Remount Road is mainly commercial with pockets of residential and vacant parcels. Several intersecting collector roadways serve local residential roadways to neighborhoods primarily to the north and south. Beyond North Rhett Avenue, Remount Road continues and serves as the primary access to the Port at North Charleston. Remount Road serves as a major trucking connection between I-26 and the Port at North Charleston.

As shown in Figure 2.19 Remount Road carries the following traffic volumes:

- Count Station 447: 14,300 vpd west of N. Rhett Avenue
- Count Station 448: 15,800 vpd between North Rhett and Yeamans Hall Road

Three Remount Road corridor signals, between the Rivers Avenue and North Rhett Avenue, are 9 to 12 years old with fully actuated 170 controllers. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the North Rhett Avenue approach and stop-bar detection (quadrupole) on the main-street left-turn bays and side-street approaches. All Remount Road corridor signals operate as isolated locations with no coordination and have no communications with the TCC.

2.7.7 Mall Drive - East Montague Avenue to Lacross Road

Mall Drive is a collector/distributor (posted at 35 mph) from East Montague Avenue to Lacross Road that provides access to the adjacent commercial land uses. Mall Drive has two through lanes in each direction and widens to provide additional exclusive turn lanes at major intersecting roadways. Mall Drive is a median-divided roadway and land use adjacent to the roadway is commercial. Mall Drive 4,900 vpd west of US 52 (Rivers Avenue) (Count Station 613).

Three Mall Drive corridor signals between the East Montague Avenue and Lacross Road are operated by NEMA (Gammatronix) controllers that are between 24 and 33 years old. The detection schemes for the fully actuated signals generally follow standard SCDOT protocol with advance loops on the North Rhett Avenue approach and stop-bar detection (quadrupole) on the main street left-turn bays and side street approaches. All Mall Drive corridor signals operate as isolated locations with no coordination and have no communications with the TCC.

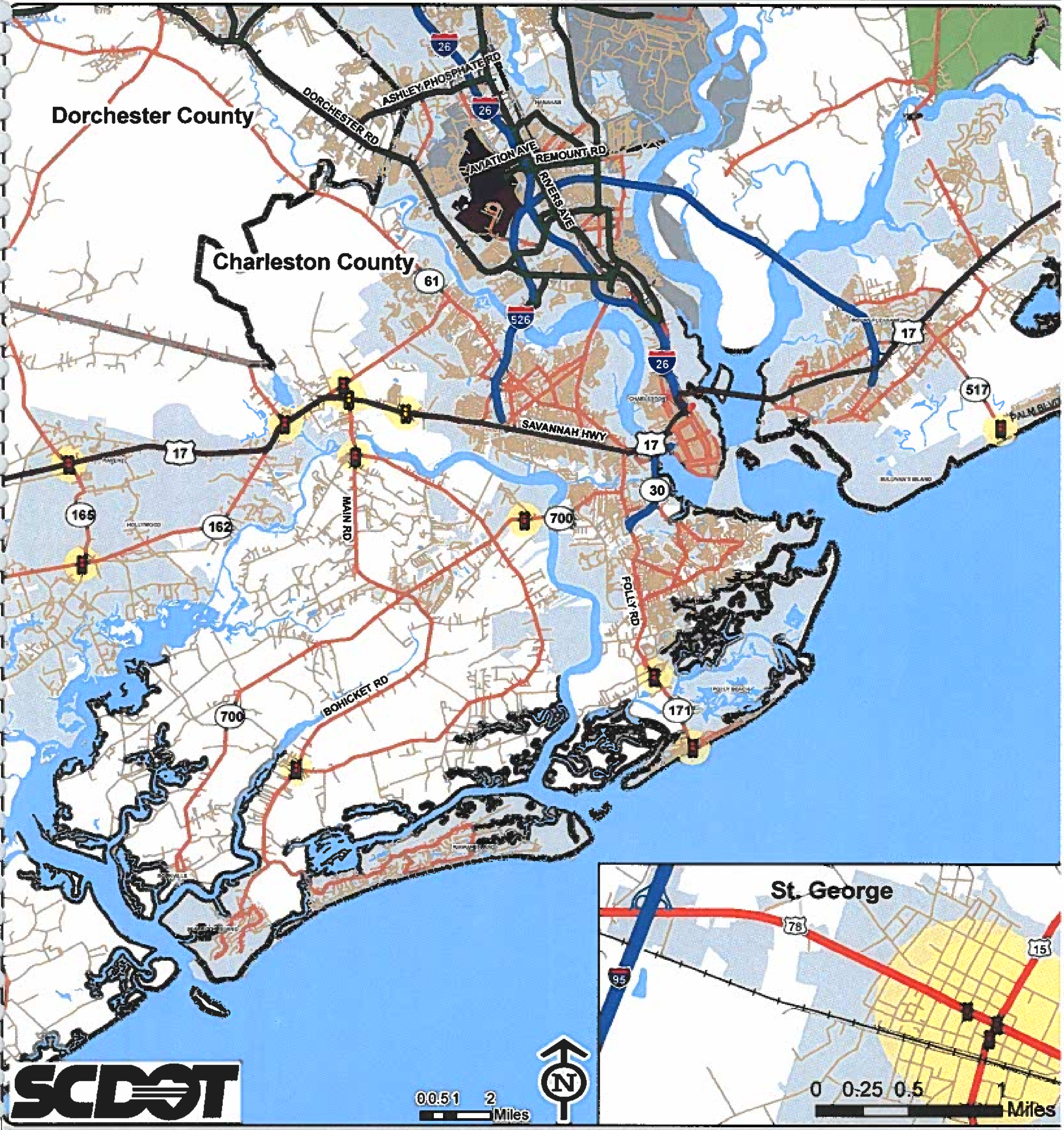
2.8 Zone 8 – Isolated Locations South of US 17

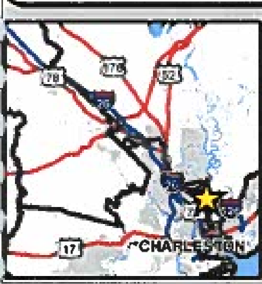
Zone 8 generally consists of many isolated intersections south of US 17 and has locations in Ravenel, Hollywood, West Ashley, Johns Island and Folly Beach. Figure 2.20 shows the traffic signal locations along each corridor and depicts the type of traffic signal controller. Figure 2.21 shows the SCDOT 2011 AADT volumes along the study corridors.

2.8.1 Southern – US 17 (Savannah Highway)

US 17 (Savannah Highway) from Carolina Bay/Croghans Landing Drive to Old Jacksonboro Road is a four-lane divided east-west arterial (posted at 55 mph) that has two lanes in each direction with a grass median. The US 17 (Savannah Highway) segment between Old Jacksonboro Road and SC 165, has a two-way left-turn lane in place of the median. Land use is largely undeveloped with some commercial and residential. US 17 carries approximately 15,200 vpd east of SC 165 (Count Station 103), approximately 30,400 vpd west of Davidson Road (Count Station 109), and 37,200 vpd East of Carolina Bay Drive/Croghans Landing Drive (Count Station 113).

North CHATS Area Traffic Signal Master Plan





LEGEND

Traffic Signals Controller Type
- 170
- 2070
- NEMA

- Interstate
- Major Highways
- Other Highways
- Local Streets
- Selected Zone
- Study Area Corridors

Figure 2.20
Zone 8: Existing Signals

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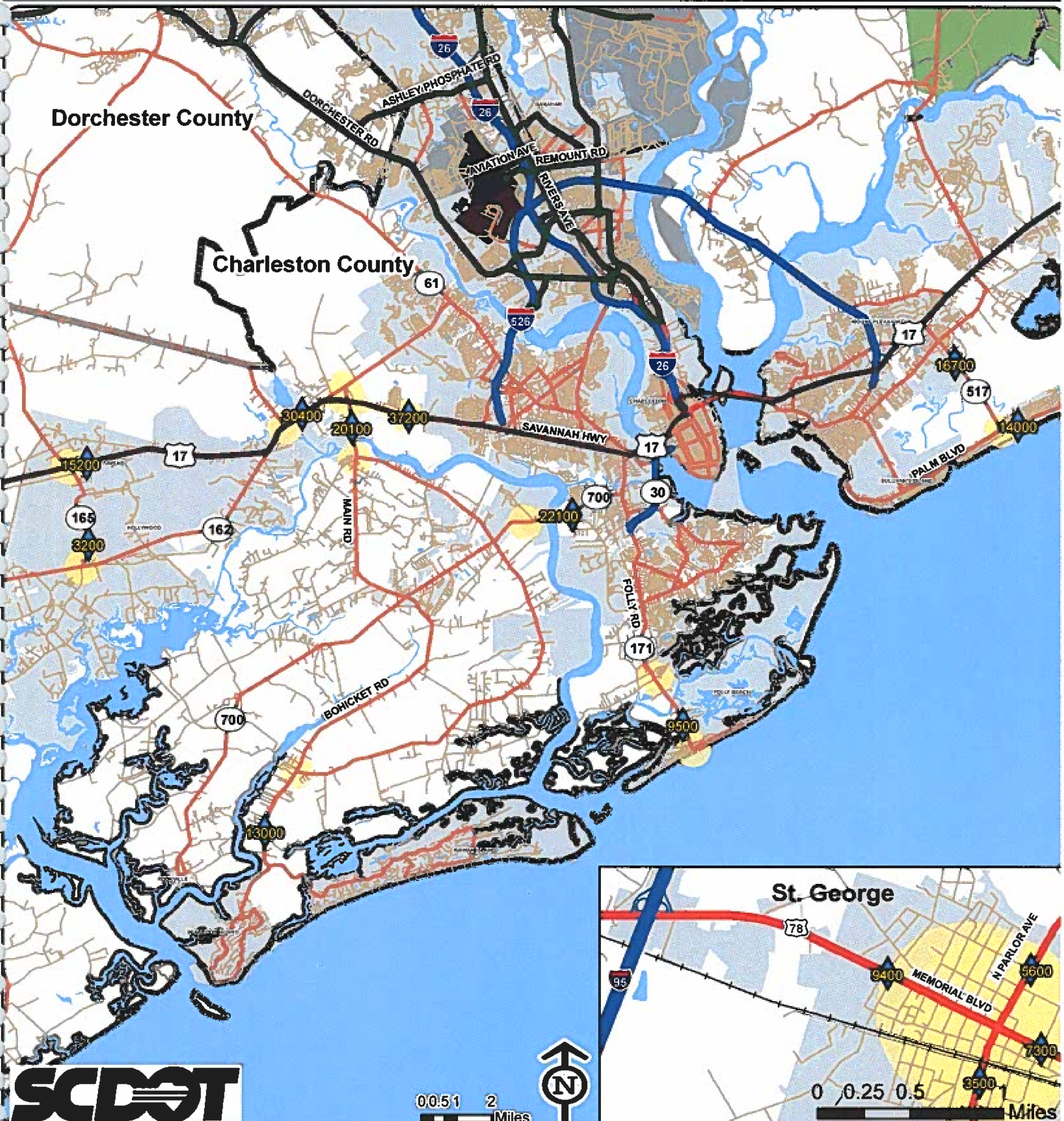

LEGEND

- Traffic Count Location
- 000 Traffic Count
- Selected Zone
- Interstate
- Major US and State Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.21
Zone 8: Average Annual Daily Traffic Volumes

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The four signals along this stretch of US 17 do not have communication equipment. The signals at Main Road and Carolina Bay/Croghans Landing Drive are operated by Naztec 2070 controllers and the signals at Davidson Road and SC 165 have Safetran 170 controllers. These controllers range from four years old to nearly ten years old.

2.8.2 Main Road

Main Road is a two-lane road (one lane in each direction) from Bees Ferry Road to River Road with a two-way left-turn lane in some locations. Main Road has a posted speed of 35 mph north of the river and 45 mph south of the river. Some land use is commercial but primarily land use in this area is residential. Main Road carries approximately 20,100 vpd between US 17 and River Road (Count Station 345).

There are two signalized intersections along this segment of Main Road. The signal at Bees Ferry Road is operated by a Safetran 170 controller and River Road is operated by a 170 controller. None of these signals has any communication equipment. These controllers range from four to nearly thirteen years old.

2.8.3 SC 165

SC 165 is a two-lane road (one lane in each direction) and has exclusive turn lanes at major intersections. The posted speed limit alternates between 30 mph and 45 mph. The surrounding land uses of SC 165 are primary are residential or undeveloped. Some commercial development is present at the signalized intersections. SC 165 carries 3,200 vpd between US 17 and SC 162 (Count Station 229).

There is one signalized intersections along this segment of SC 165 at SC 162, which is operated by Safetran 170 controller. The signal does not have communication equipment. The SC 165 corridor controller at US 17 is nearly ten years old and the SC 165 corridor controller at SC 165 is nearly thirteen years old.

2.8.4 SC 700 (Maybank Highway)

An isolated signal is located at SC 700 (Maybank Highway) and Old Maybank Highway. This signalized intersection provides access to a residential area. SC 700 (Maybank Highway) is a four-lane road and Old Maybank Highway a two-lane road. Maybank Highway carries 22,100 vpd east of Old Maybank Highway (Count Station 269). The signal is operated by a 170 controller that is almost eight years old. is the signal has no existing communication equipment.

2.8.5 Bohicket Road/Betsy Kerrison Parkway

An isolated signal is located at River Road and Bohicket Road/Betsy Kerrison Parkway. Commercial developments and undeveloped parcels are located around this intersection. Betsy Kerrison Parkway (northbound approach) is a four-lane divided road, Bohicket Road is a two-lane road that widens to four lanes at the intersection (southbound approach), and River Road is a two-lane road (westbound approach). Betsy Kerrison Parkway carries approximately 13,000 vpd south of River Road (Count Station

348). The signal is operated by a 170 controller that is almost eight years old. This signal has no existing communication equipment.

2.8.6 SC 171

SC 171 is a four-lane road at both signalized intersections (two lanes in each direction) and has exclusive turn lanes at major intersections. A large portion of the road has two lanes and less-developed areas. The posted speed limit varies between 30 mph, 35 mph, and 45 mph. SC 171 has a variety of land uses including residential and commercial. A large portion of the land around SC 171 is undeveloped due to wetlands. SC 171 carries approximately 9,500 vpd between Sol Legare Road and Ashley Avenue (Count Station 233). This segment of SC 171 has two signalized intersections, both of which are operated by 170 controllers. Sol Legare Road has a Dynamic Traffic Systems controller that is nearly five years old and Ashley Avenue has a Signal Control controller that is nearly thirteen years old. The SC 171 corridor signals do not have any communication equipment.

2.8.7 SC 517

An isolated signal is located at SC 517 and Palm Boulevard located on Sullivan's Island. Commercial development surrounds the intersection. SC 517 is a two-lane road and Palm Boulevard is a five-lane road (two lanes in each direction with a two-way left-turn lane). Palm Boulevard carries approximately 14,000 vpd east of SC 517 (Count Station 280) and SC 517 carries approximately 16,700 vpd north of Palm Boulevard (Count Station 693). The signal is operated by a Safetran 170 controller that is almost thirteen years old. No communication equipment is present.

2.8.8 St. George – US 15 (North Parlor Avenue) & US 78 (Memorial Boulevard)

Located in St. George, US 78 (Memorial Boulevard) (posted speed 35 mph) is a four-lane road (two lanes in each direction) with exclusive turning bays at most major intersections. US 15 (North Parlor Avenue) (posted speed 25 mph) is a four-lane road (two lanes in each direction) without turning bays at the majority of the intersections. Additionally, limited street side parking exists along US 15 (North Parlor Avenue) within the study area. The land use adjacent to the roads is primarily commercial with nearby residential areas. Most of the intersecting streets lead to residential areas.

US 78 (Memorial Boulevard) carries 9,400 vpd west of US 15 (North Parlor Avenue) (Count Station 127) and 7,300 vpd east of US 15 (Count Station 129). US 15 (North Parlor Avenue) carries 5,600 vpd north of US 78 (Count Station 105) and 3,500 vpd south of US 78 (Memorial Boulevard) (Count Station 103).

There are three signalized intersection in this region - US 78 (Memorial Boulevard) at Ridge Street (170 controller), US 15 at US 78 (Memorial Boulevard) (170 controller), and US 15 at George Street (Safetran 170 controller). None of these signals has any current communication equipment. These signal controllers range from eight to sixteen years old.

2.9 I-26 Fiber Optic Trunk Line

An existing fiber optic trunk line (144 fibers) on I-26 traverses the study area and connects all existing I-26 ITS devices (VMS and closed-circuit television, or CCTV) to the District 6 Incident Management Center and SCDOT Headquarters in Columbia. Currently, only one connection exists for the traffic signal systems to the fiber optic trunk line. This connection is from the Remount at I-26 intersection to the I-26 fiber optic cable. This connection allows the Ashley Phosphate and Rivers Avenue corridors to be controlled via fiber optic Ethernet from the TCC.

SCDOT is proposing to add connections to the trunk line from the existing traffic signal systems at the following various corridor crossings locations:

- US 17A
- US 78 (University Boulevard)
- College Park Road

Currently, the connection along US 78 (University Boulevard) to the I-26 fiber optic trunk line is under construction.

2.10 SCDOT Traffic Management Center

The District 6 TCC is currently located in the Traffic Signal Shop at the District 6 offices on Fain Street and is resident on a dedicated Naztec server. There are two computers that are clients to this server located in the Traffic Signal Shop and three additional computers that are clients to this server located in the District 6 Traffic Engineering offices.

Naztec Streetwise software is used to review and monitor intersection data and where traffic signal timings and splits are input to be sent to local masters or intersection timings are refined to obtain the best levels of service while minimizing intersection queuing. Feeds from SCDOT Traffic Management Center's (TMC) CCTV are available for viewing on monitors in the signal shop and in the Traffic Engineering offices.

A fiber optic cable connection via I-26 connects at the TMC. Ethernet-connected intersections are routed to the TCC's server for intersections that have been directly connected by fiber Ethernet on Rivers Avenue (20 intersections) and Ashley Phosphate Road (11 intersections). Six on-street master controllers have dial-up modems to the TCC server. These include the following:

- College Park Road (two master controllers – six intersections)
- SC 642 (Dorchester Road) at Ladson Road (one master controller – three intersections)
- University Boulevard at Fernwood Road (one master controller – five intersections)
- US 17A at Farmington Drive (one master controller – eight intersections)
- US 52 and US 176 in Goose Creek (one master controller – 11 intersections)

Thirty-seven intersections are running time-based coordination and have no communications with the TCC.

The TMC and the TCC operate separately. The TMC monitors freeways with CCTV, places messages on freeway VMS during events, dispatches SHEP units, and communicates with local and state police. The

TCC operates, monitors, and maintains the traffic signals. Interviews with SCDOT District 6 personnel indicate that there is currently no direct communication between the two units. During I-26 diversion routing, the TCC does not plan diversion routing and is unable to respond to signalized arterial demand in the form of new signal timing plans.

2.11 VMS, CCTV and Signing

A number of permanent and portable VMS are located within the study area. The majority of the VMS are located on I-26. Messaging for the VMS is a function of the SCDOT District 6 Incident Management Center during its hours of operations. During off hours messaging for the VMS is a function of SCDOT Incident Management Centers via SCDOTnet. Messages are displayed for incident, travel times and emergency evacuation information.

Current CCTVs are located on I-26 and are controlled by the Incident Management team. CCTVs may be viewed on-line via the SCDOT web site as part of information dissemination to the public. Static signing for Hospital and Evacuation routes are present in complimentary locations. Figure 2.21 shows the existing VMS and CCTV locations.

Since the area is prone to weather emergencies, evacuation route signing is posted on a number of the major arterials. Also, signing for major hospitals is located along the corridors within the study area. Figure 2.22 depicts the emergency evacuation routes.

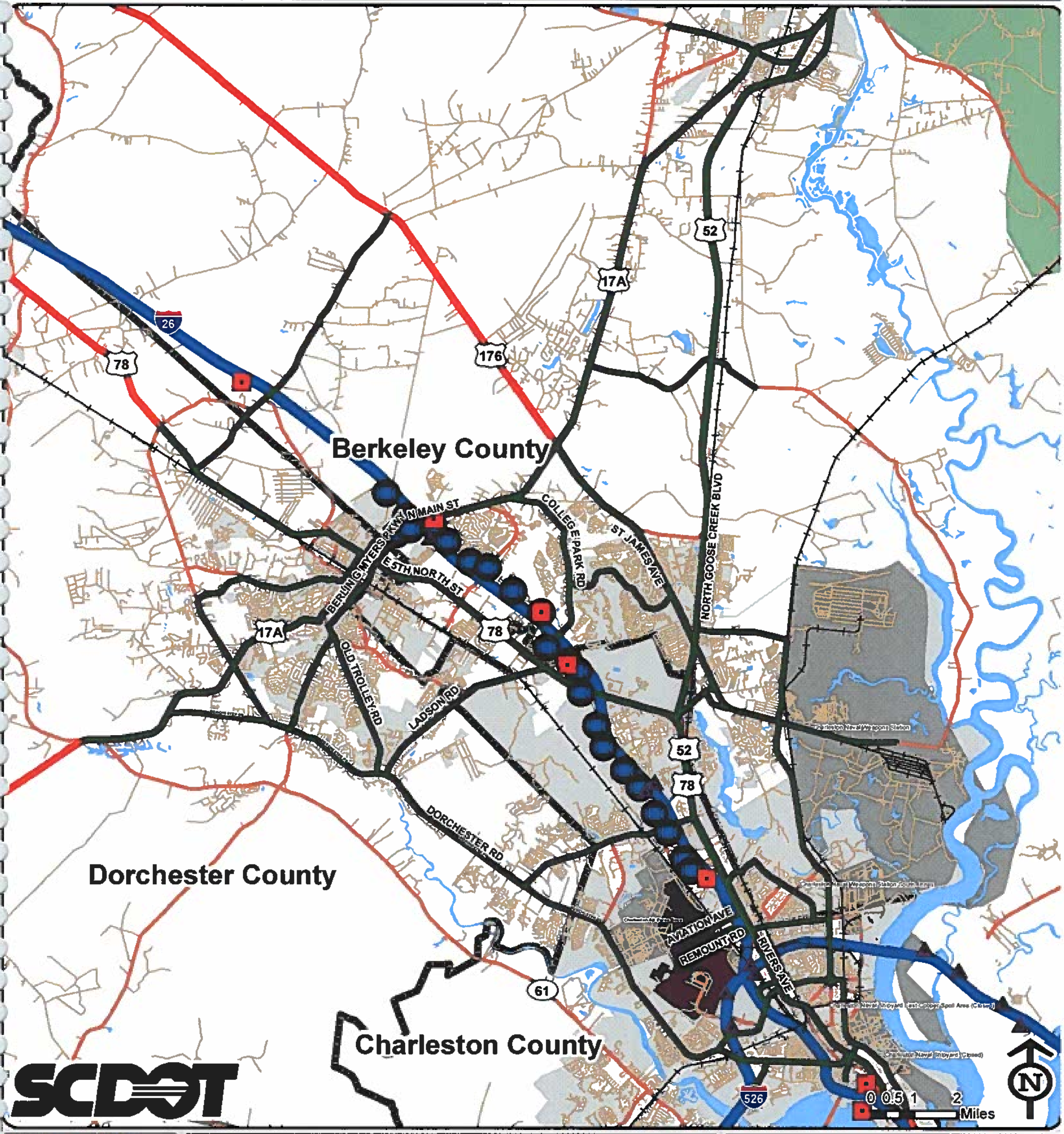
2.12 Functional Needs Assessment

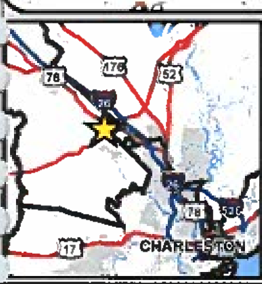
A functional needs assessment of the existing traffic signals and communications system within the study area was performed. The traffic signals were reviewed based on a number of parameters including controller age and capabilities, software, detection, and signal equipment. The communication systems were reviewed based on interconnection between intersections, communications equipment and communications methodology to the TCC.

2.12.1 Controllers

The majority of the controllers along the study area corridors are Naztec 2070 that are seven years old or newer. The typical life expectancy of a traffic signal controller, barring catastrophic events, should be between 10 and 15 years. The Naztec Model 2070 controllers can serve as a local or a master controller, which are designed around the Advanced Transportation Controller (ATC) standard specifications and have Apogee local controller software. With the Apogee software, the controllers are currently capable of being programmed to run as a traffic-responsive system. With an added software package (such as SynchroGreen or IN-SYNC) the controllers can also be programmed to operate as a traffic-adaptive system. Many of the signals are connected to the Naztec Streetwise central signal system via fiber optic Ethernet cable or dial up modem connections. The remaining 170 controllers are all over 10 years old and their replacement should coincide with a signal system upgrade.

North CHATS Area Traffic Signal Master Plan





LEGEND

- Existing CCTV
- Existing Permanent VMS
- Existing Portable VMS
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 2.22
Existing CCTV/VMS Locations

JACOBS

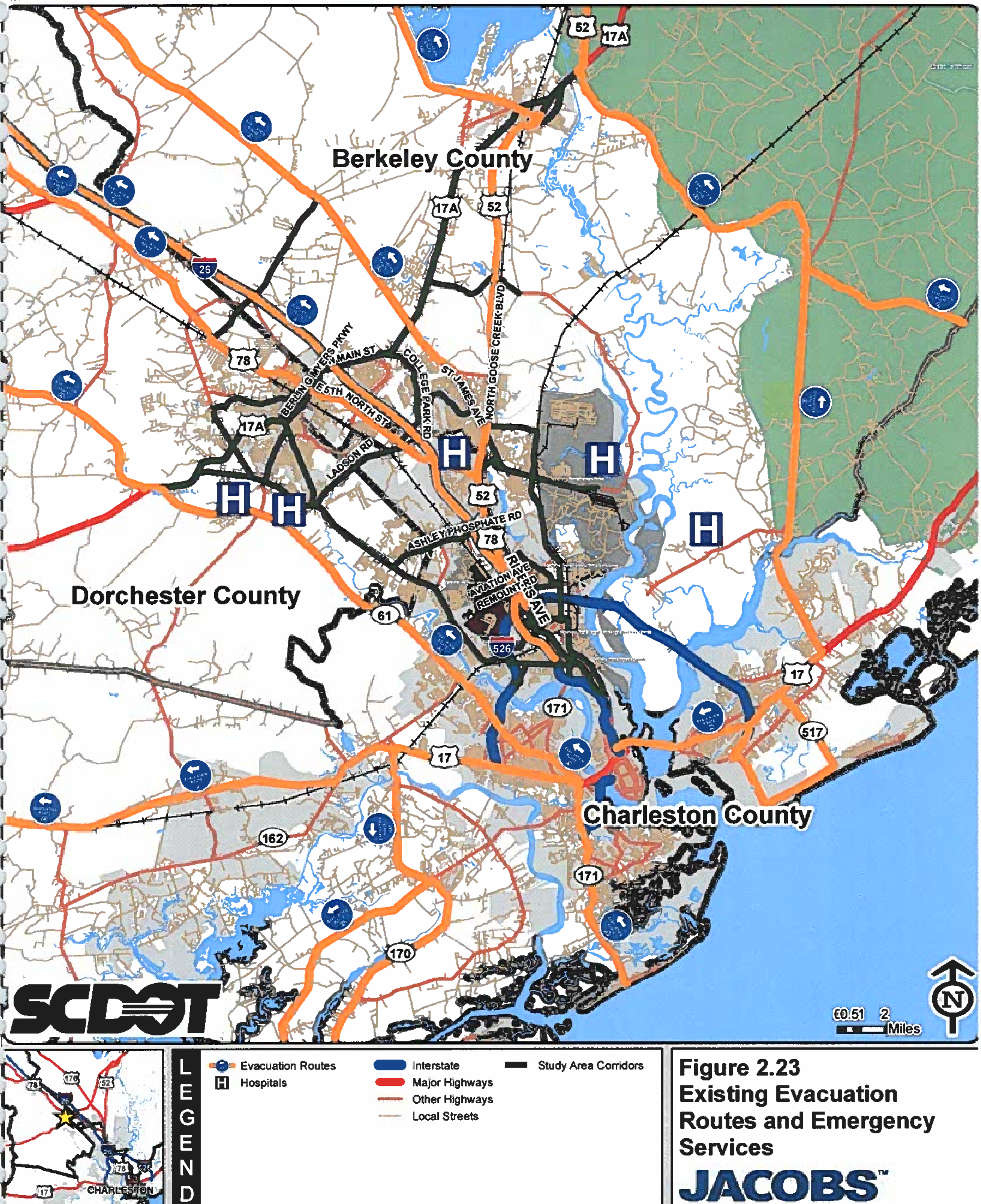


Figure 2.23 Existing Evacuation Routes and Emergency Services

JACOBS

2.12.2 Detection

The standard SCDOT protocol for detection is to provide a single loop over multiple lanes in advance of the intersection (for approaches of 35-40 mph) and multiple loops per lane (for approaches of 45 mph and greater) for Dilemma Zone Protection. Quadrupole loops are set on the left-turn lanes and on the minor-street approaches. The advance loop detectors can count the approach volume; however, a single loop detector over multiple lanes provides less accurate count data than does a single loop detector per lane. As part of this Master Plan, Jacobs recommends that SCDOT evaluate their current configuration and change to single lane detection at approach speeds of 30-40 MPH, which can provide more accurate traffic volume data. System loops and occupancy loops are also recommended for the implementation of a traffic-adaptive signal system control.

2.12.3 Controller Cabinets

Approximately one-half of traffic signal controller cabinets in the study area are Type 336. To accommodate added detector element needs for both traffic-responsive and traffic-adaptive control, these cabinets will have to be replaced with the larger Type 332 cabinets. Other signal equipment at the study area intersections is in generally good condition. No major issues with controller cabinets were noted during site visits and windshield surveys.

2.12.4 Capacity/Geometric Constraints

Jacobs also noted operation as well as capacity/geometric constraints at study area intersections during the windshield surveys. At the Rivers Avenue at Ashley Phosphate Road intersection, the westbound left-turn traffic volume from Rivers Avenue to Ashley Phosphate Road is very high and the available left-turn storage length is not adequate. The left-turning vehicles subsequently queue in the through lanes and block through traffic. The observed PM peak hour cycle length may be also contributing to delay at the intersection, as the left-turn green time does not appear to be sufficient to serve the observed left-turn demand.

Another factor contributing to poor operations was the construction at the I-26 interchanges with Remount Road and Aviation Avenue resulting in higher than normal left-turn volume at the Rivers Avenue at Ashley Phosphate Road intersection. This situation may be relieved by the completion of the construction for the I-26 interchanges. Extending the left-turn lanes or increasing the left-turn green time would be also be beneficial at this intersection.

The S. Goose Creek Boulevard at St. James Avenue/Red Bank Road intersection is the first signal on S. Goose Creek Boulevard and is located approximately 1.53 miles north of the Rivers Avenue at US 78 interchange. The converging and unmetered northbound PM peak hour traffic from both US 78 and Rivers Avenue result in random arrival rates at the intersection. The intersection skew limits usable green time percentage per cycle, particularly for northbound left-turning vehicles with longer clearance times required. An at-grade railroad crossing on the east leg of the intersection provides further safety and operational concerns. The surrounding land use and development create difficulties for realignment/geometric improvements at the intersection. The intersection geometry and operations should be reviewed to determine whether geometric improvements or turn restrictions could improve the intersection.

The SC 642 (Dorchester Road) at Michaux Parkway intersection eastbound left-turn operation was also observed for its contribution to congestion. The completion of expansion of Boeing will exacerbate the poor operations at this intersection and further add to the delay. A dual left-turn lane would relieve this problem; however, there is only one receiving lane for this movement. Increasing the storage length would also improve the intersection if widening to accommodate a second eastbound left-turn lane proves unfeasible. The intersection geometry and operations should be reviewed to determine whether other geometric improvements could improve the intersection.

The eastbound left-turn volume into the Air Force Base entrance is very high at the SC 642 (Dorchester Road) at West Hill Boulevard intersection. This high demand coupled with the security check at the entrance gate results in low flow rates and long queues that occasionally spill over into the eastbound through lane during the AM peak hour. The exclusive eastbound left-turn bay extends approximately 365 ft and is limited from further expansion by the westbound left-turn into Michigan Avenue. As geometric changes are impossible for either extending the left-turn or widening for dual lefts, and the Base Security checkpoint is located approximately 600 ft from SC 642 (Dorchester Road), signal timing is the only identified solution for addressing the congestion at this location. Maryland Avenue and Apartment/Lamb's School should be included in the signal timing for coordination.

3.0 System Evaluation

The objective of this section is to compile and document relevant system evaluation criteria for subsequent review and technology analysis. The evaluation criteria builds upon the input and information gathered during the project to identify the functional requirements for the proposed system upgrades. The prioritization of user needs and functional requirements is analyzed and summarized within this section.

3.1 Current Traffic Signal Systems and Planned Systems

Based on the information from SCDOT District 6, the current signal systems that are in place include the following:

- **Ashley Phosphate Road** – Fiber optic ethernet cable from Rivers Avenue to Cross County Road. Ethernet radio interconnect from Cross County Road to Dorchester Road controlled by server at the TCC.
- **Rivers Avenue** – Fiber optic ethernet cable interconnect from Remount Road to Otranto Boulevard controlled by server at the TCC. Fiber optic cable also exists between Mall Drive and Meeting Street and McMillian Avenue to Reynolds Avenue.
- **Aviation Avenue** – Fiber optic ethernet cable interconnect from Fain Street/Core Avenue to Rivers Avenue.
- **Remount Road** – Fiber optic ethernet cable interconnect from I- 26 EB to Rivers Avenue.

- **College Park Road** – Spread spectrum radio interconnect between I-26 and University Boulevard with dial-up modem located at I-26. Fiber optic cable is located between Corporate Parkway and Crowfield Boulevard with dial-up modem located at Corporate Parkway.
- **SC 642 (Dorchester Road)** – (System 1) Spread spectrum radio interconnect from Old Trolley Road to Cross County Road with dial-up modem. (System 2) Time-based coordination is located from Cross County Road to Michaux Parkway.
- **East Carolina Avenue/Old Trolley Road** – Time-based coordination from US 17A to Midland Parkway.
- **SC 165 (Berlin G. Myers Parkway)** – Time-based coordination from US 17A to East Carolina Avenue.
- **US 78 (University Boulevard)** – Fiber optic cable is located between I-26 and North Goose Creek Boulevard. Time-based coordination system is operating from College Park Road to Ladson Road. Spread spectrum radio interconnect along College Boulevard located at I-26 with dial-up modem.
- **US 17A (Main Street)** – Time-based coordination system is operating from US 176 (St. James Avenue) to SC 165 (Berlin G. Myers Parkway) with dial-up modem. Fiber optic cable interconnect is located between Beauregard Road and SC 165 (Berlin G. Myers Parkway). Twisted pair cable exists between East 9th North Street and West 1st North Street with radio interconnection continuing to Richardson Avenue.
- **US 52 (Goose Creek Boulevard)** – Fiber optic Ethernet cable exists from University Drive to Old Mount Holly Road.
- **US 176 (St. James Avenue)** – Fiber optic cable exists from US 52 (North Goose Creek Boulevard) to Crowfield Boulevard. Time-based coordination system exists from Crowfield Boulevard to Devon Boulevard with dial-up modem.
- **Cedar Street** –Twisted pair cable exists between US 78 (West 5th North Street) and West 1st North Street with radio interconnection continuing to Richardson Avenue.
- **Jedburg Road** – Fiber optic cable exists between the I-26 ramps.
- **International Boulevard**– Fiber optic cable exists between Michaux Parkway and Tanger Outlet Boulevard.
- **Red Band Road** –Twisted pair cable exists between North Rhett Avenue and Pomflant Access Road. A spread spectrum radio is located at Deke Giles Avenue intersection that is not connected at the controller.

SCDOT has a number of fiber optic Ethernet cable placement/upgrade projects that are either under construction or planned and anticipated to be completed within the next two years. These projects include the following:

- **College Park Road** – Planned fiber optic Ethernet cable from I-26 EB ramps to Treeland Drive with connection to the I-26 fiber optic trunk line.
- **SC 642 (Dorchester Road)** – Planned fiber optic Ethernet cable from Old Trolley Road to Michaux Parkway with dial-up modem connection to the TCC.

- **US 78 (University Boulevard)** – Under-construction fiber optic Ethernet cable from I-26 EB ramps to Fernwood Drive/Wannamaker Park with connection to the I-26 fiber optic trunk line.
- **US 17A (North Main Street)** – Planned fiber optic Ethernet cable from Berlin G. Myers Parkway (SC 165) to Beauregard Road with connection to the I-26 fiber optic trunk line.
- **US 52 (North Goose Creek Boulevard)** – Under-construction fiber optic Ethernet cable from St. James Avenue (US 176) to Stephanie Drive with connection to the I-26 fiber optic trunk line via University Boulevard and Rivers Avenue.
- **US 176 (St. James Avenue)** – Under-construction fiber optic Ethernet cable from North Goose Greek Boulevard (US 52) to Crowfield Boulevard with connection to the I-26 fiber optic trunk line via University Boulevard and Rivers Avenue.

The ongoing effort to interconnect and coordinate traffic signals along the regionally-significant corridors is an important initial step in managing traffic congestion in the area. The establishment of a good and reliable communications infrastructure is of utmost importance to moving traffic through the study area corridors. The primary function of a roadway is to move traffic safely and efficiently, which for signalized corridors depends on the efficiency of the traffic signal system. SCDOT has many existing and planned coordinated signal systems as previously described. The existing systems generally run coordinated during defined periods based on a predetermined traffic signal timing plan.

The field of transportation engineering continues to develop and expand with increasing use of advanced technologies to reduce congestion. An example of such technologies that has great potential for improving traffic conditions is the use of advanced traffic signal systems. Advanced traffic signals systems include both traffic-adaptive and traffic-responsive signal control systems. These systems are used to better manage traffic in a coordinated signalized network. Traffic-adaptive and traffic-responsive systems provide several advantages over fixed-time systems because of their ability to monitor traffic conditions and implement appropriate timing plans that best serve the current traffic needs.

A traffic-adaptive signal control system can adjust signal timings (offsets, cycle lengths, and splits) incrementally based on real-time traffic volume information. Although traffic-responsive signal systems also adjust signal timings based on current volumes, they are slightly different from traffic-adaptive systems. In a traffic-responsive system, each coordination plan is predefined, whereas the plans in traffic-adaptive signal timing systems are continuously being modified.

3.2 Traffic-Responsive System Features

Traffic-responsive signal systems operate different timing plans at different times of the day and days of the week. Traffic-responsive signal systems are able to determine which timing plan can best serve traffic demand based on current traffic conditions. Traffic-responsive signal systems can therefore select a timing plan to operate, but the system does not make further modifications to the timings specified in the selected timing plan. These systems may also operate in free (uncoordinated) mode at other times, such as overnight. Although traffic-responsive systems have the capability to use numerous plans, common timing plans include the following: AM peak, AM peak (heavy), balanced, midday, PM peak, PM peak (heavy), Saturday peak and holiday peak. Special timing plans for extra heavy traffic (in one direction) bypassing a freeway blockage or for evacuation scenarios can also be developed for implementation. Plans are selected by the system based on traffic demand as determined by detection in and around the intersection.

Traffic-responsive plan selection normally takes place in a field master or a central computer system. This central control instructs all signals in a coordinated group to change to the new plan simultaneously, thus ensuring coordination is maintained along the corridor.

The master or central computer monitors volume and/or occupancy data from multiple vehicle detectors. The data is used to calculate values for key parameters that are then compared to set thresholds. When a threshold is met, one of the predetermined plans associated with that threshold is implemented. Considerable effort is needed to identify the vehicle detection scheme that will provide an adequate representation of traffic conditions as well as to establish the appropriate thresholds and associated signal timing plans. Historical traffic count volumes should be used in order to develop detection schemes and calibrate parameters, especially thresholds. Observations can then be used to calibrate the calculated values to actual traffic conditions until effective settings are established.

The detectors used in traffic-responsive signal systems are generally advance detectors or departure-side detectors. These detectors need to be configured so that the controller can obtain accurate traffic volumes as well as determine occupancy over a specified loop location for each direction of travel and preferably by lane. Naztec controllers used in traffic-responsive systems can use existing set-back loops as system detectors which reduces additional cost.

If the volume of traffic making a movement at an intersection exceeds the capacity of the signal phase serving that movement, queuing can grow over multiple cycles. Occupancy (the portion of time that a detector is occupied) on an advance detector can be used to select a plan with a cycle length and split that will accommodate the excess traffic demand. A well-designed and fine tuned traffic-responsive signal system can result in improved traffic signal operation compared to fixed TOD plan selection for coordinated signal groups that are subject to unpredictable changes in traffic flows.

3.3 Traffic-Adaptive System Features

Traffic-adaptive signal systems detect traffic in a network and an algorithm is used to predict when and where traffic flows. Signal timing adjustments (splits and cycle length) as well as offsets for upstream and downstream intersections are then based on those predictions. The traffic-adaptive software computes optimal signal timings based on detected traffic volume and implements the timings in real-time through either proprietary hardware connected to the controller or controller-resident software. This real-time optimization allows a signal network to react to volume variations, resulting in reduced vehicle delay, shorter queues and decreased travel times.

Traffic-adaptive systems have the ability to adjust signal timing based on changing traffic conditions. Unlike traffic-responsive systems, traffic-adaptive systems do not select adjustments based on predetermined databases of set signal plans. . A traffic-adaptive system therefore makes decisions that are more complex. Traffic-adaptive systems differ from traffic-responsive systems as traffic-adaptive systems can vary details such as splits (the duration of green on each approach), cycle lengths (the time for all approaches to an intersection), and offsets (the travel time between intersections). The time to implement changes based on the collected and analyzed data varies.

All traffic-adaptive systems must have good vehicle detection systems as the reliability and accuracy of the decisions made by the adaptive algorithms cannot be achieved without appropriate detection. Traffic-adaptive signal systems adjust signal timing parameters in real-time to respond to actual, real-time traffic conditions. By adjusting the traffic control parameters to closely align with traffic conditions, adaptive systems can reduce traffic delay, increase average speeds, improve travel times, and decrease travel time variability. Many adaptive systems have been developed over the last 30 years. Adaptive control systems are based on the following concepts:

- Collect data in real-time from detectors to identify traffic conditions
- Evaluate alternative signal timing strategies on a model of traffic behavior
- Implement the "best" strategy according to some performance metric.

This process is continuous and the traffic signal timings and phasing is adjusted to meet traffic flow demands. Each traffic-adaptive system is distinguished by how it uses different components in the control of the traffic system. All traffic-adaptive systems need accurate and comprehensive traffic detection systems, but some need a particular size, and placement of detectors, while others are more flexible. Most adaptive systems require more detection than currently exist at the study area intersections for a traffic-responsive system.

Studies have shown that traffic-adaptive systems can improve intersection operations as well as other traffic operation measures of effectiveness. Traffic-adaptive systems can have a profound impact on operations in places where traffic conditions fluctuate on a day-to-day basis, traffic conditions change rapidly due to new or changing developments in land use or if there are incidents, crashes, or other events that result in unanticipated changes to traffic demand.

Traffic-adaptive systems vary in cost. Some typical costs include equipment upgrades, detection, central system upgrades, employee training, and maintenance. Some traffic-adaptive systems use proprietary equipment. All have added maintenance and reliability issues that generate costs for any local or state government through either internal or contract labor costs. As a key component to most traffic-adaptive systems is that of detection, this cost cannot be overlooked when selecting a system.

Most traffic-adaptive systems use some form of traffic model to evaluate alternative traffic control strategies and may be based on virtually moving individual vehicles down the street and predicting their movements, estimating platoons of vehicles, measuring statistics of occupancy or volumes over time.

All adaptive systems evaluate alternative traffic control strategies and pick the best alternative according to a performance metric. Traffic-Adaptive Systems that are of prime consideration for this study are discussed in the following subsections.

3.3.1 SCOOT

SCOOT (Split Cycle Offset Optimization Technique) was developed in the United Kingdom in the 1970's and has an installation cost of approximately $45,000 to $60,000 per intersection. SCOOT relies heavily on calibrating a range of parameters for each movement in the SCOOT network. This calibration is paramount to enable SCOOT to operate efficiently. SCOOT provides a three-level optimization: cycle, split and offset. Ideally, vehicle detectors are placed eight seconds upstream of each approach and can be tied to the upstream intersection. SCOOT assignment of the detectors is made within the SCOOT centralized computer. SCOOT determines arrival and departure profiles each second based on this detection. SCOOT therefore requires once-per-second communication with the local intersection controller. The centralized computer performs all optimizations and communicates the new settings back to the field controllers; therefore, SCOOT is completely dependent on the communications network to perform adaptively.

3.3.2 SCATS

SCATS (Sydney Coordinated Adaptive Traffic System) was also developed in the 1970's and has an installation cost of approximately $45,000 to $50,000 per intersection. SCATS calculates cycle length, splits and offsets cycle by cycle and can dynamically make changes to groups of signals as traffic patterns change. SCATS use a central management system with regional computers that control up to 250 intersections per regional computer. SCATS requires vehicle detection at the stop-bar and does not require set-back detection. The stop-bar detection area is approximately 6 feet by 12 feet for each lane. SCATS signal controllers are required as the controller collects and computes detector information to obtain the adaptive settings.

3.3.3 INSYNC

InSync was developed in 2009 and has an installation cost of approximately $25,000 to $30,000 per intersection. InSync uses existing controller and central system software. No additional vehicle detection zones (such as stop-bar and set-back approach loops) are required. Vehicle detection is through proprietary IP cameras and signal controller operation is made through a proprietary processor. Video cards, processor and an equipment panel are installed in the controller cabinet. The INSYNC system continually evaluates its current state for change based on intersection demand and predicted arrivals of platoons from upstream and downstream intersections. InSync is not dependant on standard barrier/ring structure but places calls where it deems necessary for improved operation. InSync uses Ethernet standards and a standard web browser for both configuration and monitoring of video images. Should vehicular detection fail, InSync can reference historical data and can run traffic optimization based on previous events that occurred at similar time periods.

3.3.4 SynchroGreen

Developed in 2010, SynchroGreen has an installation cost of approximately $24,000 per intersection. This traffic-adaptive system uses controller-installed software in various manufacturer controllers. SynchroGreen uses the advanced traffic controllers NTCIP architecture to vary changes in the controller to meet demand and is not a proprietary system. It uses standard computers and has no proprietary equipment. SynchroGreen can be used in a central or in a closed loop environment. SynchroGreen is a product of TrafficWare, the developers of Synchro and SimTraffic. Naztec and TrafficWare have been associated for a number of years. The software seamlessly integrates with Synchro and SimTraffic to allow modeling of real-time control. Settings are calibrated before implementation to allow a preview of expected results.

Vehicle detection can be from any detection source, provided the detection zones are located in the correct positions (stop-bar and advanced detection required). SynchroGreen allows current ATMS software to remain while SynchroGreen runs in the background. SynchroGreen uses SimTraffic to model real-time control and calibrate settings to preview expected results prior to implementation in the field.

SynchroGreen allows a user to choose system settings for either progression bandwidth, balanced flow, or for critical movements. Real-time data is used to minimize the time between green bands, which minimizes the delay along side streets. The real-time function may be turned off and the current infrastructure will revert to current programming. SynchroGreen has the ability for its traffic-adaptive function to be managed either from a central server or in a closed loop environment. This flexibility allows installation of traffic-adaptive prior to the high bandwidth Ethernet connectivity needed for central processing.

SynchroGreen requires no proprietary detection that is not usable in the current infrastructure. The District can use any detection technology available with this traffic-adaptive system. SynchroGreen also uses less detection areas than most traffic-adaptive systems with only stop-bar and advance detection necessary. This reduced detection need decreases the installation and ongoing maintenance costs. The location of detection is very important in SynchroGreen traffic-adaptive scenarios and TrafficWare will work with a client to determine the ideal locations for placement.

3.4 Traffic Signal Control

Ideally, traffic signal control would be controlled by a system server for all study area intersections. In order to achieve this, several intersections would need 2070 controller upgrades and fiber optic cable connectivity.

The current District 6 Naztec build and software version for controllers and server are capable of operating as a traffic-responsive signal system, and with software and hardware installation are capable of operating as a traffic-adaptive signal system. Additional detection devices are needed to utilize traffic-adaptive coordination and provide congestion information for traveler Information. Although additional detection is not required to operate a traffic-responsive system (SCDOT current detection protocol will be adequate) the location and size of existing setback loops is not optimal. Future signal installations and loop failure replacement should require individual loops in each lane rather than the shared loop protocol. This new detector standard will result in more accurate traffic volume counts and provide more accurate occupancy data. In order to gather 24-hour and turning movement counts, system loops should be installed per Naztec guidelines. These traffic volume counts are necessary in developing a historical database required for use in developing signal timing plans.

3.5 Data Management/Records

The available records for the traffic signal layout as well as the interconnection and coordination are in conflict at a number of locations. Traffic signal plans should be updated to reflect the most current equipment and layout and the outdated information archived. Traffic signal systems and subsystems should also be shown in order to reflect the most current information. A system to track the controller's age should be implemented to understand and budget for controller replacement for future upgrades. Additionally, the on-line traffic signal database should be maintained and updated as needed in order to reflect the most current information.

Traffic volume data should be obtained and catalogued from available sources including the following: SCDOT count stations, traffic impact assessments performed for proposed developments, and using traffic counting capabilities of the Naztec 2070 controllers that SCDOT has in the field.

3.6 Equipment Management/Maintenance

It is important that the traffic signal hardware receive proper maintenance and regularly scheduled inspection. This includes all aspects of the existing and proposed signal systems including traffic signal hardware (controllers, detection, signal heads, conflict monitors, etc). The traffic signal database being prepared under separate contract is an initial step. Staffing to develop maintenance schedules and to perform the inspection and maintenance of the signal system are required.

3.7 Communications

The ideal communication system is NTCIP communications directly connected to the Streetwise Communications Server. Additional fiber optic cable runs and fiber optic allocations from the I-26 144-strand fiber trunk are needed to implement this strategy from intersections and to recommended VMS and CCTV locations.

Using private cellular devices within the signal control cabinets for corridor communications limits the amount of bandwidth necessary to enact traffic-responsive or traffic-adaptive signal control and CCTV from a Central Master. Controllers in systems using time-of-day programming only would not be negatively affected by private cellular communications.

As an alternative to fiber optic cable, the existing radio communications on SC 642 (Dorchester Road) could be upgraded from the 900 MHz to 5.8 GHz to extend the quality and functionality of radio communications. A radio survey of the route should be taken to determine frequency range interference. This improvement would be a short-term solution until fiber optic cable could be installed along the route. The 5.8 GHz capacity will allow for VMS and CCTV bandwidth requirements.

3.8 Communication Manager

A communication manager should be added to perform the duty of traffic signal system monitoring. This monitoring would include collecting and storing count information, maintaining signal databases, uploading system/intersection reports, reporting alarms, and both dispatching and working with technicians in downloading, monitoring CCTV, and message assignments to VMS. Staffing should be adequate to monitor all peak periods and special events. The manager position should be located in the TCC and have use of five or six video monitors in order to have direct access to additional off-interstate CCTVs and to work with current incident management staff to direct motorists during incidents to auxiliary routes.

All intersections and systems should be set-up in Streetwise by Group and/or Flex Groups. A District-wide System Map should be developed using the latest bitmap graphics or GIS information. Using the Intersection Data Screens in Streetwise, the Communication Manager would be able to query intersections for general information and coordination status. The Reports could be collected by TOD from the Streetwise Scheduler during off-peak hours when bandwidth utilization would be at a minimum.

The communication manager would be responsible for polling all intersections and checking the alarm status at predetermined times. Any unexpected alarm determined to cause operational problems would be dispatched to technicians. Field changes that require temporary changes (such as inoperable detection) would be tracked and noted in the Intersection Notes Utility so the Permanent File would not be corrupted.

The communication manager should be responsible for checking any coordination changes to insure all minimums are met prior to the changes being downloaded using the Excel Coordination Diagnostic Tool and producing a text report of the Real-Time Split Monitor function by request for Signal Coordination applications by signal engineers.

The communication manager would work with current incident management staff to address incidents that involve I-26 adjacent signal system coordination timing changes due to an incident on the freeway. Plan changes may be required for closed loop time-of-day systems and traffic-responsive systems. A timing plan developed for this particular incident may be called by the Communication Manager and monitored after implementation for effectiveness and duration. Traffic-adaptive systems should react to traffic volumes and directional components without any necessary input from the Communication Manager but the manager should monitor the system during the event. The collection of data during incidents is necessary to develop effective timing plans based on the type of event. The traffic-adaptive software must be able to adjust to increased volumes on side streets and turning movements as well as the arterial mainline volumes. One example of a location where these additional thresholds would be critical is the intersection of Ashley Phosphate at Rivers Avenue.

3.9 Staffing

Additional staff is required to provide basic signal control and advanced ITS practices. Jacobs recommends that the District develop operations and maintenance objectives to further refine staffing needs.

An Associate Engineer II is recommended to head a new operations group reporting to the District Traffic Engineer. Duties would include but would not be limited to signal timing design; signal system performance data review; signal retiming; review of data collection from the TCC; database inventory development; development of performance measures, testing, and operation performance evaluations; supervision of an Engineering Technician in the TCC, and review of plans for accuracy and conformance to SCDOT standards.

An Engineering Technician is recommended to support the Associate Engineer II primarily in the TCC by collecting and storing count information; maintaining signal databases; uploading system/intersection and alarm reports; dispatching and working with technicians in downloading; monitoring CCTV, and message assignments to VMS; working with current incident management staff to direct motorists during incidents to auxiliary routes; and other tasks as directed by the Associate Engineer II.

Two Signal Field Technicians (Trades Spec IV) are needed to provide the recommended staffing levels for signal technicians. The FHWA publication Traffic Signal Operations and Maintenance Staffing Guidelines (2009) reports 30-40 intersections per technician based on the reporting agencies interviewed for the study. The addition of two technicians to the District 6 SCDOT staff will reduce the number of intersections per field technician to 44 (263 intersections/6 technicians) from its current ratio of 66 intersections per field technician. The additional staff will allow the district greater maintenance activities and response for its signal system.

3.10 Incident/Event Management

The current incident management should be expanded to include additional proposed VMS and CCTV. Modes of operation that can be controlled or monitored during events are available with existing equipment and with the addition of software and/or equipment or with traffic-adaptive control. Three possible scenarios are:

Time-of-Day

Time-of-Day (TOD) systems may be used with pre-planned incident management plans. This type of system could be accomplished using the Streetwise Control Flex Group to monitor a specified alarm and trigger a remote download of a pre-selected pattern by placement of Queue Detectors at various critical locations. The Queue Detector Programming in the local controller would place a queue alarm based on parameters selected for each queue detector to either the master controller or back to the main server. These Queue detectors would not be used for normal phase detection and their placement would be critical. Pre-planned programs for incidents would need to be established using data collected during a particular directional incident, which can be entered in Synchro to develop the specified plan.

Traffic-Responsive

Traffic-Responsive (TR) systems should react to changing conditions in the field and thereby should not require input other than well-placed system detectors. Once a set of perameters is met the controller chooses a pre determined timing plan. This type of system can be accomplished by using either an On-street Master or the Central Master. Pre-planned programs for incidents would need to be established using data collected during a particular type of incident per direction of traffic flow. These pre-planned programs can then be placed in Synchro to develop the specified plan.

Traffic-Adaptive

Traffic-Adaptive (TA) systems continually produce timing necessary at each intersection to handle traffic variations. This type of system runs in the central master and can override TOD plans if they are programmed in the local controllers. This system permits for a metered approach to allowing the TA to take full control immediately. The use of alarms such as Naztec alarms for fire station pre-emption to sub-groups and Naztec queue alarm can also be beneficial for emergency preemption detection and route selection.

3.11 Vehicle Detection and Monitoring

The current SCDOT protocol for placing detection should be revised to obtain by-lane traffic volume information. Currently, advance loop detection is provided. The current standard with a single loop covering multiple lanes should be reevaluated as the traffic volume counting function could provide more accurate traffic counts and vehicle occupancy data if a single loop was provided for each lane. The traffic counting function of the Naztec controllers should be fully used in order to provide a database for traffic signal timing plans and to understand traffic flow characteristic during normal conditions as well as during special events/incidents that may occur. This database would allow SCDOT to better predict traffic flow should a similar occurrence happen in the future.

In addition to revising the advance loop detection protocol, stop-bar loop detection should also be evaluated to determine whether the quadrupole configuration for left-turns and side streets is the most effective. The use of multiple smaller loops would provide redundancy should there be a loop failure. Stop-bar loops provided in each lane could also be used with the vehicle-counting capabilities of the controller to understand the turning movement characteristics at the intersection. However, multiple wire loop detection adds the potential of significant cost and maintenance increases. New technologies for wireless loop detection and video detection should be evaluated in real time to determine their effectiveness. Ensuring that the loop detectors operate and do not fail is a very important component of both traffic-responsive and traffic-adaptive signal systems.

3.11.1 Sensys In-Pavement Wireless Detection

An example of recent technology development, the Sensys in-pavement wireless detection can be used for system, counting, and signal control. The detection is magnetometer based and measures changes in the earth's magnetic field. Each device is addressable and configurable and the firmware can be upgraded over-the-air. The wireless communication is Spread Spectrum with a frequency band of 1400 to 2483.5 MHz in the unlicensed band. Each device is powered by battery, which has an average life of ten years. The devices can be deployed where loops cannot such as on damaged pavement and in areas with high water tables. The device is also not hampered by sun exposure, shadows, and vehicle headlight detection at night. The unit is housed in a NEMA Type 6P enclosure.

The installation process involves coring the roadway with a 4-inch hole and applying a fast-drying epoxy to cover. This process results in fast and simple installation. The exposure of personnel to traffic is less than for loop installation, increasing safety and reducing the time a lane must be closed.

An access point device maintains two-way communication to the sensors, time synchronization, transmits commands, and receives and processes the sensor data. The access point relays the sensor data either wired or wirelessly to the intersection controller or central server. The access point uses a single cable to support 10Base-T Ethernet communications or serial communications to the controller. The data collected is used on a per-vehicle basis to process gap, speed and length; and a per-lane basis for counts, occupancy, speeds, stored speeds and vehicle lengths over selectable time intervals. The detection data is interfaced in the controller cabinets with contact closure cards that plug directly into the input file without any adapters.

Set-back approach or system sensors require a repeater if greater than 150 feet from the access point. The repeater is wireless and battery-powered and therefore requires no outside power source. The repeater relays Sensys radio communications to and from sensors, access points, and other repeaters.

Monitoring traffic operations is a key component to ensuring the intersections are working as intended. Additional CCTVs are recommended to allow SCDOT personnel to view actual field conditions and implement signal timing modifications as appropriate.

3.12 Traveler Information

VMS are needed to disseminate current traffic information to the public. This publication can be for diversion route information, evacuation instructions, road or lane closures, accident notification, road construction information, or current route travel times. In joint operations with police, Amber Alerts can also be displayed. The VMS and CCTVs in the study area are mainly located along the I-26 corridor. Additional CCTV traffic cameras and VMS on selected arterial routes would enable the District to monitor existing conditions, verify reported problems, and use that information for action and monitoring events. The suggested combination of ITS devices would allow District 6 to monitor and review signal operations, log events, receive alarms, provide real-time control of incidents, notify the affected route drivers, and provide special and construction events information directly to the street or via online traveler information.

The current incident management technique should be expanded to include additional proposed VMS and CCTV on the arterial routes including Rivers Avenue, Ashley Phosphate Road, Remount Road, Aviation Avenue, US 17A, US 78, and SC 642 (Dorchester Road) in the near future. The other corridors in the study area would benefit from these devices; however, their needs are not as critical as the local interstate system. Travel times along I-26 and I-526 are currently being processed through cell phone tracking. While this is appropriate for travel on I-26 where long distances are traveled, off interstate routes such as Rivers Avenue may require a different data collection strategy.

4.0 Traffic Control Systems and Operations Recommendations

The existing traffic control systems operating in the study area are all time-of-day (TOD) coordinated traffic control systems. SCDOT has or has planned numerous fiber optic Ethernet systems within the study area. US 17A, US 78, Rivers Avenue, Ashley Phosphate Road, US 176 and US 52 and SC 642 (Dorchester Road) all have or will have a fiber optic cable for the majority of the length of each corridor. College Park Road has two separate closed loop systems that are interconnected with fiber optic cable. In general, the fiber optic cable encompasses the majority of the study area critical systems.

The TOD systems that are in place provide coordination based on a standard set of data and is currently operating with reasonable effectiveness. To enhance the traffic operations, Jacobs recommends that SCDOT implement the following improvements along the study area corridors. (All corridors are referenced with I-26 having an east-west orientation.)

4.1 Zone 1 – Moncks Corner

The following sections summarize the recommendations for the signalized intersections located within Zone 1 by corridor or group of signals. Figure 4.1 shows all of the recommendations for Zone 1.

4.1.1 US 52 (North Goose Creek Boulevard)

US 52 (North Goose Creek Boulevard) is a major north-south arterial with 9 signalized intersections located along the corridor spanning from Cypress Gardens Road to SC 45 (Ravenel Street/Church Road. Between the southern intersection with Rembert Dennis Boulevard and the northern split with US 17A there are seven more closely-spaced intersections. Although three signalized intersections have communication capabilities (Rembert Dennis Boulevard (South), Heatley Street, and Main Street) they are currently offline. All of these locations are operated by Naztec 2070 controllers with the exception of the isolated intersection located at US 52 at SC 45 (Ravenel Street/Church Road) which has a 170 controller.

Jacobs recommends the following improvements for implementation:

- Replace copper with overhead fiber optic interconnect between the southern intersection with Rembert Dennis Boulevard and SC 6 (Main Street)
- Install radio communications between SC 6 (Main Street) and the northern split with US 17A
- Install cellular modems at Cypress Gardens Road, Gaillard Road, and SC 45 (Ravenel Street/Church Road
- Install traffic-responsive signal system control between the southern intersection with Rembert Dennis Boulevard and the northern split with US 17A

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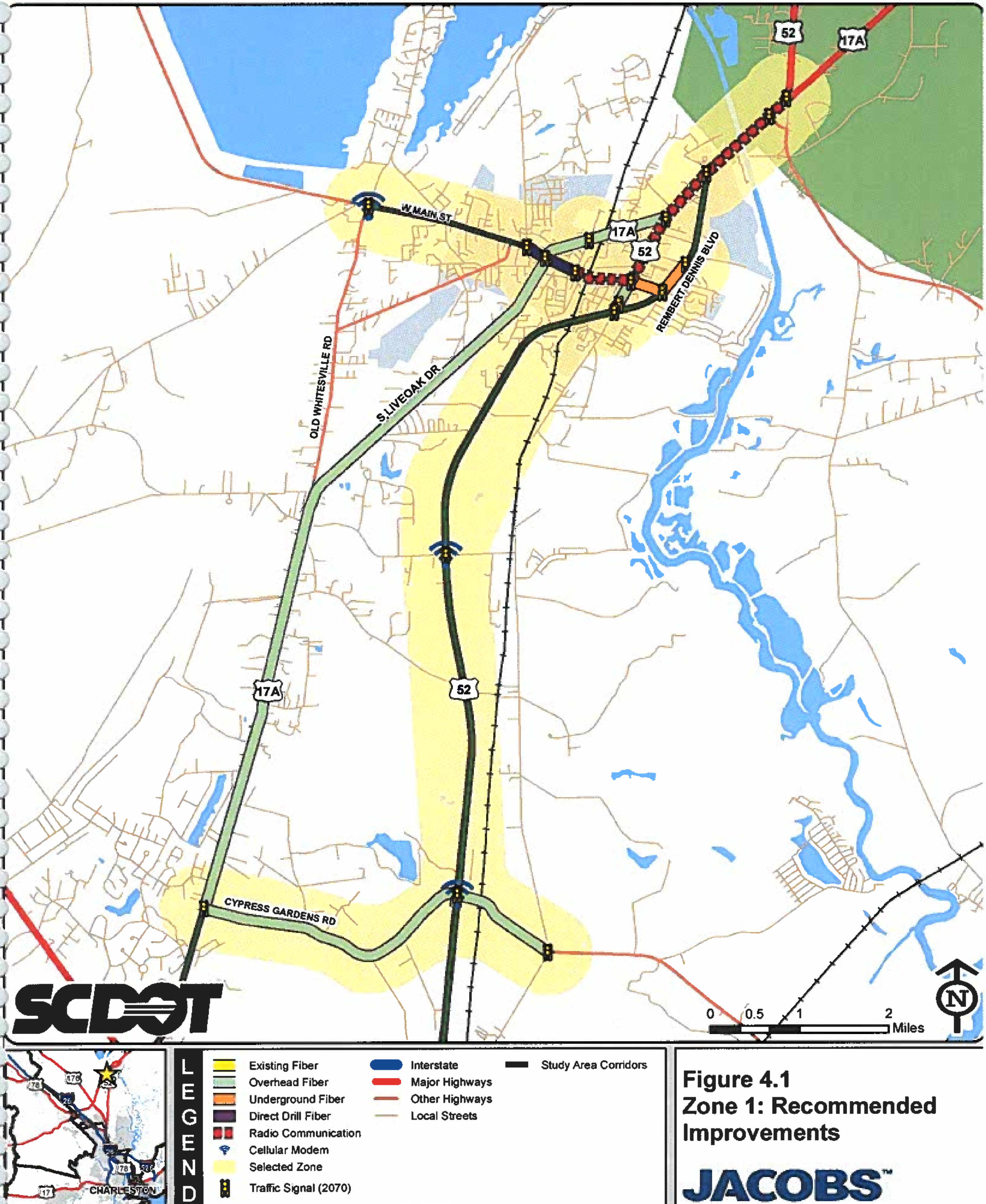

Figure 4.1
Zone 1: Recommended Improvements

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- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (nine locations, Refer to Appendix A)
- Replace existing 170 controller with 2070 controller (SC 45 (Ravenel Street/Church Road)

The estimated costs associated with the proposed improvements are summarized in Table 4.1.1

Table 4.1.1 – US 52 (North Goose Creek Boulevard) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	9 Locations	$10,000	$90,000
2070 Controllers	1 Location	$3,000	$3,000
		Sub-Total	$93,000
Communications			
Fiber Optic Interconnect (OH)	2100 LF	$5	$10,500
Radio Communications	4 Locations	$1,000	$4,000
Cellular Modem	3 Locations	$250	$750
		Sub-Total	$15,250
Trafffic Responsive			
Traffic Responsive Installation	7 Locations	$6,000	$42,000
		Sub-Total	$42,000
GRAND TOTAL			$150,250

Jacobs recommends that the installation of fiber optic interconnect from the southern intersection with Rembert Dennis Boulevard to (SC 6 Main Street) use the existing utility pole line along US 52. This installation will replace the non-functioning existing communication equipment. The fiber optic cable should then go underground along Main Street to provide connection to signals along Rembert Dennis Boulevard. The four intersections north along US 52 (southern US 17A, northern Rembert Dennis Boulevard, SC 402, and northern US 17A) are recommended to have radio communication due to the lack of locations for fiber communication installation. Jacobs recommends the installation of cellular modems at the isolated intersections located at Cypress Gardens Road, Gaillard Road, and SC 45 to provide communications at these intersections.

Based on the volumes and the characteristics of traffic in this area, Jacobs recommends the implementation of a traffic-responsive control system along US 52 between the southern intersection with Rembert Dennis Boulevard and the northern intersection with US 17A. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.1.2 US 17A (Live Oak Drive)

From Cypress Gardens Road to the US 52 diverge, US 17A has four signalized intersections. All of the controllers are Naztec 2070 with the exception of the intersection at Cypress Gardens Road, which is operated by Dynamic Traffic Systems 170. No existing communication equipment is present at any of these intersections.

Jacobs recommends that the following improvement be implemented:

- Install overhead fiber optic interconnect between Cypress Garden Road and US 52 (North Goose Creek Boulevard)
- Install 2070 controller at Cypress Garden Road

The estimated costs associated with the proposed improvement are summarized in Table 4.1.2.

Table 4.1.2 – US 17A (Live Oak Drive) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	1 Location	$10,000	$10,000
2070 Controllers	1 Locations	$3,000	$3,000
		Sub-Total	$13,000
Communications			
Fiber Optic Interconnect (OH)	52800 LF	$5	$264,000
		Sub-Total	$264,000
GRAND TOTAL			$277,000

The recommended fiber optic interconnect should be incorporated into capacity and operational improvements along the corridor to be utilized by anticipated future development.

4.1.3 SC 6 (Main Street)

SC 6 (Main Street) is a major east-west arterial with six signalized intersections from Old Whitesville Road to Rembert Dennis Boulevard. The SC 6 (Main Street) recommendations at the US 52 and Rembert Dennis Road intersections are included in the aforementioned corridors. The only intersection along the SC 6 corridor that currently has communications equipment is at the intersection with US 52; however, that communication equipment is not currently operational. All locations are operated by Naztec 2070 controllers with the exception of the intersections at Old Whitesville Road, which has a 170 controller.

The intersections of US 52 at SC 6 and Rembert Dennis Boulevard at SC 6 are not included in the following recommendations because of their inclusion on other corridors.
Jacobs recommends the following improvements for implementation:

- Install underground fiber optic interconnect via direct drill between Broughton Road and Carolina Avenue

- Install underground fiber optic interconnect between US 52 and Rembert Dennis Boulevard
- Install radio communications between Carolina Avenue and US 52
- Install a cellular modem at Old Whitesville Road
- Install traffic-responsive signal system control between Broughton Road and Carolina Avenue (US 52 and Rembert Dennis Boulevard are included in other systems and are not included in the estimate for SC 6.)
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (one location at Old Whitesville Road)

The estimated costs associated with the proposed improvements are summarized in Table 4.1.3.

Table 4.1.3 – SC 6 (Main Street) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
2070 Controllers	1 Location	$3,000	$3,000
		Sub-Total	$43,000
Communications			
Fiber Optic Interconnect (UG)	2200 LF	$15	$33,000
Fiber Optic Interconnect (DD)	3600 LF	$25	$90,000
Radio Communications	2 Location	$1,000	$2,000
Cellular Modem	1 Location	$250	$250
		Sub-Total	$125,250
Trafffic Responsive			
Traffic Responsive Installation	3 Locations	$6,000	$18,000
		Sub-Total	$18,000
GRAND TOTAL			$186,250

Jacobs recommends the installation of fiber optic interconnect from Broughton Road to Carolina Avenue by direct drilling using the grass utility strip that runs along the side of SC 6/Main Street. Radio communication equipment is recommended at SC 6/Main Street at Carolina Avenue to communicate to the intersection of US 52 and SC 6. Fiber optic interconnect should be installed underground between US 52 and Rembert Dennis Boulevard. The recommended cellular modem at the isolated intersection at Old Whitesville Road will also provide communication.

Based on the volumes and the characteristics of traffic in this area (generally predictable commuter traffic), Jacobs recommends the implementation of a traffic-responsive control system along this corridor between Broughton Road and Rembert Dennis Boulevard. Traffic volumes are needed to develop the associated signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.1.4 US 52 Bypass (Rembert Dennis Boulevard)

Rembert Dennis Boulevard is a bypass for US 52 around Moncks Corner and has only two signalized intersections (excluding the two intersections with US 52). Neither of these intersections have any existing communications equipment. Both locations are operated by 170 controllers. Recommended connection via underground fiber optic interconnect between US 52 at SC 6 and SC 6 at Rembert Dennis Boulevard is included in the SC 6 (Main Street) recommendations.

Jacobs recommends the following improvements for implementation:

- Install underground fiber optic interconnect between SC 6 (Main Street) and Stoney Landing Road
- Install traffic responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (one location at Stoney Landing Rd)
- Replace existing 170 controllers with 2070 controllers (two locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.1.4.

Table 4.1.4 – Rembert Dennis Boulevard Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	**1 Location**	**$10,000**	**$10,000**
2070 Controllers	**2 Locations**	**$3,000**	**$6,000**
		Sub-Total	**$16,000**
Communications			
Fiber Optic Interconnect (UG)	**2400 LF**	**$15**	**$36,000**
		Sub-Total	**$36,000**
Trafffic Responsive			
Traffic Responsive Installation	**2 Locations**	**$6,000**	**$12,000**
		Sub-Total	**$12,000**
GRAND TOTAL			**$64,000**

Jacobs recommends that fiber optic interconnect be installed from SC 6 (Main Street) to Stoney Landing Road by burying the line underground. This interconnect would be an extension of the line that connects US 52 at SC 6 to SC 6 at Rembert Dennis Boulevard.

Based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area, Jacobs recommends the implementation of a traffic-responsive control system along this corridor between SC 6 (Main Street) and Stoney Landing Road/Santee Cooper. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.1.5 Cypress Gardens Road

Cypress Gardens Road is an east-west arterial and has three signalized intersections, including its intersection with US 52. These intersections do not currently have communications equipment. The two signalized intersections (excluding US 52) have 170 controllers.

Jacobs recommends the following improvements for implementation:

- Installation of Cellular Modem at US 52 at Cypress Gardens Road intersection was previously included with the US 52 corridor and is excluded from this estimate.)
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (one location at 17A)
- Replace existing 170 controllers with 2070 controller at Old US 52 (17A location included in recommendations at that location)

The estimated costs associated with the proposed improvements are summarized in Table 4.1.5.

Table 4.1.5 – Cypress Gardens Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	1 Location	$10,000	$10,000
2070 Controllers	2 Locations	$3,000	$6,000
		Sub-Total	$16,000
Communications			
Fiber Optic Interconnect (OH)	23200 LF	$5	$116,000
		Sub-Total	$116,000
GRAND TOTAL			$132,000

4.2 Zone 2 – Downtown Summerville

The following sections summarize the recommendations for the signalized intersections located within Zone 2 by corridor or group of signals. Figure 4.2 shows all of the recommendations for Zone 2.

4.2.1 US 17A (North Main Street)

US 17A (North Main Street) is a major north-south arterial with 23 signalized intersections between St. James Avenue (US 178) and SC 61, as follows:

Six signalized intersections are located between the western intersection with SC 61 and East 6th South Street. None of these intersections have existing communications equipment. The two US 17A intersections with SC 61 and Carolina Avenue have 2070 controllers. The Old Orangeburg Road, Luden Drive, and East 6th South Street intersections are operated by 170 controllers.

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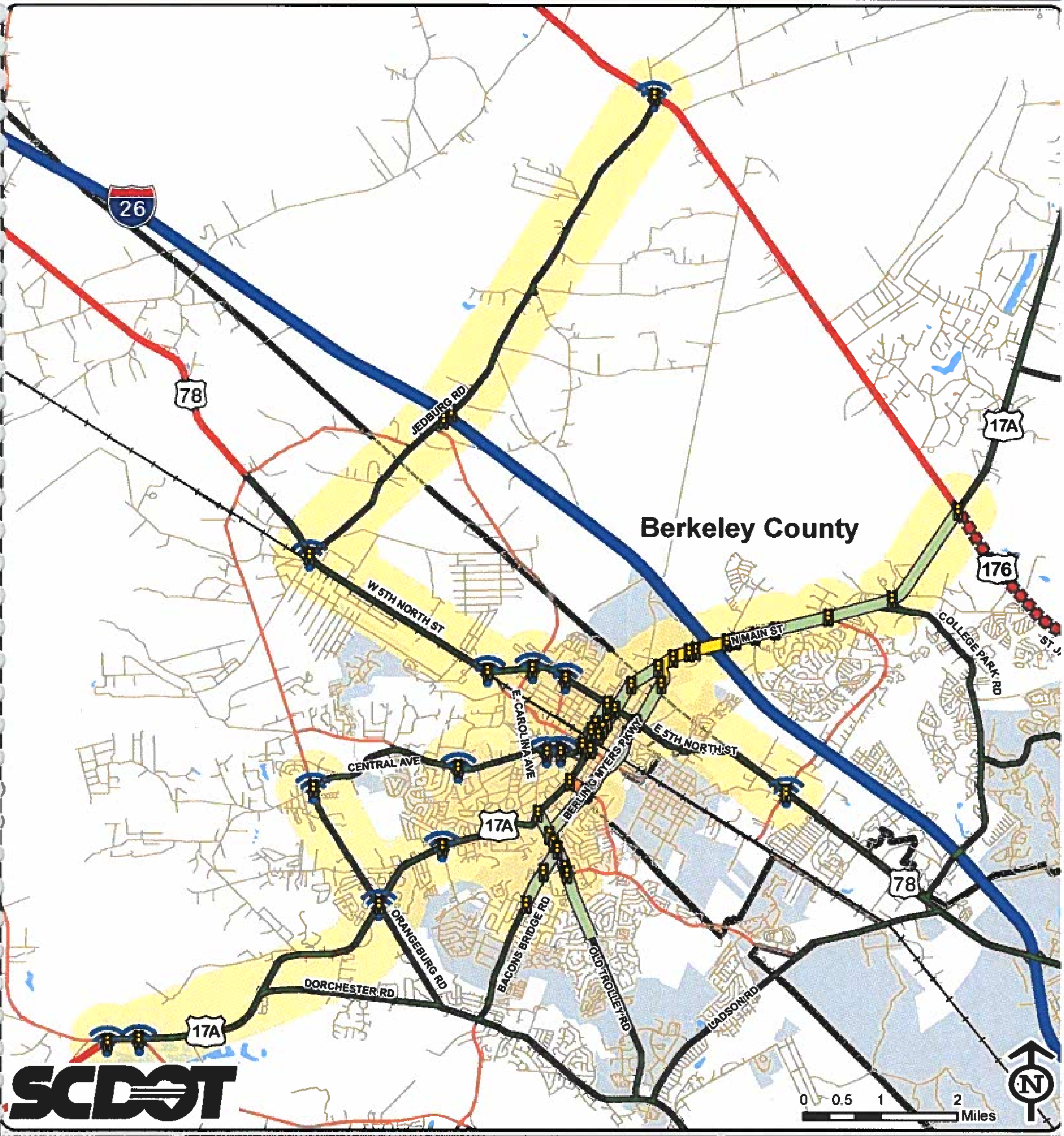

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- Existing Fiber
- Overhead Fiber
- Underground Fiber
- Direct Drill Fiber
- Radio Communication
- Cellular Modem
- Selected Zone
- Traffic Signal (2070)
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 4.2
Zone 2: Recommended Improvements

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Between Richardson Road and East 9th North Street there are currently six interconnected signals with 2070 controllers, however the phone line at the master controller is disconnected. There is currently inoperable radio communication across the railroad tracks between Richardson Road and East 1st North Street. An existing copper connection that is not currently in operation extends from East 1st North Street to East 9th North Street.

Between Beauregard Street and Berlin G. Myers Parkway, eight signals are interconnected with fiber optic cable. These eight locations operate in TOD coordination by Naztec 2070 controllers. SCDOT has current plans to connect this system to the I-26 fiber optic trunk line. Additionally there is an existing fiber optic interconnect between US 17A at Berlin G. Myers Parkway and Berlin G. Myers Parkway at Marymeade Drive.

The intersections from Royle Road to US 176 (St James Avenue) are operated by 170 controllers. No communications currently exists between these three signals and coordination is done time of day.

Jacobs recommends the following improvements for implementation:

- Install overhead fiber optic interconnect between Beauregard Road and St. James Avenue (US 176)
- Install overhead fiber optic interconnect between Berlin G. Myers Parkway and East 9th North Street
- Install underground fiber optic interconnect connecting US 17A to the Berlin G. Myers system at East 6th Street
- Replace copper with fiber optic interconnect between East 9th North Street and East 1st North Street
- Replace existing radio equipment between East 1st North Street and Richardson Street
- Install cellular modems at Luden Drive, Old Orangeburg Road, SC 61 East, and SC 61 West
- Install traffic-responsive signal system control between Carolina Avenue and Holiday Drive
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (ten locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (six locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.2.1.

Table 4.2.1 – US 17A (North Main Street) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	10 Location	$10,000	$100,000
2070 Controllers	6 Locations	$3,000	$18,000
		Sub-Total	$118,000
Communications			
Fiber Optic Interconnect (OH)	24300 LF	$5	$121,500
Fiber Optic Interconnect (UG)	1600 LF	$15	$24,000
Radio Communications	2 Locations	$1,000	$2,000
Cellular Modem	4 Locations	250	$1,000
		Sub-Total	$148,500
Trafffic Responsive			
Traffic Responsive Installation	11 Locations	$6,000	$66,000
		Sub-Total	$66,000
GRAND TOTAL			$332,500

Jacobs recommends that the fiber optic interconnect be installed from Beauregard Road to St. James Avenue (US 178) by using the existing utility pole line along US 17A. The fiber optic cable should be connected to the proposed Carolina Avenue fiber optic interconnect cable in order to provide a redundant ring for communications. Jacobs also recommends underground fiber optic interconnect to be installed connecting the US 17A system to the Berlin G. Myers system at East 6th Street along the south side of the roadway. (Overhead fiber optic interconnect cable installed along Carolina Avenue connecting the signal located along US 17A at Carolina Avenue to Berlin G. Myers is included in the Carolina Avenue/Old Trolley Road section.)

Based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area), Jacobs recommends the implementation of a traffic-responsive control system along this corridor from Richards Avenue to I-26 WB ramp. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.2.2 SC 165 (Berlin G. Myers Parkway)

SC 165 (Berlin G. Myers Parkway) is a north-south arterial that has four signalized intersections from Marymeade Drive to East 6th South Street operated by Naztec 2070 controllers. The signals on the SC 165 (Berlin G. Myers Parkway) corridor operate in time-based coordination with no interconnection for controller synchronization. The intersections along the SC 165 (Berlin G. Myers Parkway) corridor also have no communications with the TCC.

The following improvements are recommended:

- Install overhead fiber optic interconnect between Marymeade Drive and Carolina Avenue
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (two locations, Refer to Appendix A)
- Install CCTV Camera at Berlin G. Myers Parkway at East 6th South Street intersection

The estimated costs associated with the proposed improvements are summarized in Table 4.2.2.

Installation of fiber optic interconnect is recommended from Marymeade Drive to Carolina Avenue. This installation will connect to the existing SC 165 fiber optic cable that travels between US 17A and Marymeade Drive. Without an existing utility pole line along SC 165 (Berlin G. Myers Parkway), the fiber optic cable would use a new underground conduit and pull box system. This recommendation assumes that fiber conduit can be placed across the two bridges. The fiber optic cable should be connected to the proposed Carolina Avenue fiber optic interconnect cable, which would allow connection to the TCC.

Table 4.2.2 – SC 165 (Berlin G. Myers Parkway) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	2 Locations	$10,000	$20,000
		Sub-Total	$20,000
Communications			
Fiber Optic Interconnect (UG)	14500 LF	$15	$217,500
		Sub-Total	$217,500
Trafffic Responsive			
Traffic Responsive Installation	4 Locations	$6,000	$24,000
CCTV Cameras	1 Locations	$21,000	$21,000
		Sub-Total	$45,000
GRAND TOTAL			$282,500

The Naztec 2070 controllers at the SC 165 signals will allow traffic-responsive signal control. Based on the volumes and the characteristics of traffic in this area (generally predictable commuter traffic), Jacobs recommends the implementation of a traffic-responsive system along this corridor. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.2.3 North Cedar Street/Central Avenue

North Cedar Street/Central Avenue is a north-south arterial that has eight signalized intersections, four of which are closely spaced in a grid system. In the grid system, North Cedar Street/Central Avenue runs parallel to US 17A. Radio communication equipment exists across the railroad tracks between

Richardson Road and West 1st North Street, but is not operational, and an existing copper connection extends from West 1st North Street to US 78. The copper line runs along US 78 and ties into US 17A at US 78; however, it is not currently operational. The other four intersections on this study corridor do not have any communications equipment. Two intersections are being operated by Naztec 2070 controllers are at US 78 and Richardson Avenue; the other six signals are operated by 170 controllers.

Jacobs recommends the following improvements for implementation:

- Replace copper with overhead fiber optic interconnect between West 1st North Street and US 78
- Replace copper with overhead fiber optic interconnect along US 78 between North Cedar Street/Central Avenue and US 17A
- Replace existing radio equipment between East 1st North Street and Richardson Street
- Install cellular modems at Laurel Street, Carolina Avenue, Parson Road, and Old Orangeburg Road
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (eight locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (six locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.2.3.

Table 4.2.3 – North Cedar Street/Central Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	8 Locations	$10,000	$80,000
2070 Controllers	6 Loctions	$3,000	$18,000
		Sub-Total	$98,000
Communications			
Fiber Optic Interconnect (OH)	3000 LF	$5	$15,000
Radio Communications	2 Locations	$1,000	$2,000
Cellular Modem	4 Locations	$250	$1,000
		Sub-Total	$18,000
Trafffic Responsive			
Traffic Responsive Installation	4 Locations	$6,000	$24,000
		Sub-Total	$24,000
GRAND TOTAL			$140,000

Jacobs recommends that the existing copper line (US 78 from US 17A to North Cedar Street/Central Avenue, then down North Cedar Street/Central Avenue to West 1st North Street) be upgraded to overhead fiber optic interconnect. Radio communications between Richardson Avenue and West 1st

North Street is inoperable and should be replaced. Jacobs also recommends cellular modems at Laurel Street, Carolina Avenue, Parson Road, and Old Orangeburg Road.

Jacobs recommends implementation of a traffic-responsive control system along this corridor between US 78 and Richardson Avenue based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.2.4 East Carolina Avenue/Old Trolley Road

Carolina Avenue and Old Trolley Road are east-west collector roadways used by commuters with destinations on the SC 642 (Dorchester Road) corridor. Land use adjacent to Carolina Avenue and Old Trolley Road is predominantly residential west of Berlin G. Myers Parkway and predominantly mixed-use east to SC 642 (Dorchester Road).

Two time-based coordination systems operate along the Carolina Avenue/Old Trolley Road corridor. The first system has no interconnection for controller synchronization and consists of five signals operating in time-based coordination from Berlin G. Myers Parkway to Miles Jamison Road. The remaining four signals (Trolley Road at Crestview Drive to Trolley Road at Midland Parkway) along this corridor have similar configurations and are included with Old Trolley Road recommendations in section 4.3.1.

The following improvements are recommended:

- Install overhead fiber optic interconnect between US 17A and Crestview Drive (Crestview Drive to SC 642 (Dorchester Road) included in 4.6.1)
- Install traffic-responsive signal system control between Berlin G. Myers Parkway and Miles Jamison Road
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations)
- Install CCTV Camera at Carolina Avenue at Summerville Plaza intersection

The estimated costs associated with the proposed improvements are summarized in Table 4.2.4.

Table 4.2.4 – Carolina Avenue/Old Trolley Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
		Sub-Total	$40,000
Communications			
Fiber Optic Interconnect (OH)	10200 LF	$5	$51,000
		Sub-Total	$51,000
Trafffic Responsive			
Traffic Responsive Installation	5 Locations	$6,000	$30,000
CCTV Cameras	1 Location	$21,000	$21,000
		Sub-Total	$51,000
GRAND TOTAL			$142,000

Jacobs recommends fiber optic interconnect to be installed from US 17A to Crestview Drive using the existing utility pole line along Carolina Avenue and Old Trolley Road. This fiber optic cable should be connected to the SC 642 (Dorchester Road) fiber optic interconnect cable, which would in turn connect to the TCC.

Five intersections from Berlin G Myers to Miles Jamison Road have Naztec 2070 controllers that would allow these intersections to operate with traffic-responsive signal control. Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.2.5 Jedburg Road, US 78, SC 165 (Bacons Bridge Road)

Zone 2 has some outlying signalized intersections, three locations on Jedburg Road, five locations on US 78, and two locations on SC 165 (Bacons Bridge Road). The intersections of Jedburg Road and the I-26 EB and WB ramps are the only two outlying locations with communications equipment. These two intersections have fiber optic interconnect that is not currently connected. These two locations are operated by 2070 controllers, in addition to US 78 at Maple Street. The other seven signals are operated by 170 controllers.

The following improvements are recommended:

- Connect fiber optic interconnect between I-26 westbound ramps and I-26 eastbound ramps along Jedburg Road and to the I-26 backbone fiber.
- Install overhead fiber optic interconnect along SC 165 between Old Trolley Road and Mikell Drive/Edisto Drive

- Install cellular modems at Jedburg Road at US 176, Jedburg Road at US 78, US 78 at Richardson Avenue, US 78 at Maple Street, US 78 at Bryan Street, and US 78 at Von Oshen Road/Royle Road
- Program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (seven locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (seven location, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.2.5.

Table 4.2.5 – Zone 2 Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	7 Locations	$10,000	$70,000
2070 Controllers	7 Locations	$3,000	$21,000
		Sub-Total	$91,000
Communications			
Fiber Optic Interconnect (OH)	4800 LF	$5	$24,000
		Sub-Total	$24,000
Trafffic Responsive			
Cellular Modem	7 Locations	$250	$1,750
		Sub-Total	$1,750
GRAND TOTAL			$116,750

4.3 Zone 3 – Summerville

The following sections summarize the recommendations for the signalized intersections located within Zone 3 by corridor or group of signals. Figure 4.3 shows all of the recommendations for Zone 3.

4.3.1 Old Trolley Road

Old Trolley Road is an east-west collector roadway used as a commuter route for traffic with destinations on the SC 642 (Dorchester Road) corridor. Land use adjacent to this roadway is predominantly residential west of Berlin G. Myers Parkway and predominantly mixed use east to SC 642 (Dorchester Road).

As mentioned previously, two time-based coordination systems operate along the Carolina Avenue/Old Trolley Road corridor. The first system consists of six signals from US 17A to Miles Jamison Road that are included in the recommendations for Zone 2 (4.2.4). The four Old Trolley Road traffic signals between Crestview Drive and Midland Parkway operate under time-based coordination with no interconnection. These four signals currently have 170 controllers.

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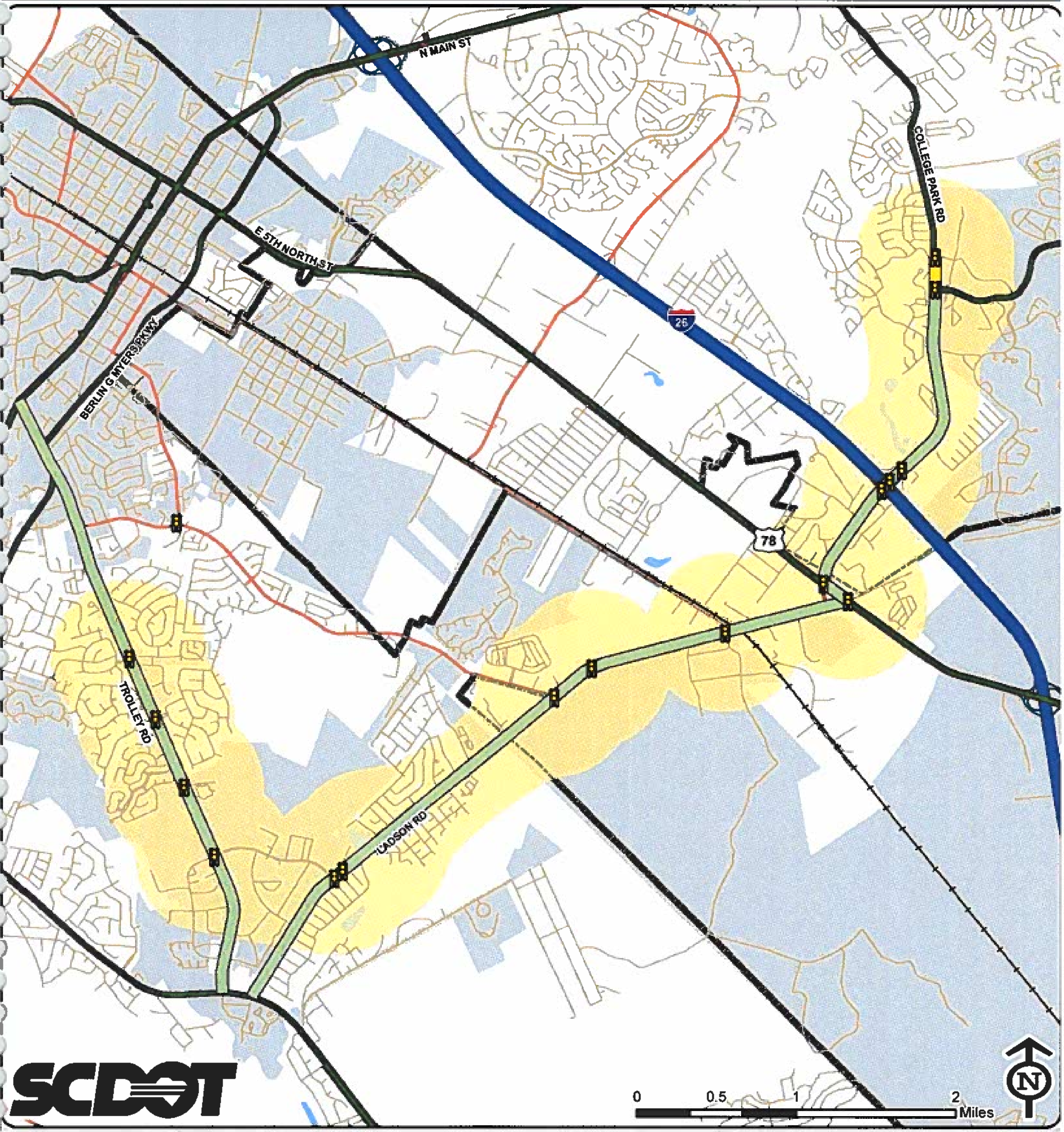

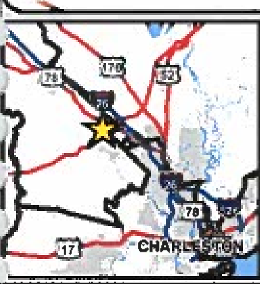

LEGEND

- Existing Fiber
- Overhead Fiber
- Underground Fiber
- Direct Drill Fiber
- Radio Communication
- Cellular Modem
- Selected Zone
- Traffic Signal (2070)
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 4.3
Zone 3: Recommended Improvements

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The following improvements are recommended:

- Install overhead fiber optic interconnect between Crestview Drive and SC 642 (Dorchester Road)
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (four locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.3.1.

Table 4.3.1 – Old Trolley Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
2070 Controllers	4 Locations	$3,000	$12,000
		Sub-Total	$52,000
Communications			
Fiber Optic Interconnect (OH)	13000 LF	$5	$65,000
		Sub-Total	$65,000
Trafffic Responsive			
Traffic Responsive Installation	4 Locations	$6,000	$24,000
		Sub-Total	$24,000
GRAND TOTAL			$141,000

Jacobs recommends the installation of fiber optic interconnect from Crestview Drive to SC 642 (Dorchester Road) use the existing utility pole line along Old Trolley Road. This fiber optic cable should be connected to the SC 642 (Dorchester Road) fiber optic interconnect cable, which would in turn connect to the TCC. Jacobs also recommends upgrading the 170 controllers to 2070 controllers to handle the traffic-responsive control. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.3.2 Ladson Road

Ladson Road is a northeast/southwest arterial that serves as a commuter route between the population centers and the employment destination. The peak travel patterns observed were to the northeast during the AM period and to the southwest during the PM peak period. Four of the six signals on Ladson Road are controlled by 170 controllers. The Ladson Road/Lincolnville Road and US 78 (University Boulevard) intersections are operated by a Naztec 2070 controller. No interconnection or coordination currently exists along this corridor.

Jacobs recommends the following improvements for implementation:

- Install overhead fiber optic interconnect between SC 642 (Dorchester Road) and College Park Road on the existing utility pole line
- Install traffic-responsive signal system control (six locations)
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (five locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (four locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.3.2.

Table 4.3.2 – Ladson Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	5 Locations	$10,000	$50,000
2070 Controllers	4 Location	$3,000	$12,000
		Sub-Total	$62,000
Communications			
Fiber Optic Interconnect (OH)	27000 LF	$5	$135,000
		Sub-Total	$135,000
Trafffic Responsive			
Traffic Responsive Installation	6 Locations	$6,000	$36,000
		Sub-Total	$36,000
GRAND TOTAL			$233,000

Jacobs recommends that the fiber optic interconnect be installed from SC 642 (Dorchester Road) and US 78 (University Boulevard) by using the existing poles on Ladson Road. Based on the volumes and the characteristics of traffic in this area, implementation of a traffic-responsive control system is recommended for this corridor. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.3.3 College Park Road

College Park Road is a north-south arterial characterized by commercial/retail and some residential/recreational land uses adjacent to the roadway. Stratford High School is located along the corridor near the intersection of College Park Road at Crowfield Boulevard.

The College Park Road corridor has six signals. Three of the signals are located within approximately 1,000 feet of each other, are adjacent to I-26 and are operated by Naztec 2070 controllers with the master being located at the I-26 EB ramps. The signal at US 78 (University Boulevard) is also operated by a 2070 controller. The remaining two signals are operated by 170 controllers. An existing fiber optic interconnect is present between Corporate Parkway and Crowfield Boulevard. The signals on College

Park Road between College Park Road/I-26 and College Park Road/Treeland Drive are interconnected using spread spectrum radio and connect to the TCC office using a dial-up modem at the master controller. SCDOT has current plans to interconnect these signals using a fiber optic cable and connect this system to the I-26 fiber optic trunk line.

In addition to this proposed connection, the following improvements are recommended:

- Install overhead fiber optic interconnect between Crowfield Boulevard at US 78 (University Boulevard) continuing to Ladson Road at US 78 (University Boulevard)
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)
- Install 2070 controllers (two locations, Refer to Appendix A)
- Install CCTV at I-26 EB Ramp

The estimated costs associated with the proposed improvements are summarized in Table 4.3.3.

Table 4.3.3 – College Park Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
2070 Controllers	2 Locations	$3,000	$6,000
		Sub-Total	$46,000
Communications			
Fiber Optic Interconnect (OH)	13200 LF	$5	$66,000
		Sub-Total	$66,000
Trafffic Responsive			
Traffic Responsive Installation	5 Locations	$6,000	$30,000
CCTV Cameras	1 Location	$21,000	$21,000
		Sub-Total	$51,000
GRAND TOTAL			$163,000

Fiber optic interconnect cable exists between the College Park at Crowfield Drive and the College Park Road at Corporate Drive intersections. These two locations have 170 controllers that are six to nine years old and should be replaced. Communications between these two intersections and the TCC is via a dial-up modem located at the master controller. This communication method could be replaced by extending the fiber optic interconnect cable from Treeland Drive to Crowfield Drive, however this recommendation would be a lower-priority improvement. The fiber optic interconnect could be added using existing poles now or could be incorporated in probable future roadway improvements on College Park Road.

Installation of fiber optic interconnect on College Park Road is recommended from the existing fiber optic cable to US 78/University Boulevard and then continuing on US 78 to Ladson Road. This installation can be accomplished using the existing utility pole line along College Park Road. This connection would provide a redundant connection to US 78 and create a "ring" of fiber optic cable connecting back to the TCC.

Based on the volumes and the characteristics of traffic in this area, Jacobs recommends the implementation of a traffic-responsive control system along this corridor. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.4 Zone 4 – Goose Creek

The following sections summarize the recommendations for the signalized intersections located within Zone 4 by corridor or group of signals. Figure 4.4 shows all of the recommendations for Zone 4.

4.4.1 US 176 (St. James Avenue)

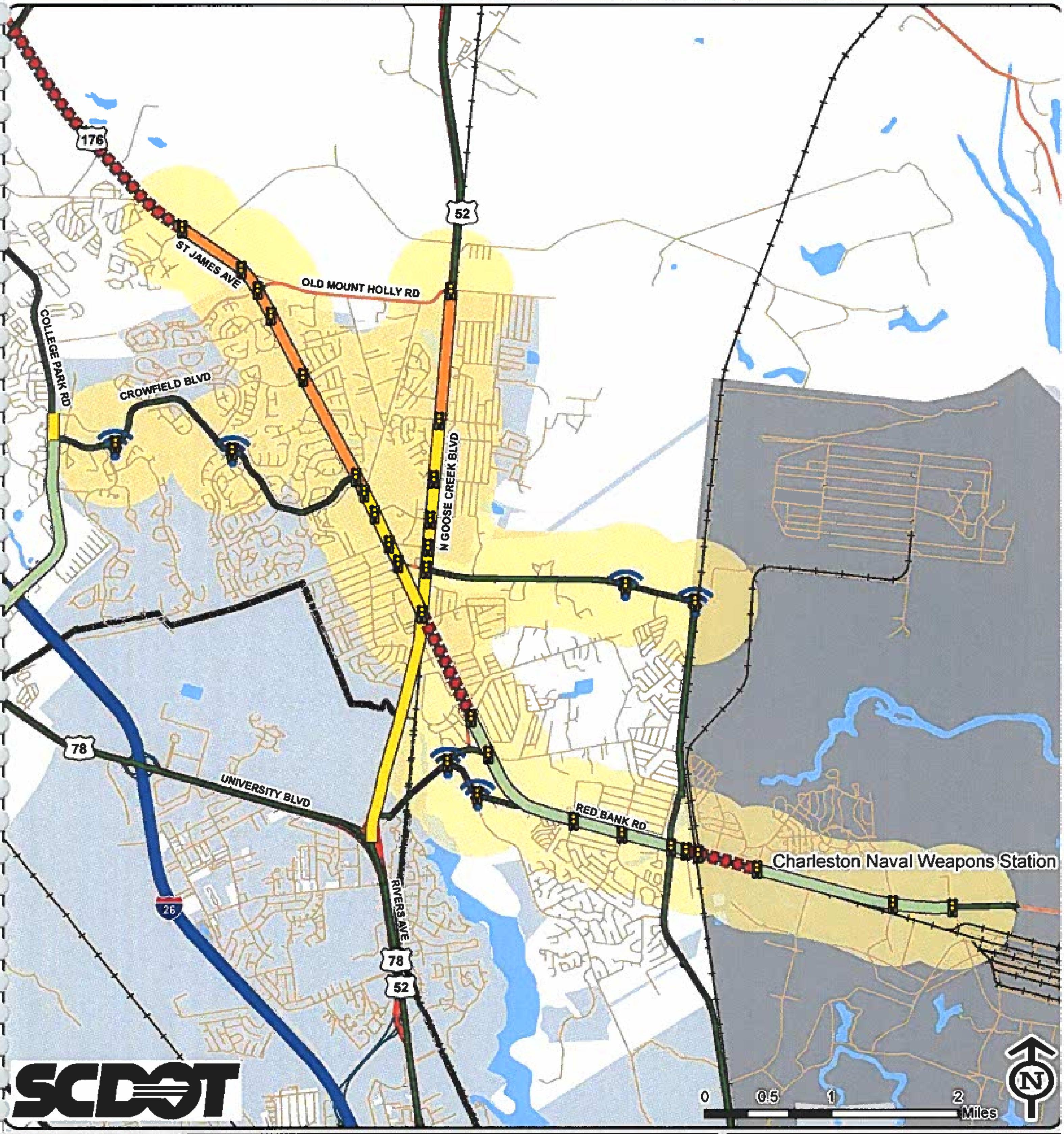
US 176 (St. James Avenue) is an east-west arterial that serves as a commuter route between population centers and employment destinations with weekday peak travel patterns eastbound during the AM period and westbound during the PM peak period. US 176 (St. James Avenue) has ten signals from Thomason Boulevard to Devon Boulevard. All are operated by Naztec 2070 controllers with the exception of the Devon Boulevard intersection, which is operated by a 170 controller. A fiber optic cable connects five intersections from Thomason Boulevard to Crowfield Boulevard. SCDOT is currently constructing interconnection from this signal system to the I-26 fiber optic trunk line via US 78. The remaining five intersections along US 176 (St. James Avenue) from Gainesborough Drive to Devon Boulevard operate in time-based coordination and are not interconnected.

Jacobs recommends the following improvements for implementation:

- Install underground fiber optic interconnect between Crowfield Boulevard and Devon Boulevard
- Install radio communications between Devon Boulevard and US 17A (N. Main Street)
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (eight locations, Refer to Appendix A)
- Replace existing 170 controller with 2070 controller (one location at Devon Boulevard)

The estimated costs associated with the proposed improvements are summarized in Table 4.4.1.

North CHATS Area Traffic Signal Master Plan



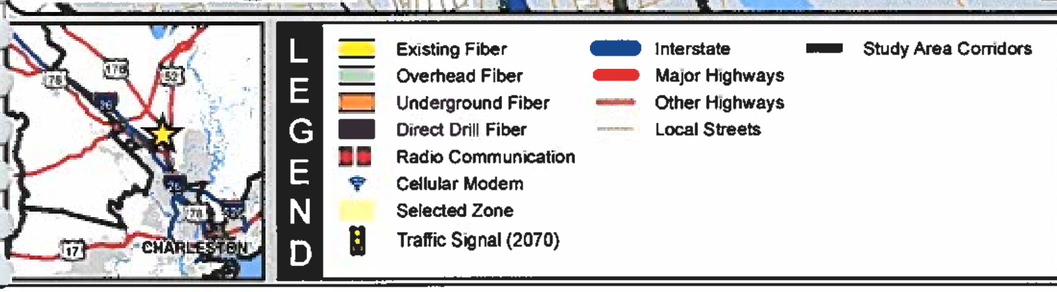


Figure 4.4
Zone 4: Recommended Improvements

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Table 4.4.1 – St. James Avenue (US 176) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	8 Locations	$10,000	$80,000
2070 Controllers	1 Location	$3,000	$3,000
		Sub-Total	$83,000
Communications			
Fiber Optic Interconnect (UG)	11850 LF	$15	$177,750
Radio Communications	2 Locations	$1,000	$2,000
		Sub-Total	$179,750
Trafffic Responsive			
Traffic Responsive Installation	10 Locations	$6,000	$60,000
		Sub-Total	$60,000
GRAND TOTAL			$322,750

Jacobs recommends the installation of underground fiber optic interconnect from Crowfield Boulevard to Devon Boulevard use a new underground conduit and pull box system because this section of US 176 does not have an existing utility pole line. The recommended radio communication connecting Devon Boulevard to US 17A provide redundancy connecting to the TCC.

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.4.2 North Goose Creek Boulevard (US 52)

North Goose Creek Boulevard (US 52) is a north-south arterial that parallels an active rail line located to the east. There are seven signals along this corridor from St. James Avenue (US 176) to Old Mount Holly Road. All westbound approaches to the intersections cross the CSX rail line and each intersection has rail pre-emption. The signals use Naztec 2070 controllers and a fiber optic cable connects six of the seven intersections. These signals operate in a coordinated system with the North Goose Creek Boulevard/Old Mount Holly Road intersection. SCDOT has current plans to interconnect the North Goose Creek signal system to the I-26 fiber optic trunk line via US 78/University Boulevard. This improvement is currently under construction.

In addition, Jacobs recommends the following improvements for implementation:

- Install underground fiber optic interconnect between Stephanie Drive and Old Mount Holly Road
- Install traffic-responsive signal system control

- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (six locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.4.2.

Table 4.4.2 – North Goose Creek Boulevard (US 52) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	6 Locations	$10,000	$60,000
		Sub-Total	$60,000
Communications			
Fiber Optic Interconnect (UG)	5400 LF	$15	$81,000
		Sub-Total	$81,000
Trafffic Responsive			
Traffic Responsive Installation	7 Locations	$3,000	$21,000
		Sub-Total	$21,000
GRAND TOTAL			$162,000

Jacobs recommends the installation of underground fiber optic interconnect from Stephanie Drive to Old Mount Holly Road using a new underground conduit and pull box system because no existing utility pole line is present along this section of US 52.

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.4.3 Red Bank Road

Red Bank Road is an east-west arterial with ten signals from Forest Lawn Avenue to NNPTC/Ordinance Avenue. The four signals from North Rhett Road to Deke Giles Avenue currently have communications equipment that is inoperable and have Naztec 2070 controllers. The remaining signals have no communications equipment and are operated by 170 controllers, with the exception of NNPTC/Ordinance Avenue which has a Naztec 2070 controller. The radio communications at Deke Giles Avenue is not currently connected.

Jacobs recommends the following improvements for implementation:

- Install radio communications from US 52 (North Goose Creek) to Forest Lawn Avenue
- Install overhead fiber optic interconnect from Forest Lawn Avenue to Eagle Road
- Install radio communications between Eagle Road and Deke Giles Avenue
- Install overhead fiber optic interconnect from Deke Giles Avenue to NNPTC/Ordinance Avenue

- Install Type 332 cabinets at locations that currently have Type 336 cabinets (nine locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (five locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.4.3.

Table 4.4.3 – Red Bank Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	9 Locations	$10,000	$90,000
2070 Controllers	5 Location	$3,000	$15,000
		Sub-Total	$105,000
Communications			
Fiber Optic Interconnect (OH)	21600 LF	$5	$108,000
Radio Communications	5 Locations	$1,000	$5,000
		Sub-Total	$113,000
GRAND TOTAL			$218,000

Jacobs recommends installation of radio communication from US 52 to Forest Lawn Avenue to connect to the fiber optic system along US 52. Jacobs also recommends radio communication from Eagle Road to Pomflant Access Road and from Pomflant Access Road to Deke Giles Avenue in order to cross the railroad tracks on both sides of Pomflant Access Road.

4.4.4 Crowfield Boulevard, Liberty Hall Road, Snake Road

Zone 4 has some outlying signalized intersections including two locations on Crowfield Boulevard, two locations on Liberty Hall Road, and two locations on Snake Road. None of these signals has any existing communication equipment. The signal at Henry E Brown Jr. Boulevard at Liberty Hall Road has a Naztec 2070 controller; the other five signals have 170 controllers.

The following improvements are recommended:

- Install cellular modems at the following locations:
    - Crowfield Boulevard at Hamlet Circle/Corporate Parkway
    - Crowfield Boulevard at Londonderry Road/Westview Boulevard
    - Liberty Hall Road at Wildberry Lane
    - Henry E Brown Jr. Boulevard at Liberty Hall Road
    - NAD Road at Snake Road
    - Snake Road at Foster Creek Road
- Program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (five locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (six locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.4.4.

Table 4.4.4 – Zone 4 Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	6 Locations	$10,000	$60,000
2070 Controllers	5 Locations	$3,000	$15,000
		Sub-Total	$75,000
Communications			
Radio Communications	6 Locations	$1,000	$6,000
		Sub-Total	$6,000
GRAND TOTAL			$81,000

4.5 Zone 5 – Ashley Phosphate Road/Rivers Avenue

The following sections summarize the recommendations for the signalized intersections located within Zone 5 by corridor or group of signals. Figure 4.5 shows all of the recommendations for Zone 5.

4.5.1 US 78 (University Boulevard)

US 78 (University Boulevard) is a major north-south arterial with five signals from College Park Road to Fernwood Drive/Wannamaker Park. The five US 78 (University Boulevard) signals from Park are coordinated and interconnected with fiber optic cable. SCDOT has current plans to connect this system to the I-26 fiber optic trunk line.

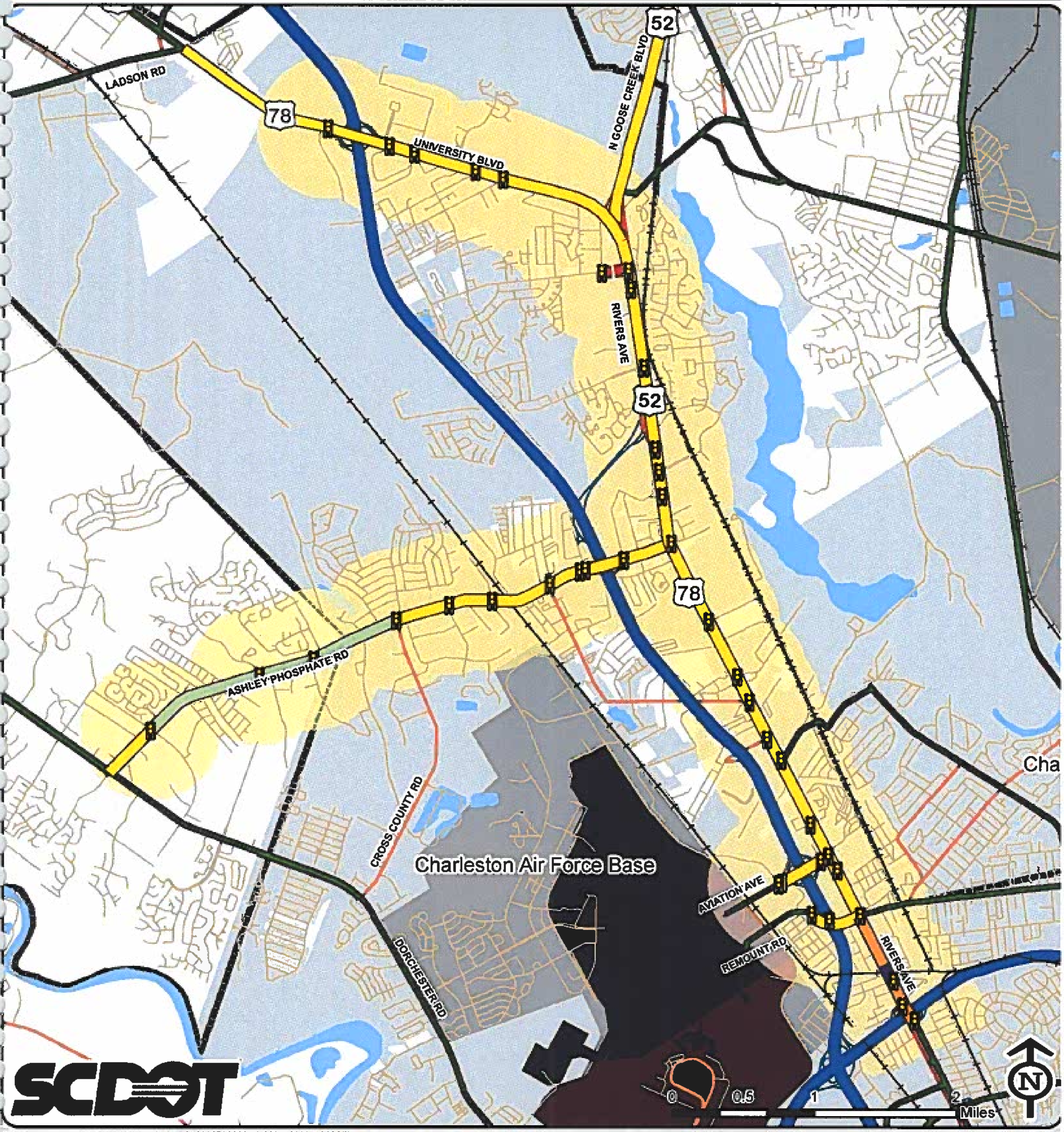
The remaining intersections along US 78 (University Boulevard) at College Park Road and Ladson Road operate in time-based coordination. Spread spectrum radio connects the system between the US 78 (University Boulevard) at College Park Road intersection and the College Park Road at I-26 EB intersection. The corridor has communication to the TCC through this connection.

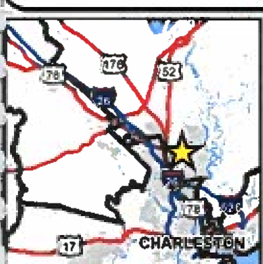
Jacobs recommends the following improvements for implementation:

- Install fiber optic interconnect between I-26 to Ladson Road
- Install traffic-adaptive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (five locations, Refer to Appendix A)
- Install CCTV at US 78/I-26 intersection

The estimated costs associated with the proposed improvements are summarized in Table 4.5.1.

North CHATS Area Traffic Signal Master Plan





LEGEND

- Existing Fiber
- Overhead Fiber
- Underground Fiber
- Direct Drill Fiber
- Radio Communication
- Cellular Modem
- Selected Zone
- Traffic Signal (2070)
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 4.5
Zone 5: Recommended Improvements

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Table 4.5.1 – University Boulevard (US 78) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	7 Locations	$10,000	$70,000
		Sub-Total	$70,000
Communications			
Fiber Optic Interconnect (OH)	7500 LF	$5	$37,500
		Sub-Total	$37,500
Trafffic Adaptive			
Detection	146 Each	$1,000	$146,000
Traffic Adaptive Installation	7 Locations	$25,000 to $30,000	$175,000 to $210,000
CCTV Cameras	1 Locations	$21,000	$21,000
		Sub-Total	$342,000 to $377,000
GRAND TOTAL			$449,500 to $484,500

Jacobs recommends the installation of overhead fiber optic interconnect cable from I-26 to College Park Road. This installation can use the existing utility pole line along US 78. This fiber optic cable should connect to the proposed College Park Road and Old Trolley Road fiber optic interconnects cable. This connection would provide a portion of the "ring" of fiber optic cable connecting back to the TCC.

Jacobs recommends installation of a traffic-adaptive signal control based on traffic volumes and the frequent emergency vehicles use. US 78 (University Boulevard) is also used as an alternate to I-26 during incidents and serves as an evacuation route. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-adaptive mode.

4.5.2 Ashley Phosphate Road

Ashley Phosphate Road is a major east-west arterial characterized by predominantly commercial/retail land uses adjacent to the roadway with residential neighborhoods predominantly south of Cross County Road. Several collector roadways intersect Ashley Phosphate Road including Rivers Avenue, I-26 and SC 642 (Dorchester Road). Ashley-Phosphate Road has ten signals located between SC 642 (Dorchester Road) and Rivers Avenue.

The existing intersections along Ashley Phosphate Road have a fiber optic interconnect from Rivers Avenue to Cross County Road and spread spectrum ratio from Cross County Road to SC 642 (Dorchester Road). These signals operate in TOD coordination and are networked back to the TCC and connected to the central server.

Additionally, SCDOT is scheduled to install CCTV cameras at the Ashley Phosphate intersections with SC 642 (Dorchester Road), Cross County Road and Rivers Avenue. These devices and fiber optic Ethernet system are an initial step in the series of additional recommended improvements on this corridor. This corridor has high importance because of its connectivity to I-26, Rivers Avenue and SC 642 (Dorchester Road), as well as the high traffic volumes associated with both commuters and commercial development related traffic.

We recommend the implementation of traffic-adaptive control system in addition to the following improvements:

- Install overhead fiber optic interconnect cable from Cross County Road to Lincoln Boulevard on existing utility pole line
- Connect existing fiber at Lincoln Boulevard and SC 642 (Dorchester Road)
- Install system detection and traffic counting detection and program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (two locations, Refer to Appendix A)
- Install traffic-adaptive signal system control
- Install CCTV at I-26 EB Ramps
- Connect existing system to I-26 fiber optic trunk line

The estimated costs associated with the proposed improvements are summarized in Table 4.5.2.

Table 4.5.2 – Ashley Phosphate Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	2 Locations	$10,000	$20,000
		Sub-Total	$20,000
Communications			
Fiber Optic Interconnect (OH)	10250 LF	$5	$51,250
		Sub-Total	$51,250
Trafffic Adaptive			
Detection	238 Each	$1,000	$238,000
Traffic Adaptive Installation	10 Locations	$25,000 to $30,000	$250,000 to $300,000
CCTV Cameras	1 Location	$21,000	$21,000
		Sub-Total	$509,000 to $559,000
GRAND TOTAL			$580,250 to $630,250

Jacobs recommends the installation of overhead fiber optic interconnect cable from Cross County Road to Lincoln Boulevard and that the existing fiber optic cable between Lincoln Boulevard and SC 642 (Dorchester Road) be connected. This installation can use the existing utility pole line along Ashley Phosphate Road. The purpose and need for this connection would be to provide communication to the SC 642 (Dorchester Road) corridor, which subsequently could be connected to the Carolina Avenue/Trolley Road Corridor and to US 17A. This connection to Dorchester Road represents the shortest distance available for fiber optic cable interconnection. The fiber optic interconnect to SC 642

(Dorchester Road) could also serve as a portion of the "ring" of fiber optic cable connecting back to the TCC with the recommended installation of fiber optic cable along SC 642 (Dorchester Road).

Additionally, Jacobs recommends the connection of the existing fiber optic cable along Ashley Phosphate Road to the existing I-26 fiber optic trunk line. No existing connection exists to the I-26 fiber optic trunk line and communications to the Ashley Phosphate Road corridor are routed to the TCC via the Rivers Avenue fiber optic cable. This I-26 connection would provide an additional redundant connection in the event of fiber optic cable damage.

4.5.3 US 52 (Rivers Avenue) – Otranto Boulevard to I-526

US 52 (Rivers Avenue) is a major north-south arterial that is a major commuter route that is densely developed with major shopping areas extending from Aviation Avenue to US 78. US 52 (Rivers Avenue) has numerous driveway access points serving these commercial uses. US 52 (Rivers Avenue) also acts as a bypass of I-26 in the event of an incident.

US 52 (Rivers Avenue) has 20 signals over a five and three quarter mile stretch) from I-526 to Otranto Boulevard. All signals along this corridor are operated by Naztec 2070 controllers. The existing intersections along US 52 (Rivers Avenue) have a fiber optic interconnect between Remount Road and Otranto Boulevard and operate in TOD coordination. The fiber optic interconnect should be extended from Remount Road to I-526.

The US 52 (Rivers Avenue) traffic signals from Remount Road to Otranto Boulevard are networked back to the TCC and connected to the central server. Additionally, SCDOT is currently installing CCTV cameras at the US 52 (Rivers Avenue) intersections with Remount Road, Aviation Avenue, Stokes Avenue, Ashley Phosphate Road and Greenridge Road. Recommended VMS installation at key decision points will aid drivers with advisory information.

Jacobs recommends the implementation of a traffic-adaptive control system based on this corridor's importance as a major commuter route, an alternate to I-26 during incidents and its designation as an evacuation route. Jacobs recommends the following improvements:

- Install fiber optic interconnect cable from Remount Road to I-526 underground in the existing grass median
- Install traffic-adaptive signal system control
- Install system detection and traffic counting detection and program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (seven locations, Refer to Appendix A)
- Install CCTV at US 52 Connector (NB and SB)
- Install VMS at Stokes Avenue (NB), at Greenridge Road (NB & SB), and west of the US 52 Connector (EB & WB)

Estimated costs associated with the proposed improvements are summarized in Table 4.5.3.

Table 4.5.3 – Rivers Avenue (Otranto Road to I-526) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	7 Locations	$10,000	$70,000
		Sub-Total	$70,000
Communications			
Fiber Optic Interconnect (UG)	4000 LF	$15	$60,000
Fiber Optic Interconnect (DD)	800 LF	$25	$20,000
		Sub-Total	$80,000
Trafffic Adaptive			
Detection	366 Each	$1,000	$366,000
Traffic Adaptive Installation	20 Locations	$25,000 to $30,000	$500,000 to $600,000
CCTV Cameras	2 Locations	$21,000	$42,000
VMS	5 Locations	$140,000	$700,000
		Sub-Total	$1,608,000 to $1,708,000
GRAND TOTAL			$1,758,000 to $1,858,000

4.5.4 Aviation Avenue

Aviation Avenue is an east-west roadway that interchanges with I-26 and provides access for the Charleston International Airport /Charleston Air Force Base with I-26 and Rivers Avenue. Aviation Avenue is currently under construction as part of the I-26 widening project.

The three signals along Aviation Avenue (excluding US 52) are being reconstructed as part of the I-26 widening project. These signals will be operated by new Naztec 2070 controllers. The three Aviation Avenue signals will be connected via fiber optic Ethernet interconnect cable to the Rivers Avenue/Aviation Avenue intersection and the TCC.

Based on this corridors importance as an interchange for the Charleston International Airport/Charleston Air Force Base with I-26 and the Rivers Avenue corridor, Jacobs recommends the following improvements:

- Install traffic-adaptive signal system control
- Install system detection and traffic counting detection and program existing controllers to obtain traffic volume data
- Install CCTV at I-26 EB Ramp

The estimated costs associated with the proposed improvements are summarized in Table 4.5.4.

Table 4.5.4 – Aviation Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Trafffic Adaptive			
Detection	48 Each	$1,000	$48,000
Traffic Adaptive Installation	3 Locations	$25,000 to $30,000	$75,000 to $90,000
CCTV Cameras	1 Location	$21,000	$21,000
		Sub-Total	$144,000 to $159,000
GRAND TOTAL			$144,000 to $159,000

4.5.5 Remount Road – I-526 to Rivers Avenue

Remount Road is an east-west roadway that interchanges with I-26 approximately one half mile east of Aviation Avenue and provides access from the Charleston International Airport /Charleston Air Force Base to I-26 and Rivers Avenue.

Remount Road was recently reconstructed as part of the I-26 widening project. The two Remount Road signals at the I-26 ramps have new Naztec 2070 controllers and are fully actuated. These signals are connected via fiber optic Ethernet interconnect cable via I-26 to the TCC using the existing I-26 trunk.

Based on this corridor's importance with its connection to I-26 and the Rivers Avenue corridor, Jacobs recommends the implementation of a traffic-adaptive control system in the following improvements:

- Install traffic-adaptive signal system control
- Install system detection and traffic counting detection and program existing controllers to obtain traffic volume data
- Install CCTV at I-26 EB Ramp

The estimated costs associated with the proposed improvements are summarized in Table 4.5.5.

Table 4.5.5 – Remount Road (I-526 to Rivers Avenue) Cost Estimate

Item	Quantity	Unit Cost	Total
Trafffic Adaptive			
Detection	36 Each	$1,000	$36,000
Traffic Adaptive Installation	2 Locations	$25,000 to $30,000	$50,000 to $60,000
CCTV Cameras	1 Location	$21,000	$21,000
		Sub-Total	$107,000 to $117,000
GRAND TOTAL			$107,000 to $117,000

4.5.6 Otranto Road

The Otranto Road at Antler Drive intersection is located just over 1000 feet from Rivers Avenue. This intersection currently has no communications equipment and is operated by a 170 controller. Jacobs recommends installing radio communication to connect the controller to Rivers Avenue and replacing the controller with a 2070 and cabinet with a Type 332 cabinet. The estimated costs associated with the proposed improvements are summarized in Table 4.5.6.

Table 4.5.6 – Otranto Road Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	1 Locations	$10,000	$10,000
2070 Controllers	1 Location	$3,000	$3,000
		Sub-Total	$13,000
Communications			
Radio Communications	2 Locations	$1,000	$2,000
		Sub-Total	$2,000
GRAND TOTAL			$15,000

4.6 Zone 6 – SC 642 (Dorchester Road)

The following sections summarize the recommendations for the signalized intersections located within Zone 6 by corridor or group of signals. Figure 4.6 shows all of the recommendations for Zone 6.

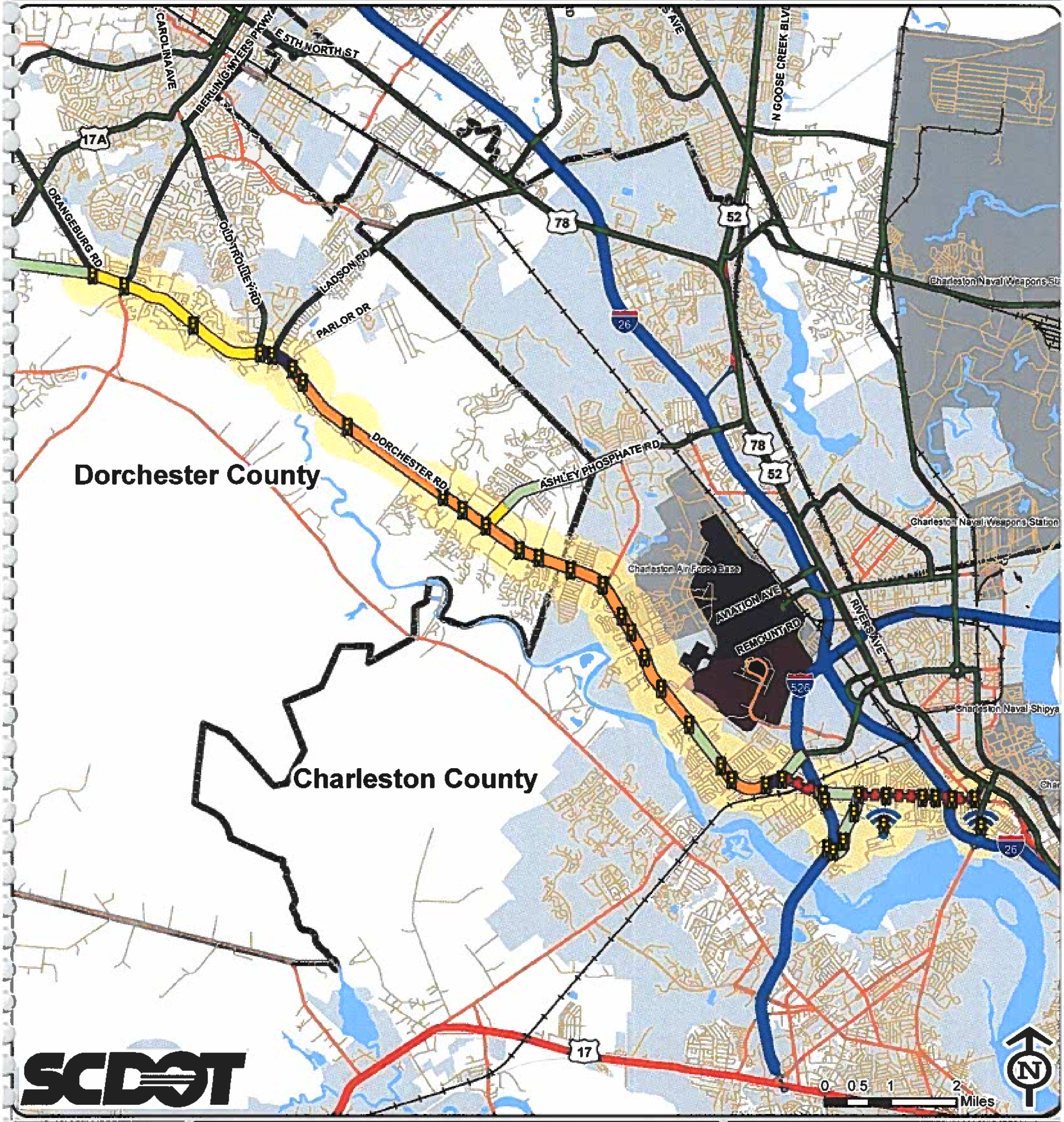
4.6.1 SC 642 (Dorchester Road)

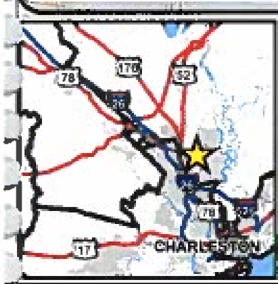
SC 642 (Dorchester Road) is a major east-west arterial with an adjacent mix of vacant, residential and commercial properties. Dorchester Road has 34 signals from Old Orangeburg Road to Meeting Street. The 17 existing signals from Old Trolley Road to Michaux Parkway and Industrial Avenue are operated by Naztec 2070 controllers. The other signals along the corridor are all operated by 170 controllers

Two time-based coordinated systems are located along SC 642 (Dorchester Road) from Old Trolley Road to Parlor Road/Shaftsbury Lane and from Beacon Hill Lane, just south of Parlor Road, to Michaux Parkway. The Old Trolley Road to Parlor Road system has spread-spectrum radio to maintain time synchronization with a dial-up modem located at the master controller. The Beacon Hill Lane system also has spread-spectrum radio to maintain time synchronization, however; the radios along both segments are currently inactive. Jacobs concurs with the current SCDOT plans to interconnect these signals using a fiber optic cable. Additionally, because of the variable peaking characteristics associated with Charleston Air Force Base and Charleston International Airport related traffic, Jacobs recommends the installation of traffic-adaptive signal system control between Club Course Drive and I-526 WB.

Based on this corridors importance as a major commuter route, an alternate to I-26 during incidents and an evacuation route, the following improvements are recommended:

North CHATS Area Traffic Signal Master Plan





LEGEND

- Existing Fiber
- Overhead Fiber
- Underground Fiber
- Direct Drill Fiber
- Radio Communication
- Cellular Modem
- Selected Zone
- Traffic Signal (2070)
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 4.6
Zone 6: Recommended Improvements

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- Install overhead fiber optic interconnect between US 17A and Old Orangeburg Road (long term plan)
- Install direct drill fiber optic interconnect between Old Trolley Road and Parlor Drive
- Install underground fiber optic interconnect between Parlor Dive and Michaux Parkway in existing median
- Install overhead fiber optic interconnect cable from Michaux Parkway to Trailwood Drive
- Install underground fiber optic interconnect between Trailwood Drive and Scarsdale Avenue in grass median on north side of SC 642 (Dorchester Road) and direct bore to West Montague Avenue
- Install radio communications between W. Montague Avenue and I-526
- Install overhead fiber optic interconnect cable from I-526 to Leeds Avenue
- Install radio communications between from Leeds Avenue to Meeting Street
- Install traffic-responsive signal system control from Wescott Boulevard to Orangeburg Road
- Program existing controllers to obtain traffic volume data
- Install traffic-adaptive signal system control from Club Course Drive to Meeting Street
- Install system detection and traffic counting detection and program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (13 locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (24 locations, Refer to Appendix A)
- Install CCTV camera at Michaux Parkway
- Install VMS at Michaux Parkway

The estimated costs associated with the proposed improvements are summarized in Table 4.6.1.

Table 4.6.1 – SC 642 (Dorchester Road) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	24 Locations	$10,000	$240,000
2070 Controllers	13 Locations	$3,000	$39,000
		Sub-Total	$240,000
Communications			
Fiber Optic Interconnect (OH)	19200 LF	$5	$96,000
Fiber Optic Interconnect (UG)	53100 LF	$15	$796,500
Fiber Optic Interconnect (DD)	3300 LF	$25	$82,500
Radio Communications	3 Locations	$1,000	$3,000
		Sub-Total	$978,000
Trafffic Responsive			
Traffic Responsive Installation	8 Locations	$6,000	$48,000
Trafffic Adaptive Detection	330 Each	$1,000	$330,000
Traffic Adaptive Installation	23 Locations	$25,000 to $30,000	$575,000 to $690,000
CCTV Cameras	1 Locations	$21,000	$21,000
VMS	1 Location	$140,000	$140,000
		Sub-Total	$1,114,000 to $1,229,000
GRAND TOTAL			$2,332,000 to $2,447,000

Jacobs recommends the installation of fiber optic interconnect through direct drilling between Scarsdale Avenue and Montague Avenue due to crowded overhead wires and the lack of a median. The details of the current SCDOT proposed connection to the TCC are unclear. To clarify this connection, Jacobs recommends fiber optic connection along Ashley Phosphate Road to SC 642 (Dorchester Road) to bring communications back to the TCC. Jacobs recommends radio for interconnect communication from Leeds Avenue to Meeting Street. Jacobs also recommends extending the existing fiber optic interconnect at Old Trolley Road by direct drilling from Old Trolley Road to Parlor Road.

Based on the volumes and the generally predictable commuter characteristics of traffic in this area, Jacobs recommends the implementation of a traffic-responsive control system at 10 locations along the SC 642 corridor from Orangeburg Road to Appian Way. A traffic- adaptive system would tie into the other 18 signals along SC 642 (Dorchester Road) to the east from Ashley Phosphate Road to Meeting Street. Traffic volumes are needed to develop signal timing plans, and the controllers must be programmed to obtain that traffic volume data and to operate in the traffic-responsive mode.

4.6.2 Leeds Avenue

Leeds Avenue is a north-south arterial that has four signalized intersections. These four signals are operated by 170 controllers and have no existing communications equipment.

The following improvements are recommended:

- Connect Leeds Avenue to the I-526 fiber optic trunk line
- Install overhead fiber optic interconnect from I-526 to SC 642 (Dorchester Road)
- Replace existing 170 controllers with 2070 controllers (four locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.6.2.

Table 4.6.2 – Leeds Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
2070 Controllers	4 Locations	$3,000	$12,000
		Sub-Total	$52,000
Communications			
Fiber Optic Interconnect (OH)	6600 LF	$5	$33,000
		Sub-Total	$33,000
GRAND TOTAL			$85,000

Jacobs recommends connecting the Leeds Avenue at I-526 signal to the existing fiber optic trunk line along I-526 to provide communications back to the TCC. Overhead fiber optic interconnection is recommended along Leeds Avenue from I-526 to SC 642 (Dorchester Road), which will provide a "ring" for communications back to the control center for both Leeds Avenue and SC 642 (Dorchester Road).

4.6.3 Paramount Drive and Azalea Drive

Zone 6 has some outlying signalized intersections located along Paramount Drive and Azalea Avenue. The intersections of Paramount Drive at the I-526 EB and WB ramps are currently operated by one 170 controller (located at the I-526 EB ramp). The two Azalea Drive signals at Industrial Avenue and Cosgrove Avenue have 170 controllers. None of the four outlying signals has any existing communication equipment.

The following improvements are recommended:

- Connect Paramount Drive at I-526 westbound ramps and I-526 eastbound ramps to the existing fiber optic trunk line along I-526
- Install cellular modems at Azalea Drive at Industrial Avenue and Azalea Drive at Cosgrove Avenue
- Replace existing 170 controllers with 2070 controllers (three locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (three locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.6.3.

Table 4.6.3 – Zone 6 Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	3 Locations	$10,000	$30,000
2070 Controllers	3 Locations	$3,000	$9,000
		Sub-Total	$39,000
Communications			
Cellular Modems	2 Locations	$250	$500
		Sub-Total	$500
GRAND TOTAL			$39,500

Jacobs recommends connecting the Paramount Drive at I-26 ramps to the existing fiber optic trunk line along I-526 and installing cellular modems at Azalea Drive at Industrial Avenue and Azalea Drive at Cosgrove Avenue. These recommendations will allow communications back to the TCC.

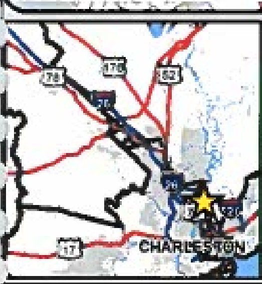
4.7 Zone 7 – North Charleston and Hanahan

The following sections summarize the recommendations for the signalized intersections located within Zone 7 by corridor or group of signals. Figure 4.7 shows all of the recommendations for Zone 7.

4.7.1 US 52 (Rivers Avenue) – I-526 to Reynolds Avenue

US 52 (Rivers Avenue) is a major east-west arterial that serves as both a densely developed major commuter route and as a bypass of I-26 in the event of an incident. US 52 (Rivers Avenue) has 10 signals along the three-mile stretch from Reynolds Avenue to Mall Drive. All signals along this corridor are operated by 170 controllers.

North CHATS Area Traffic Signal Master Plan



LEGEND

- Existing Fiber
- Overhead Fiber
- Underground Fiber
- Direct Drill Fiber
- Radio Communication
- Cellular Modem
- Selected Zone
- Traffic Signal (2070)
- Interstate
- Major Highways
- Other Highways
- Local Streets
- Study Area Corridors

Figure 4.7
Zone 7: Recommended Improvements

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Two existing fiber optic interconnect systems operate along US 52 (Rivers Avenue): from Mall Drive to Meeting Street/Durant Avenue and from Reynolds Avenue to McMillan Avenue. Additionally, at the US 52 traffic signal at Helm Avenue has a dial-up modem; however, it is not currently connected.

The following improvements are recommended:

- Install fiber optic interconnect cable from I-526 eastbound ramps underground in grass median
- Install radio communications between Meeting Street/Durant Avenue and McMillan Avenue
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (ten locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.1.

Table 4.7.1 – US 52 (Rivers Avenue) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	**4 Locations**	**$10,000**	**$40,000**
2070 Controllers	**10 Locations**	**$3,000**	**$30,000**
		Sub-Total	**$70,000**
Communications			
Fiber Optic Interconnect (UG)	**3000 LF**	**$15**	**$45,000**
Radio Communications	**3 Locations**	**$1,000**	**$3,000**
		Sub-Total	**$48,000**
Trafffic Responsive			
Traffic Responsive Installation	**10 Locations**	**$6,000**	**$60,000**
		Sub-Total	**$60,000**
GRAND TOTAL			**$178,000**

Jacobs recommends the following connections:

- an underground fiber optic interconnect cable in the grass median from I-526 eastbound to Mall Drive (connecting with the existing system)
- establishing a connection to the fiber optic trunk line located along I-526
- radio communications from Durant Avenue and McMillan Avenue (due to the existing railroad tracks and the distance between signals)

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.7.2 Spruill Avenue – East Montague Avenue to Meeting Street

Spruill Avenue is a north-south arterial with ten signalized intersections. These signals are operated by 170 controllers and have no existing communication equipment.

Jacobs recommends the following improvements for implementation:

- Install overhead fiber optic interconnect from East Montague Avenue to Buist Avenue
- Install radio communications from Buist Avenue to Aragon Avenue
- Install overhead fiber optic interconnect from Aragon Avenue to Meeting Street
- Install fiber optic interconnect from Spruill Avenue along McMillan Avenue to US 52 (Rivers Avenue)
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (eight locations, Refer to Appendix A)
- Replace existing 170 controllers with 2070 controllers (ten locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.2.

Table 4.7.2 – Spruill Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	8 Locations	$10,000	$80,000
2070 Controllers	10 Locations	$3,000	$30,000
		Sub-Total	$110,000
Communications			
Fiber Optic Interconnect (OH)	19900 LF	$5	$99,500
Fiber Optic Interconnect (UG)	2000 LF	$15	$30,000
Radio Communications	2 Locations	$1,000	$2,000
		Sub-Total	$131,500
Trafffic Responsive			
Traffic Responsive Installation	10 Locations	$6,000	$60,000
		Sub-Total	$60,000
GRAND TOTAL			$301,500

Jacobs recommends radio communications from Buist Avenue to Aragon Avenue due to the existing railroad tracks. Fiber optic interconnect is then recommended from Aragon Avenue to Meeting using the existing utility poles. Jacobs also recommends a fiber optic interconnect Spruill Avenue at McMillan Avenue to US 52 (Rivers Avenue) at McMillan Avenue in order to connect to the US 52 (Rivers Avenue) system. This connection will allow communications back to the control center

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.7.3 East/West Montague Avenue – Dorchester Road to Spruill Avenue

Montague Avenue is an east-west arterial that has seven signalized intersections. The signals are operated by 170 controllers, with the exception of Piedmont Street, which has a NEMA controller. These signals do not have existing communications equipment.

Jacobs recommends the following improvements for implementation:

- Install fiber optic interconnect from SC 642 (Dorchester Road) to I-526 and connect to I-526 trunk line
- Install fiber optic interconnect from I-26 to Mall Drive and connect to the I-26 trunk line (will continue along Mall Drive)
- Install fiber optic interconnect from Rivers Avenue at Montague Avenue to Montague Avenue at Piedmont Avenue/Morningside Drive
- Install radio communications between Piedmont Avenue/Morningside Drive to Mixon Avenue
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336/NEMA cabinets (six locations, Refer to Appendix A)
- Replace existing 170/NEMA controllers with 2070 controllers (seven locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.3.

Table 4.7.3 – Montague Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	**6 Locations**	**$10,000**	**$60,000**
2070 Controllers	**7 Locations**	**$3,000**	**$21,000**
		Sub-Total	**$81,000**
Communications			
Fiber Optic Interconnect (OH)	**5300 LF**	**$5**	**$26,500**
Radio Communications	**2 Locations**	**$1,000**	**$2,000**
		Sub-Total	**$28,500**
Trafffic Responsive			
Traffic Responsive Installation	**7 Locations**	**$6,000**	**$42,000**
		Sub-Total	**$42,000**
GRAND TOTAL			**$151,500**

Jacobs does not recommend a continuous line of communications along Montague Avenue due to intersection spacing, curvature of road, bridges, and railroad tracks. Instead, Jacobs recommends that each signal communicate to the TCC by connecting to other systems or connecting to a fiber optic trunk line along I-26 or I-526.

The overhead fiber optic interconnect installation from SC 642 (Dorchester Road) to I-526 should connect to the I-526 fiber optic trunk line. This connection will allow redundant communications back to the TCC for both Dorchester Avenue and Montague Avenue. Jacobs recommends radio communications between Piedmont Avenue/Morningside Drive and Mixon Avenue to provide communications back to the TCC via the proposed Rivers Avenue fiber optic interconnect system.

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.7.4 International Boulevard – I-526 to West Montague Avenue

Excluding its signalized intersection with SR 642 (Dorchester Road) that was included in an earlier corridor, International Boulevard has four signalized intersections. Two of these four signals (Michaux Parkway and Aviation Boulevard) are maintained by the Charleston Airport and are therefore not included in this study. An existing fiber interconnect system runs along International Boulevard between Aviation Avenue and Tanger Outlet Boulevard. The two International Boulevard signals included in this study have 170 controllers. The following improvements are recommended:

- Install underground fiber optic interconnect from International Boulevard at Tanger Outlet Boulevard to Montague Avenue at International Boulevard (extension of existing International Boulevard system)
- Replace existing 170 controllers with 2070 controllers (two locations, Refer to Appendix A)
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (two locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.4.

Table 4.7.4 – International Boulevard Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	2 Locations	$10,000	$20,000
2070 Controllers	2 Locations	$3,000	$6,000
		Sub-Total	$26,000
Communications			
Fiber Optic Interconnect (OH)	1000 LF	$5	$5,000
		Sub-Total	$5,000
Trafffic Responsive			
Traffic Responsive Installation	2 Locations	$6,000	$12,000
		Sub-Total	$12,000
GRAND TOTAL			$43,000

The International Boulevard fiber optic cable should connect to the fiber optic trunk line along I-526 to allow communications back to the TCC.

4.7.5 North Rhett Avenue – Braddock Avenue to Remount Road

North Rhett Avenue is a north-south arterial that has six signalized intersections between Braddock Avenue and Tanner Boulevard. . Three signals (Remount Road, I-526 eastbound ramps, and I-526 westbound ramps) are operated by Naztec 2070 controllers, two signals (Tanner Boulevard and Yeamans Hall Road) are operated by 170 controllers, and one signal (Braddock Avenue) is operated by a NEMA controller. No North Rhett Avenue corridor signals have existing communications equipment

Jacobs recommends the following improvements for implementation:

- Install radio communications between Braddock Avenue and I-526 eastbound
- Install underground fiber optic interconnect from I-526 eastbound to Remount Road
- Install cellular modems at Yeamans Hall Road and Tanner Ford Boulevard
- Install traffic-responsive signal system control
- Program existing controllers to obtain traffic volume data
- Install Type 332 cabinets at current Type 336/NEMA cabinet locations (five locations, Refer to Appendix A)
- Replace existing 170/NEMA controllers with 2070 controllers (three locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.5.

Table 4.7.5 – North Rhett Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	5 Locations	$10,000	$50,000
2070 Controllers	3 Locations	$3,000	$9,000
		Sub-Total	$59,000
Communications			
Fiber Optic Interconnect (UG)	3600 LF	$15	$54,000
Radio Communications	2 Locations	$1,000	$2,000
Cellular Modem	2 Locations	$250	$500
		Sub-Total	$56,500
Trafffic Responsive			
Traffic Responsive Installation	6 Locations	$6,000	$36,000
		Sub-Total	$36,000
GRAND TOTAL			$151,500

Jacobs recommends the installation radio communications between Braddock Avenue and I-526 eastbound because of the railroad tracks between the intersections. The fiber optic interconnect recommended from I-526 eastbound to Remount Road should be installed underground along the east side of the road. The North Rhett Avenue fiber optic line should connect to the I-526 fiber optic trunk line. Due to their isolated location, Jacobs recommends the installation of cellular modems for the intersections of North Rhett Avenue at Tanner Boulevard and North Rhett Avenue at Yeamans Hall Road for communication with the TCC.

Jacobs recommends the implementation of a traffic-responsive control system along this corridor based on the volumes and the characteristics of traffic (generally predictable commuter traffic) in this area. Traffic volumes are needed to develop signal timing plans and the controllers must be programmed to operate in the traffic-responsive mode.

4.7.6 Remount Road – Yeamans Hall Road to North Rhett Avenue

Remount Road is a collector road and has three signalized intersection from Attaway Street to North Murray Avenue. These signals have 170 controllers and do not have existing communications equipment.

The following improvements are recommended:

- Install radio communications along Remount Road from Rivers Avenue to North Rhett Avenue (includes Rivers Avenue and Rhett Avenue intersections)
- Replace existing 170 controllers with 2070 controllers (three locations)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (three locations)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.6.

Table 4.7.6 – Remount Road (Yeamans Hall Road to North Rhett Avenue) Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	3 Locations	$10,000	$30,000
2070 Controllers	3 Locations	$3,000	$9,000
		Sub-Total	$39,000
Communications			
Radio Communications	5 Locations	$1,000	$5,000
		Sub-Total	$5,000
GRAND TOTAL			$44,000

The recommended radio improvements will allow communication to the TCC through the US 52 (Rivers Avenue) system or the North Rhett Avenue system and provide a redundant connection.

4.7.7 Mall Drive - East Montague Avenue to Lacross Road

Mall Drive connects Montague Avenue to Rivers Avenue and provides access to a variety of retail and government buildings. The three intersections along Mall Drive have NEMA controllers and no existing communications equipment.

The following improvements are recommended:

- Install overhead fiber optic interconnect along Mall Drive from Lacross Road to East Montague Avenue
- Replace existing NEMA controllers with 2070 controllers (three locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (three locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.7.

Table 4.7.7 – Mall Drive Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	3 Locations	$10,000	$30,000
2070 Controllers	3 Locations	$3,000	$9,000
		Sub-Total	$39,000
Communications			
Fiber Optic Interconnect (OH)	2400 LF	$5	$12,000
		Sub-Total	$12,000
GRAND TOTAL			$51,000

The recommended fiber optic interconnect along Mall Drive from Lacross Road to East Montague Avenue will allow communications back to the TCC via the recommended East Montague connections to the I-26 fiber optic trunk line.

4.7.8 Murray Avenue, Yeamans Hall Road, Carner Avenue

Zone 7 has five outlying signalized intersections located on Murray Avenue, Yeamans Hall Road and Carner Avenue. Four signals have 170 controllers and one has a 2070 controller. None of these outlying signals currently has communications equipment.

The following improvements are recommended:

- Install radio communications between Remount Road at Yeamans Hall Road and Yeamans Hall Road at Loftis Road
- Install cellular modems at Murray Avenue at Yeamans Hall Road, Murray Avenue at Fort Drive/Recess Road, Murray Avenue at Railroad Avenue/Highland Park Road, and Carner Avenue at Clements Avenue
- Replace existing 170 controllers with 2070 controllers (four locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (four locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.7.8.

Table 4.7.8 – Murray Avenue, Yeamans Hall Road, Carner Avenue Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	4 Locations	$10,000	$40,000
2070 Controllers	4 Locations	$3,000	$12,000
		Sub-Total	$52,000
Communications			
Radio Communications	2 Locations	$1,000	$2,000
Cellular Modem	4 Locations	$250	$1,000
		Sub-Total	$3,000
GRAND TOTAL			$55,000

4.8 Zone 8 – Isolated Locations South of US 17, St. George

The following sections summarize the recommendations for the signalized intersections located within Zone 8 by corridor or group of signals. Figure 4.8 shows all of the recommendations for Zone 8.

4.8.1 Southern– US 17 (Savannah Highway), Main Road, SC 165, Maybank Highway, Bohicket Road/Betsy Kerrison Parkway, SC 171, Palm Boulevard

Zone 8 is comprised mostly of isolated intersections. None of the 12 signals located within Zone 8 have communications equipment. The US 17 at Main Road and US 17 at Carolina Bay/Croghans Landing Drive signals have Naztec 2070 controllers. The other ten signals have 170 controllers.

North CHATS Area Traffic Signal Master Plan

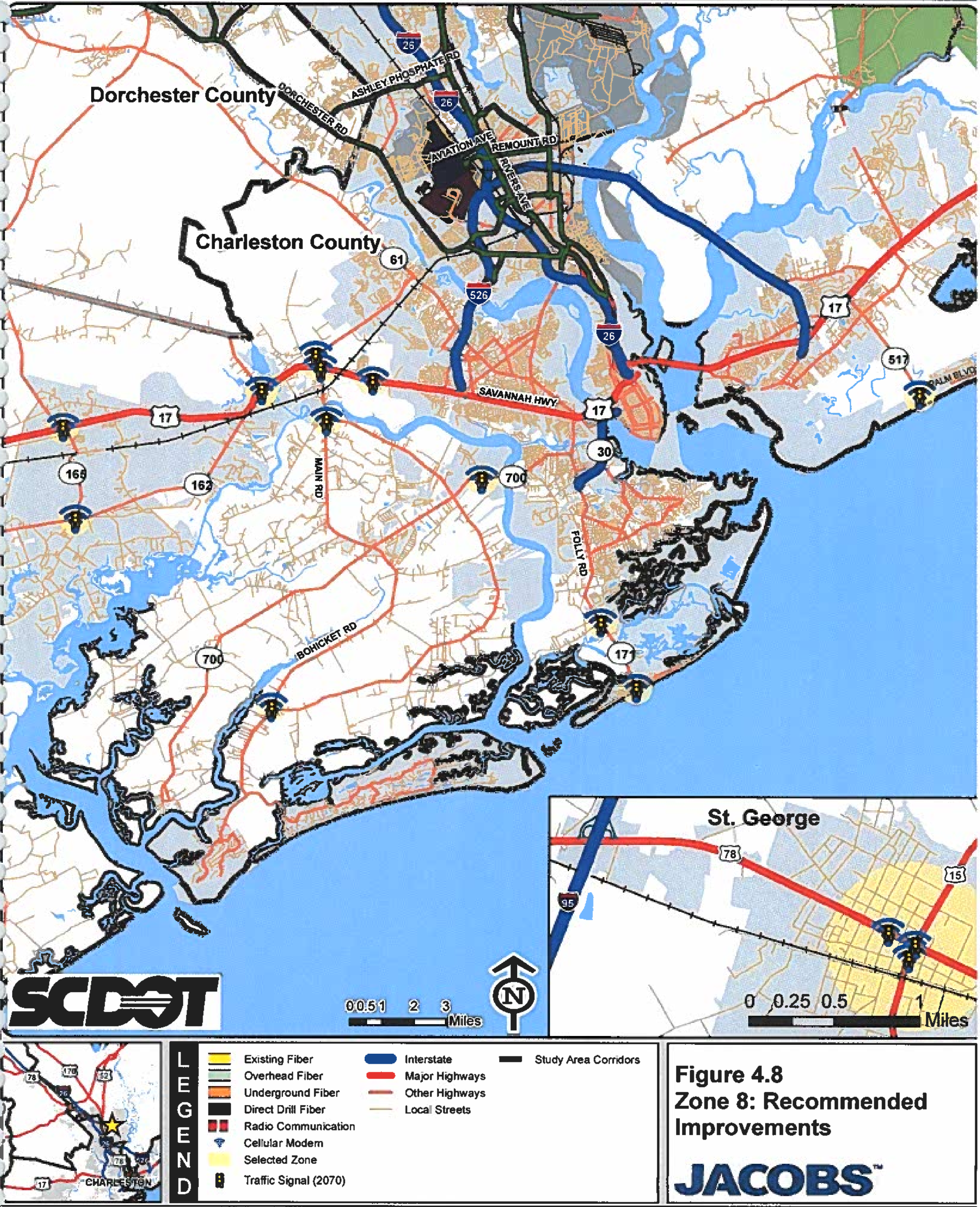

Figure 4.8
Zone 8: Recommended Improvements

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The following improvements are recommended:

- Install cellular modems at all twelve signalized locations:
  - SC 517 (IOP Connector) @ SC 704 (Palm Boulevard)
  - River Road (S-10-54) @ Bohicket Road/Betsy Kerrison Parkway (S-10-20)
  - River Road (S-10-54) @ Main Road (S-10-20)
  - Maybank Highway (SC 700) @ Old Maybank Highway
  - Bees Ferry Road (S-10-57) @ Main Road (S-10-20)
  - US 17 @ Davison Road, US 17 @ Main Road (S-10-20)
  - US 17 @ Carolina Bay/Croghans Landing Dr
  - US 17 @ SC 165, SC 162 @ SC 165
  - SC 171 @ Sol Legare Road
  - SC 171 @ Ashley Avenue
- Program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (ten locations, Refer to Appendix A)
- Install Type 332 cabinets at locations that currently have Type 336 cabinets (nine locations, Refer to Appendix A)
  - Note: Maybank Highway (SC 700) @ Old Maybank Highway cannot be replaced because it is pole mounted.

The estimated costs associated with the proposed improvements are summarized in Table 4.8.1

Table 4.8.1 –Southern Signals Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	9 Locations	$10,000	$90,000
2070 Controllers	10 Locations	$3,000	$30,000
		Sub-Total	$120,000
Communications			
Cellular Modem	12 Locations	$250	$3,000
		Sub-Total	$3,000
GRAND TOTAL			$123,000

4.8.2 St. George – US 15 (North Parler Avenue), US 78 (Memorial Boulevard)

Three additional isolated signals are located in St. George. These signals currently have no communication equipment and have 170 controllers.

The following improvements are recommended:

- Install cellular modems at US 15 at George Street, US 15 at US 78, and US 78 at Ridge Street
- Program existing controllers to obtain traffic volume data
- Replace existing 170 controllers with 2070 controllers (three locations, Refer to Appendix A)

- Install Type 332 cabinets at locations that currently have Type 336 cabinets (three locations, Refer to Appendix A)

The estimated costs associated with the proposed improvements are summarized in Table 4.8.2

Table 4.8.2 – St. George Cost Estimate

Item	Quantity	Unit Cost	Total
Signal Equipment			
Type 332 Cabinets	3 Locations	$10,000	$30,000
2070 Controllers	3 Locations	$3,000	$9,000
		Sub-Total	$39,000
Communications			
Cellular Modem	3 Locations	$250	$750
		Sub-Total	$750
GRAND TOTAL			$39,750

4.9 Traffic Control Center

As a core component of an ITS system, a TCC serves as a unified communications center. Real-time information is gathered from many sources such as traffic cameras, signals, vehicle detectors, emergency calls from the public, reports from emergency and law enforcement personnel, weather stations, and other sources. This information uses various media to communicate, including fiber optic communications and telephone calls. By gathering vital incident information and North CHATS area-wide traffic conditions in a central location staffed by trained and capable technicians and engineers, a TCC enables the fast, intelligent, and coordinated response to incidents. A mutual link should be developed to source information between the TCC and the TMC as more off-interstate ITS devices are brought on line. The TMC's freeway incident management will need to coordinate with the TCC to provide diversion routing off-interstate to local arterials combining freeway VMS messaging and arterial traffic pattern changes.

The information transmitted to the TCC provides engineers with the ability to decide on appropriate response measures to traffic situations. To improve operations on the North CHATS roadway network, staff can adjust signal timings, detour traffic, and perform many other vital tasks. TCC and TMC staff can provide information to the public via field devices such VMS as well as the SCDOT website and local television stations.

Another key function of the TCC is to provide traveler information in a variety of forms. Data transmitted to the TCC from traffic cameras and vehicle detectors, emergency personnel and other sources will provide a comprehensive, real-time understanding of existing traffic conditions and potential situations. From this data, District 6 personnel can develop and control the messages displayed on the proposed off-interstate VMS. Off-interstate ITS device information would enhance real-time traffic information regarding I-26 gathered at the TMC. This information can also display on the District's interactive website and local television stations.

The TCC will serve as the central location for all monitoring, control, communication and data sharing on local arterials for a majority of the North CHATS ITS network. Video data will be shared for the purpose of incident response, traveler information and network surveillance. Various emergency operations offices can use video images to aid in determining incident severity and deploying appropriate response. SCDOT and various local jurisdictions will also benefit from video data showing traffic conditions within the North CHATS area that might affect operations within their area.

Signal monitoring and control will occur within the TCC as well. On a daily basis, real-time traffic information from CCTV cameras and vehicle detectors will allow staff to monitor conditions, adjust timings and mitigate system errors. During emergencies, the TMC can coordinate with staff to implement evacuation or congestion relief plans.

Although the District 6 personnel currently have the ability to connect to ITS devices, the limited space in the current Traffic Engineering Tech Shop requires expansion. In the short term, expanding this facility would provide the space to properly monitor traffic control devices with the introduction of multiple monitors and servers. SCDOT District 6 personnel in the North CHATS area would have the ability to connect to and monitor all field devices from a single location.

Building upon current traffic monitoring efforts, additional proposed real-time video would transmit to the TCC via high bandwidth connections. To provide for dynamic monitoring of traffic conditions on signal controlled routes, TCC staff will have control to pan/zoom/tilt these devices. Using output from the CCTV cameras as well as the signals themselves, District staff will be able to better manage traffic signal operations. Engineers will have the ability to connect remotely to all District-owned traffic signals in the study, modify signal timing plans and implement new timing plans to mitigate traffic issues.

Long-term recommendations would be to incorporate the TCC with the TMC. Traffic engineers need the full capabilities of freeway and signalized arterial real-time monitoring to be responsive to current incidents. Re-routing of freeway to signalized arterials (as well as the reverse) should be a joint effort between the TCC and the TMC. ITS devices on and off freeway need to work in tandem to display complimentary VMS messages, monitor diversion routes, and place arterial systems into event plans.

5.0 Prioritization of Recommended Improvements

The previously mentioned improvements recommended to enhance traffic flow have been prioritized into four tiers. Tier One recommended improvements should be expedited, constructed and made operational within one year. The improvement projects focused on upgrading signal cabinet equipment and communications on major high volume corridors. Tier Two recommended improvements focused on traffic adaptive or traffic responsive on several trial corridors included in Tier One with additional signal cabinet and communications equipment upgrades. Tier Two recommended improvements should be constructed and made operational within three years. Tier Three recommended improvements focused on communications equipment upgrades on lower volume corridors and the implementation of traffic adaptive or traffic responsive along several additional corridors. Tier Three recommended improvements should be constructed and made operational within three to five years. All other improvements are considered part of Tier Four and should be implemented as funding is available.

5.1 Tier One Recommended Improvements

The previously mentioned improvements recommended to enhance traffic flow should be expedited, constructed and made operational within one year. Traffic volumes along these corridors are very high and incidents along them or along I-26 result in poor operations and long delays. Some of the infrastructure to provide enhanced traffic operations is currently in place, including fiber optic communication cable and Naztec 2070 controllers. Many of the corridors are currently connected to or are in the process of being connected to the SCDOT TCC. Naztec 2070 signal controllers and 332 cabinets are needed where currently not upgraded to integrate either traffic adaptive or traffic responsive signal control. Once the upgraded signal controller equipment is in place communications between signal controllers within the signal systems and between the TCC needs to be established. The signal controller and communications upgrades will form the network to develop improved coordinated signal timing, traffic responsive and traffic adaptive systems throughout the area. Table 5.1 lists the Tier One improvements that are recommended for implementation.

Table 5.1 - Tier One Recommended Improvements and Estimated Costs

Corridor	Improvement	Cost
Zone 1		
North Goose Creek Boulevard (US 52)	Signal Equipment	$93,000
	Communications	$15,000
	Sub-total	$108,000
US 17A (Live Oak Drive)	Signal Equipment	$13,000
	Sub-total	$13,000
Zone 2		
US 17A (North Main Street)	Signal Equipment	$118,000
	Communications	$148,500
	Sub-total	$266,500
Berlin G. Myers Parkway (SC 165)	Signal Equipment	$20,000
	Communications	$217,000
	Sub-total	$237,000
Zone 3		
College Park Road	Signal Equipment	$56,000
	Communications	$66,000
	Sub-total	$122,000

Table 5.1 - Tier One Recommended Improvements and Estimated Costs (Cont.)

Corridor	Improvement	Cost
Zone 5		
University Boulevard (US 78)	Signal Equipment Communications Sub-total	$70,000 $37,500 $107,500
Ashley Phosphate Road	Signal Equipment Communications Sub-total	$20,000 $51,250 $71,250
Rivers Avenue (Ontranto Road to I-526)	Signal Equipment Communications Sub-total	$70,000 $80,000 $150,000
Zone 6		
Dorchester Road	Signal Equipment Communications Sub-total	$279,000 $978,000 $1,257,000
Zone 7		
Rivers Avenue (Mall Drive to Reynolds Avenue)	Signal Equipment Communications Sub-total	$70,000 $48,000 $118,000
Montague Avenue	Signal Equipment Communications Sub-total	$81,000 $28,500 $109,500
International Boulevard	Signal Equipment Sub-total	$26,000 $26,000
Remount Road (Yeamans Hall Road to North Rhett Avenue)	Signal Equipment Sub-total	$39,000 $39,000
Mall Drive	Signal Equipment Sub-total	$39,000 $39,000

5.2 Tier Two Recommended Improvements

The following Tier Two recommended improvements to enhance traffic flow should be constructed and operational within three years. Tier Two recommended improvements focused on continued signal cabinet equipment and communications upgrades in addition to the implementation of several trial traffic adaptive corridors. University Boulevard is a recommended trial candidate due to emergency vehicle and pedestrian movements on the corridor. Dorchester Road is also recommended to be a candidate for trial traffic adaptive to improve mainline vehicle progression. Table 5.2 lists the Tier Two improvements that are recommended for implementation.

Table 5.2 Tier Two Recommended Improvements and Estimated Costs

Corridor	Improvement	Cost
Zone 1		
North Goose Creek Boulevard (US 52)	Traffic Responsive Sub-total	$42,000 $42,000
US 17A (Live Oak Drive)	Communications Sub-total	$316,800 $316,800
SC 6 (Main Street)	Signal Equipment Communications Sub-total	$43,000 $125,250 $168,250
Zone 2		
US 17A (North Main Street)	Traffic Responsive Sub-total	$66,000 $66,000
Zone 3		
Old Trolley Road	Signal Equipment Sub-total	$52,000 $52,000
Ladson Road	Signal Equipment Sub-total	$75,000 $75,000
Zone 4		
North Goose Creek Boulevard (US 52)	Signal Equipment Sub-total	$60,000 $60,000
St. James Avenue (US 176)	Signal Equipment Communications Sub-total	$83,000 $179,750 $262,750
Zone 5		
University Boulevard (US 78)	Traffic Adaptive CCTV Cameras Sub-total	$321,000 to $356,000 $21,000 $342,000 to $377,000
Zone 6		
Dorchester Road	Traffic Responsive Traffic Adaptive CCTV Cameras VMS Sub-total	$48,000 $905,000 to $1,020,000 $21,000 $140,000 $1,114,000 to $1,229,000

Table 5.2 Tier Two Recommended Improvements and Estimated Costs (Cont.)

Corridor	Improvement	Cost
	Zone 7	
Spruill Avenue	Signal Equipment	$110,000
	Communications	$131,500
	Sub-total	$241,500
International Boulevard	Communications	$5,000
	Sub-total	$5,000
North Rhett Avenue	Signal Equipment	$59,000
	Communications	$56,500
	Sub-total	$115,500
Remount Road (Yeamans Hall Road to North Rhett Avenue)	Communications	$5,000
	Sub-total	$5,000
Mall Drive	Communications	$12,000
	Sub-total	$12,000

5.3 Tier Three Recommended Improvements

Tier Three recommended improvements to enhance traffic flow should be constructed and operational within three to five years. These projects are designated as Tier Three priority in that they typically carry lower traffic volumes. In addition, these corridors are less likely to be used as an alternate for I-26 during an incident on I-26 due to capacity restrictions, proximity to I-26 or direction of travel. Table 5.3 lists the Tier 3 improvements that should be implemented within the Tier Two priority corridors.

Table 5.3 - Tier Three Recommended Improvements and Estimated Costs

Corridor	Improvement	Cost
	Zone 2	
Berlin G. Myers Parkway (SC 165)	Traffic Responsive	$24,000
	CCTV Cameras	$21,000
	Sub-total	$45,000
	Zone 3	
Old Trolley Road	Communications	$65,000
	Traffic Responsive	$24,000
	Sub-total	$89,000
Ladson Road	Communications	$135,000
	Traffic Responsive	$36,000
	Sub-total	$171,000
College Park	Traffic Responsive	$30,000
	CCTV Cameras	$21,000
	Sub-total	$51,000

Table 5.3 - Tier Three Recommended Improvements and Estimated Costs (Cont.)

Corridor	Improvement	Cost
Zone 4		
North Goose Creek Boulevard (US 52)	Communications Traffic Responsive Sub-total	$81,000 $21,000 $102,000
St. James Avenue (US 176)	Traffic Responsive Sub-total	$60,000 $60,000
Zone 5		
Ashley Phosphate Road	Traffic Adaptive CCTV Cameras Sub-total	$488,000 to $538,000 $21,000 $509,000 to $559,000
Zone 7		
Rivers Avenue (Mall Drive to Reynolds Avenue)	Traffic Responsive Sub-total	$60,000 $60,000
Montague Avenue	Traffic Responsive Sub-total	$42,000 $42,000
International Boulevard	Traffic Responsive Sub-total	$12,000 $12,000

5.4 Tier Four Recommended Improvements

Recommended improvement projects that are not included in Tiers One through Three were considered included in Tier Four. Tier Four recommended improvements and cost estimates have previously been included in section 4 of this report and therefore are not listed below. Tier Four recommended improvements continue to enhance traffic flow by upgrading signal equipment, communication equipment and developing signal timing strategies that improve vehicle progression. The recommended improvements included in Tier Four occur on corridors carrying lower traffic volumes when compared to other regionally significantly corridors or are isolated intersections. As a result, the recommended improvement in Tier Four have a lesser impact on regional traffic flow and should be implemented after Tier One through Three have been implemented or when additional funding is available.

Appendix A
Existing Signal Equipment

Signal Equipement Inventory
Zone 1

Custom ID	Cabinet	Maintained By	Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
8-025-0	332	D6	Old US 52 (S-8-791) @ Cypress Gardens Rd	170	None		Jan-09	46	WAPITI	FA	Dynamic Traffic Systems
8-007-6	336	D6	US 17A @ Cypress Gardens Rd	170	None		Jan-08	58	WAPITI	FA	Dynamic Traffic Systems
8-012-5	336/332	D6	US 52 (N Goose Creek Blvd) @ Cypess Gardens Rd	2070	None		Sep-08	50	Apogee	FA	Naztec
8-013-5	336	D6	US 52 (N Goose Creek Blvd) @ Gaillard Rd (S-8-50)	2070	None	hurricane evac route NB 52 left on Gaillard	Mar-10	32	Apogee	FA	Naztec
8-017-0	336	D6	US 52 (N Goose Creek Blvd) @ Rembert Dennis Blvd	2070	Dial-up, not working		Mar-10	32	Apogee	FA	Naztec
8-012-6	336	D6	US 52 (N Goose Creek Blvd) @ Heatley St	2070	Dial-up, not working, Master		Sep-08	50	Apogee	FA	Naztec
8-011-0	336	D6	US 52 (N Goose Creek Blvd) @ Main St (SC-6)	2070	Dial-up, not working		Sep-06	74	Apogee	FA	Naztec
8-004-0	336	D6	US 52 (N Goose Creek Blvd) @ Live Oak Dr	2070	None		Feb-10	33	Apogee	FA	Naztec
8-017-3	336	D6	US 52 (N Goose Creek Blvd) @ Rembert Dennis/Reid Hill Rd	2070	None		Mar-10	32	Apogee	FA	Naztec
8-012-3	336	D6	US 52 (N Goose Creek Blvd) @ SC 402	2070	None	hurricane evac route WB 402 right to NB 52	Mar-10	32	Apogee	FA	Naztec
8-004-5	336	D6	US 52 (N Goose Creek Blvd) @ US 17A	2070	None	hurricane evac route US 52	Feb-10	33	Apogee	FA	Naztec
8-051-0	336	D6	Rembert Dennis Blvd @ Stoney Landing Rd/Santee Cooper	170	None		Jan-97	190	WAPITI	FA	Signal Control
8-050-0	332	D6	Rembert Dennis Blvd @ Main St Ext/Sterling Oaks Dr	170	None		Jan-06	82	WAPITI	FA	Signal Control
8-007-7	336	D6	US 17A @ Carolina Ave/Belt Dr	2070	None		Mar-10	32	Apogee	FA	Naztec
8-022-0	336	D6	SC-6 @ Old Whitesville Rd	170	None	hurricane evac route WB SC-6	Aug-00	147	WAPITI	FA	Safetran
8-020-0	336	D6	SC-6 @ Broughton Rd	2070	None		Mar-10	32	Apogee	FA	Naztec
8-006-0	336	D6	SC-6 @ US 17A	2070	None		Mar-10	32	Apogee	FA	Naztec
8-021-0	336	D6	SC-6 @ Carolina Ave	2070	None		Mar-10	32	Apogee	SA	Naztec
8-012-0	336	D6	US 52 @ SC-45	170	None		Jan-96	202	WAPITI	FA	Signal Control

Signal Equipement Inventory
Zone 2

Custom ID	Cabinet	Maintained By	Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
8-003-0	332	D6	Jedburg Rd (S-8-16) @ I-26 EB	2070	fiber, not connected		Apr-10	Jan-00	Apogee	FA	Naztec
8-003-5	332	D6	Jedburg Rd (S-8-16) @ I-26 WB	2070	fiber, not connected		Apr-10	Jan-00	Apogee	FA	Naztec
8-018-1	336	D6	Jedburg Rd (S-8-16) @ US 176	170	None		Oct-11	Jan-00	WAPITI	FA	Safetran
18-016-5	336	D6	US 78 @ Jedburg Rd/Mallard (S-18-58)	170	None		Jan-05	94	WAPITI	FA	Signal Control
18-018-3	336	D6	US 78 @ Auburn Hills Rd	170	None		Jul-03	112	WAPITI	FA	Safetran
18-018-0		D6	US 78 @ Maple St	2070	None						
18-018-5	336	D6	US 78 @ Bryan Street	170	None		Jan-04	106	WAPITI	FA	Dynamic Traffic Systems
10-059-5	336	D6	US 78 @ Von Oshen Rd/Royle Rd	170	None		Jan-98	178	WAPITI	FA	Dynamic Traffic Systems
18-030-0	336	D6	Central Ave (S-18-13) @ Orangeburg Rd (S-18-22)	170	None	Evac route sign on SE leg of intersection, route NW thru along Orangeburg Rd	Jan-98	178	WAPITI	FA	Safetran
18-030-1	336	D6	Central Ave (S-18-13) @ Parsons Rd	170	None		Jan-09	46	WAPITI	FA	Signal Control
18-030-3	336	D6	Central Ave (S-18-13) @ West Carolina Ave	170	None		Jan-01	142	WAPITI	FA	Signal Control
18-031-0	336	D6	Central Ave (S-18-13) @ Laurel St	170	None		Jan-98	178	WAPITI	FA	Signal Control
18-030-5	336	D6	Cedar St (S-18-13) @ Richardson	2070	Radio from US 17A (Not Operational)		Sep-08	50	Apogee	FA	Naztec
18-033-0	336	D6	Cedar St (S-18-13) @ West 1st North Street	170	Copper form 2nd		Mar-96	200	WAPITI	FA	Signal Control
18-032-0	336	D6	Cedar St (S-18-13) @ West 2nd North Street	170	copper from US 78		Jan-94	226	WAPITI	FA	Signal Control
18-015-0	336	D6	Cedar St (S-18-13) @ US 78	2070	copper from US 17A disconnected		Jun-09	41	Apogee	SA	Naztec
18-006-1	332	D6	US 17A @ SC-61W	2070	None	Evac Route sign east of intersection for westbound approach, route WBR on 61 NW	Feb-10	33	Apogee	FA	Naztec
18-006-0	332	D6	US 17A @ SC-61E	2070	None	Evac Route sign facing NB 61 approach, route NBL onto US 17A	Sep-08	50	Apogee	FA	Naztec
18-007-0	336	D6	US 17A @ Orangeburg Rd (S-18-22)	170	None		Jan-06	82	WAPITI	FA	Safetran
18-012-0	336	D6	US 17A @ Luden Dr	170	None		Jan-01	142	WAPITI	FA	Safetran
18-008-0	336	D6	US 17A @ Carolina Ave/Tupper Ln	2070	TBC		Sep-06	74	Apogee	FA	Naztec
18-010-9	336	D6	US 17A @ East 6th South Street	170	None		Jan-98	178	WAPITI	FA	Signal Control
18-008-1	336	D6	US 17A @ Richardson Ave	2070	radio 900MHZ		Sep-08	50	Apogee	SA	Naztec
18-010-4	336	D6	US 17A @ East 1st North Street	2070	copper disconnected/radio 900MHZ		Sep-08	50	Apogee	SA	Naztec
18-009-0	336	D6	US 17A @ East 2nd North Street	2070	copper disconnected		Sep-08	50	Apogee	SA	Naztec
18-010-6	336	D6	US 17A @ East 3rd North Street	2070	copper disconnected		Sep-08	50	Apogee	SA	Naztec
18-004-0	332	D6	US 17A @ US 78	2070 Master	copper disconnected		Jun-09	41	Apogee	FA	Naztec
18-011-0	336	D6	US 17A @ 9th North St (S-18-251)	2070	copper disconnected		Sep-08	50	Apogee	SA	Naztec
8-007-5	336	D6	US 17A @ Berlin G. Myers Parkway (SC-165)/Varnfield Dr	2070	fiber		Feb-08	57	Apogee	FA	Naztec
8-009-4	332	D6	US 17A @ Perkins/Azalea Sq	2070	fiber		Oct-07	61	Apogee	FA	Naztec
8-009-2	332	D6	US 17A @ Holiday Dr	2070	fiber		Jun-07	65	Apogee	FA	Naztec
8-002-5	332	D6	US 17A @ I-26 EB	2070	fiber		Jun-07	65	Apogee	FA	Naztec
8-002-0	332	D6	US 17 A @ I-26 WB	2070	fiber		Oct-07	61	Apogee	FA	Naztec
8-008-5	332	D6	US 17A @ Farmington Rd/Rose Drive	2070 Master	fiber/dial-up		Jun-07	65	Apogee	FA	Naztec
8-009-5	332	D6	US 17A @ Sangaree Pkwy	2070	fiber		Jun-07	65	Apogee	SA ???	Naztec
8-009-0	332	D6	US 17A @ Beauregard Rd	2070	fiber		Sep-08	50	Apogee	FA	Naztec
8-007-9	332	D6	US 17A @ Royle Rd	170	TBC		Feb-01	141	WAPITI	FA	Safe-Tran
8-008-0	332	D6	US 17A @ College Park Rd	170	TBC		Dec-00	143	WAPITI	FA	Safe-Tran
8-005-0	332	D6	US 17A @ US 176 (St James Ave)	170	TBC		Nov-03	108	WAPITI		Safe-Tran
18-024-5	336	D6	Berlin G Myers Pkwy @ E 6th North St	2070	TBC		Feb-08	57	Apogee	FA	Naztec
18-024-0	332	D6	Berlin G Myers Pkwy @ E 3rd North St	2070	TBC		Feb-10	33	Apogee	FA	Naztec
18-014-0	332	D6	Berlin G Myers Pkwy @ US 78	2070	TBC		Feb-10	33	Apogee	FA	Naztec
8-024-3	336	D6	Berlin G Myers Pkwy @ Marymeade Dr	2070	TBC - fiber ends no connection		Sep-06	74	Apogee	FA	Naztec
18-022-5	332	D6	E Carolina Ave @ Berlin G Myers Pkwy (SC 165)	2070	TBC		Jan-06	82	Apogee	FA	Naztec
18-025-3	336	D6	E Carolina Ave (SC 165) @ Summerville Plaza S/C	2070	TBC		Mar-10	32	Apogee	FA	Naztec
18-023-1	336	D6	Old Trolley Rd @ Bacons Bridge Rd (SC 165)	2070	TBC		Mar-10	32	Apogee	FA	Naztec
18-029-8	336	D6	Old Trolley Rd @ Stallsville Loop	2070	TBC		Mar-10	32	Apogee	FA	Naztec
18-035-0	336	D6	Old Trolley Rd @ Miles Jamison Rd	2070	TBC		Mar-10	32	Apogee	FA	Naztec
18-025-0	336	D6	SC-165 (Bacons Bridge Rd) @ Mikell Dr/Edisto	170	None		Jan-95	214	WAPITI	FA	Signal Control
18-022-8	336	D6	SC-165 (Bacons Bridge Rd) @ Stallsville Loop	170	None		Jan-93	238	WAPITI	FA	Safetran

Signal Equipement Inventory
Zone 3

Custom ID	Cabinet		Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
18-035-2	336	D6	Old Trolley Rd @ Crestview Dr	170	TBC		Jul-93	232	WAPITI	FA	Dynamic
18-035-5	336	D6	Old Trolley Rd @ Savannah Round	170	TBC		Jan-98	178	WAPITI	FA	Signal Control
18-035-6	336	D6	Old Trolley Rd @ Beverly Dr	170	TBC		Jan-02	130	WAPITI	FA	Signal Control
18-035-3	336	D6	Old Trolley Rd @ Midland Pkwy	170	TBC		Jan-02	130	WAPITI	FA	Safe-Tran
18-037-5	336	D6	Miles Jamison Rd@Gahagan Drive	170			Jan-01	142	WAPITI	FA	Safe-Tran
18-037-0	336	D6	Ladson Rd @ Midland Pkwy	170	-		Feb-02	129	WAPITI	FA	Safe Tran
18-037-2	336	D6	Ladson Rd @ Old Fort Fire Station	170	-		Jan-03	118	WAPITI	SA	Dynamic
10-117-0	336	D6	Ladson Rd @ Miles Jamison Rd	170	-		Apr-03	115	WAPITI	FA	Safe Tran
10-117-5	332	D6	Ladson Rd @ Palmetto Commerce Pkwy	170	-		Jan-06	82	WAPITI	FA	Safe Tran
10-118-2	336	D6	Ladson Rd @ William Aiken Ave/Lincolnville Rd	2070	-		Jun-09	41	Apogee	FA	Naztec
10-060-5	336	D6	US 78 (University Blvd) @ College Park Rd	2070	radio to I-26 via College P		Sep-06	74	Apogee	FA	Naztec
10-059-0	336	D6	US 78 (University Blvd) @ Ladson Rd	2070	TBC		Feb-08	57	Apogee	FA	Naztec
8-001-5	332	D6	College Park Rd @ I-26 EB	2070 Master	radio/dial-up		Oct-05	85	Apogee	FA	Naztec
8-001-0	336	D6	College Park Rd @ I-26 WB	2070	radio		May-08	54	Apogee	FA	Naztec
8-040-0	336	D6	College Park Rd @ Treeland Dr	2070	radio		Sep-06	74	Apogee	FA	Naztec
8-041-0	336	D6	College Park Rd @ Crowfield Blvd	170	fiber		Jan-02	130	WAPITI	FA	Dynamic
8-042-0	332	D6	College Park Rd @ Corporate Pkwy	170 Master	fiber/dial-up		Jan-05	94	WAPITI	FA	Dynamic

Signal Equipement Inventory
Zone 4

Custom ID	Cabinet		Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
8-012-8	336	D6	US 52 (N Goose Creek Blvd) @ Old Mt Holly Rd/Montague Plantation	2070	TBC	RR runs along east side of US 52	Sep-06	74	Apogee	FA	Naztec
8-014-0	336	D6	US 52 (N Goose Creek Blvd) @ Stephanie Dr	2070	fiber	RR runs along east side of US 52	Jun-07	65	Apogee	FA	Naztec
8-013-0	336	D6	US 52 (N Goose Creek Blvd) @ Hollywood Dr	2070	fiber	RR runs along east side of US 52	Sep-06	74	Apogee	FA	Naztec
8-017-5	336	D6	US 52 (N Goose Creek Blvd) @ Central Ave	2070	fiber	RR runs along east side of US 52	Jan-06	82	Apogee	FA	Naztec
8-016-0	336	D6	US 52 (N Goose Creek Blvd) @ Brandywine Blvd	2070	fiber	RR runs along east side of US 52	Nov-07	60	Apogee	FA	Naztec
8-015-0	336	D6	US 52 (N Goose Creek Blvd) @ Thomason Blvd/Liberty Hall Rd	2070	fiber	RR runs along east side of US 52	Sep-06	74	Apogee	FA	Naztec
8-010-0	332	D6	US 52 (N Goose Creek Blvd) @ St James Ave	2070 Master ↕	fiber/dial-up	RR runs along east side of US 52	Sep-06	74	Apogee	FA	Naztec
8-019-7	336	D6	US 176 (St James Ave) @ Devon Blvd	170	TBC		Jan-05	94	WAPITI	FA	Signal Control
8-019-8	332	D6	US 176 (St James Ave) @ Davenport St	2070	TBC		Mar-10	32	Apogee	FA	Naztec
8-018-3	336	D6	US 176 (St James Ave) @ Old Mt Holly Rd	2070	TBC		Sep-06	74	Apogee	FA	Naztec
8-018-8	332	D6	US 176 (St James Ave) @ Fairfax Blvd	2070	TBC		Jul-06	76	Apogee	FA	Naztec
8-019-4	336	D6	US 176 (St James Ave) @ Gainesborough Dr	2070	TBC		Jun-07	65	Apogee	FA	Naztec
8-019-5	336	D6	US 176 (St James Ave) @ Crowfield Blvd	2070	fiber		Jun-06	77	Apogee	FA	Naztec
8-019-3	336	D6	US 176 (St James Ave) @ Old Moncks Corner Rd	2070	fiber		Sep-06	74	Apogee	FA	Naztec
8-019-6	336	D6	US 176 (St James Ave) @ Central Ave	2070	fiber		Jun-06	77	Apogee	FA	Naztec
8-019-0	336	D6	US 176 (St James Ave) @ WestviewBlvd /Brandywine Blvd	2070	fiber		Mar-10	32	Apogee	FA	Naztec
8-018-7	336	D6	US 176 (St James Ave) @ Thomason Blvd	2070	fiber		Jun-06	77	Apogee	FA	Naztec
8-050-8	336	D6	Crowfield Blvd @Hamlet Cir/Corporate Pkwy	170	None		Feb-00	153	WAPITI	FA	Safe Tran
8-049-5	336	D6	Crowfield Blvd @Londonderry Rd/Westview Blvd	170	None		Feb-03	117	WAPITI	FA	Safe Tran
8-046-7	336	D6	Liberty Hall Rd @ Wildberry Ln/Adler Dr	170	None		Jan-07	70	WAPITI	FA	Dynamic
8-044-0	336	D6	Liberty Hall Rd @ Henry E Brown Jr Blvd	2070	None		Jun-11	17	Apogee	FA	Naztec
8-030-0	336	D6	NAD Rd (S-8-43) @ Snake Rd	170	None		Feb-02	129	WAPITI	FA	Safe Tran
8-045-0	336	D6	Snake Rd @ Foster Creek Rd	170	None		Jan-08	58	WAPITI	FA	Dynamic
8-038-0	336	D6	Red Bank Rd (S-8-29) @ Forest Lawn Ave	170	None		Mar-96	200	WAPITI	FA	Signal Control
8-031-0	336	D6	Red Bank Rd (S-8-29) @ Old State Rd/Howe Hall Rd	170	None		Jan-03	118	WAPITI	FA	Signal Control
8-034-0	336	D6	Red Bank Rd (S-8-29) @ Garwood Rd/Bayshore Blvd	170	None		Dec-02	119	WAPITI	FA	Safe Tran
8-033-0	336	D6	Red Bank Rd (S-8-29) @ Fanwood Rd	170	None		Jan-96	202	WAPITI	FA	Signal Control
8-029-0	332	D6	Red Bank Rd (S-8-29) @ North Rhett Ave (S-8-136)	2070	Master, Dial-up		Dec-08	47	Apogee	FA	Naztec
8-036-0	336	D6	Red Bank Rd (S-8-29) @ Eagle Rd	2070	Full Duplex	RR east of intersection	Oct-05	85	Apogee	FA	Naztec
8-037-0	336	D6	Red Bank Rd (S-8-29) @ Pomflant Access Rd	2070	Full Duplex	RR on both sides of intersection	Sep-06	74	Apogee	FA	Naztec
8-035-0	336	D6	Red Bank Rd (S-8-29) @ Deke Giles Ave	2070	Radio 900 MH not hooked up		Jan-97	190	Apogee	FA	Naztec
8-036-1	336	D6	Red Bank Rd (S-8-29) @ Fletcher Ave	170	None		Aug-00	147	WAPITI	FA	Safe Tran
8-036-2	336	D6	Red Bank Rd (S-8-29) @ NNPTC/Ordinance Ave	2070	None		Nov-10	24	Apogee	FA	Naztec

Signal Equipement Inventory
Zone 5

Custom ID	Cabinet		Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
18-034-8	332	D6	Ashley-Phosphate Rd @ Lincoln Blvd	2070	fiber/ethernet-radio		Mar-10	32	Apogee	FA	Naztec
18-034-9	332	D6	Ashley-Phosphate Rd @ Windsor Hill Blvd	2070	ethernet-radio		Sep-10	26	Apogee	FA	Naztec
10-115-6	332	D6	Ashley-Phosphate Rd @ Pepperidge Dr/Stall School	2070	ethernet-radio		Mar-10	32	Apogee	FA	Naztec
10-115-5	332	D6	Ashley-Phosphate Rd @ Cross County Rd	2070	fiber -ethernet/ethernet-radio		Oct-06	73	Apogee	FA	Naztec
10-115-2	336	D6	Ashley-Phosphate Rd @ Pepperdam Ave	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-115-1	336	D6	Ashley-Phosphate Rd @ N/S Spartan Blvd	2070	fiber-ethernet		May-09	42	Apogee	FA	-
10-115-0	332	D6	Ashley-Phosphate Rd @ Stall/Tedder St	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-116-0	332	D6	Ashley-Phosphate Rd @ Northside Dr	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-006-1	332	D6	Ashley-Phosphate Rd @ I-26 EB	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-006-2	332	D6	Ashley-Phosphate Rd @ I-26 WB/Northwoods Blvd	2070	fiber-ethernet		Aug-09	39	Apogee	FA	Naztec
10-001-0	336	D6	University Blvd @ I-26 EB	2070	fiber		Sep-08	50	Apogee	FA	Naztec
10-061-5	336	D6	University Blvd @ Medical Plaza Dr (W)	2070	fiber		Mar-10	32	Apogee	FA	Naztec
10-061-0	336	D6	University Blvd @ Medical Plaza Dr (E)	2070	fiber		Sep-08	50	Apogee	FA	Naztec
10-060-0	336	D6	University Blvd @ Shadow Ln	2070	fiber		Sep-08	50	Apogee	FA	Naztec
10-059-7	336	D6	University Blvd @ Fernwood Dr/Wannamaker Park	2070 Master	fiber/dial-up		-	-	Apogee	FA	Naztec
36	336	NC	Otranto Rd @ Antler Dr	170	None		Jan-06	82	WAPITI	FA	Signal Control
10-058-0	336	D6	Rivers Ave @ Otranto Rd	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-057-5	332	D6	Rivers Ave @ K-Mart	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-057-0	332	D6	Rivers Ave @ Greenridge Rd	2070	fiber-ethernet		NA	-	-	-	-
10-056-5	336	D6	Rivers Ave @ N. Rivers Ave Market	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-056-0	336	D6	Rivers Ave @ Eagle Landing Blvd	2070	fiber-ethernet		Sep-08	50	Apogee	FA	Naztec
10-055-5	332	D6	Rivers Ave @ Rivers Ave Mkt/Northwoods Blvd	2070	fiber-ethernet		Nov-07	60	Apogee	FA	Naztec
10-055-0	332	D6	Rivers Ave @ Ashley-Phosphate Rd	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/fe447002-0b23-4b8c-8130-ffa08c	May-08	54	Apogee	FA	Naztec
10-054-5	336	D6	Rivers Ave @ Morris Baker Blvd/Target	2070	fiber-ethernet		Mar-10	32	Apogee	FA	Naztec
10-054-0	332	D6	Rivers Ave @ Maybeline Rd	2070	fiber-ethernet		Feb-08	57	Apogee	FA	Naztec
10-053-5	332	D6	Rivers Ave @ Stokes Ave	2070	fiber-ethernet		May-08	54	Apogee	FA	Naztec
10-053-0	332	D6	Rivers Ave @ Midland Park Rd	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/a5976baf-60bf-4a90-b9d1-5cc63b	Sep-06	74	Apogee	FA	Naztec
10-052-5	332	D6	Rivers Ave @ Eagle Dr	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/720ed03a-292b-462f-8a89-2966d	Nov-07	60	Apogee	FA	Naztec
10-052-1	332	D6	Rivers Ave @ Hanahan Rd	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/e8ea6602-142f-4dd4-a341-25f2bf	May-08	54	Apogee	FA	Naztec
10-051-7	332	D6	Rivers Ave @ Benderson Dr	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/5bd87f6b-2083-45f3-b15d-758bd	May-08	54	Apogee	FA	Naztec
10-051-5	332	D6	Rivers Ave @ Aviation Ave	2070	fiber-ethernet	XXX	Jan-11	22	Apogee	FA	Naztec
10-051-0	332	D6	Rivers Ave @ N. Charleston Center	2070	fiber-ethernet	XXX	Feb-08	57	Apogee	FA	Naztec
10-050-5	332	D6	Rivers Ave @ Remount Rd	2070	fiber-ethernet	XXX	Jan-11	22	Apogee	FA	Naztec
10-050-0	336	D6	Rivers Ave NB @ Harley St	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/ca28eec1-ee99-4900-9110-737bd	May-08	54	Apogee	FA	Naztec
10-012-1	336	D6	Rivers Ave SB @ I-526 WB	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/fec07850-1435-41b2-bc1d-15fbcb	Jan-05	94	Apogee	FA	Naztec
10-012-2	336	D6	Rivers Ave NB @ I-526 EB	2070	fiber-ethernet	https://designitapps.com/scdot/AncillaryDocuments/58f41b6c-f977-4cd0-af4a-973363	Jun-07	65	Apogee	FA	Naztec
10-127-0	332	D6	Aviation Ave @ Fain St/Core Rd	2070	fiber-ethernet		Jan-11	22	Apogee	FA	Naztec
10-005-1	332	D6	Aviation Ave @ I-26 EB	2070	fiber-ethernet		Jan-11	22	Apogee	FA	Naztec
10-005-2	332	D6	Aviation Ave @ I-26 WB	2070	fiber-ethernet		Jan-11	22	Apogee	FA	Naztec
10-004-2	332	D6	Remount Rd @ I-26 EB	2070	fiber-ethernet		Jan-11	22	Apogee	FA	Naztec
10-004-1	332	D6	Remount Rd @ I-26 WB	2070	fiber-ethernet		Jan-11	22	Apogee	FA	Naztec

Signal Equipement Inventory
Zone 6

Custom ID	Cabinet		Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
18-025-5	336	D6	Dorchester Rd (SC-642) @ Orangeburg Rd (S-18-22)	170	None		Jan-06	82	WAPITI	-	Safetran
18-021-0	336	D6	Dorchester Rd (SC-642) @ SC-165	170	None		Jan-05	94	WAPITI	FA	Signal Control
18-029-7	336	D6	Dorchester Rd (SC-642) @ Middleton Blvd	170	None		Jul-02	124	WAPITI	FA	Safetran
18-027-0	336	D6	Dorchester Rd (SC-642) @ Old Trolley Rd	2070 Master	radio/dial-up		Oct-08	49	Apogee	FA	Naztec
18-028-0	*332	D6	Dorchester Rd (SC-642) @ Ladsen Rd	2070	radio		May-08	54	Apogee	FA	Naztec
18-029-0	336	D6	Dorchester Rd (SC-642) @ Parlor Dr	2070	radio		Jun-06	77	Apogee	FA	Naztec
18-028-5	336	D6	Dorchester Rd (SC-642) @ Beacon Hill Ln	2070	TBC- no radio		May-08	54	Apogee	FA	Naztec
18-029-1	336	D6	Dorchester Rd (SC-642) @ Wescott Blvd	2070	TBC, radio inactive		Nov-06	72	Apogee	FA	Naztec
18-029-2	336	D6	Dorchester Rd (SC-642) @ Club Course Dr	2070	TBC, radio inactive		Sep-06	74	Apogee	FA	Naztec
18-029-3	336	D6	Dorchester Rd (SC-642) @ Appian Way	2070	TBC, radio inactive		Jan-06	82	Apogee	FA	Naztec
18-026-0	332	D6	Dorchester Rd (SC-642) @ Ashley-Phosphate Rd	2070	fiber/ethernet-radio		May-08	54	Apogee	FA	Naztec
18-029-6	336	D6	Dorchester Rd (SC-642) @ Lincoln Blvd	2070	TBC, radio inactive		Sep-06	74	Apogee	FA	Naztec
18-029-5	336	D6	Dorchester Rd (SC-642) @ Franchise St	2070	TBC, radio inactive		Jun-06	77	Apogee	FA	Naztec
10-086-8	336	D6	Dorchester Rd (SC-642) @ Purcell Dr	2070	TBC, radio inactive		Sep-06	74	Apogee	FA	Naztec
10-086-9	336	D6	Dorchester Rd (SC-642) @ Cross County Rd	2070	TBC, radio inactive		Jan-06	82	Apogee	FA	Naztec
10-088-0	336	D6	Dorchester Rd (SC-642) @ Maryland Ave/Lawson Dr	2070	TBC- no radio		Oct-05	85	Apogee	FA	Naztec
10-087-0	336	D6	Dorchester Rd (SC-642) @ W Hill Blvd	2070	TBC- no radio		Sep-06	74	Apogee	FA	Naztec
10-089-0	336	D6	Dorchester Rd (SC-642) @ Apartment Blvd	2070	TBC- no radio		Sep-06	74	Apogee	FA	Naztec
10-089-3	336	D6	Dorchester Rd (SC-642) @ Zuker School	2070	TBC- no radio		Oct-08	49	Apogee	FA	Naztec
10-089-5	332	D6	Dorchester Rd (SC-642) @ Michaux Pkwy	2070	TBC- no radio		Nov-07	60	Apogee	FA	Naztec
21	332	NC	Dorchester Rd (SC-642) @ Bream Rd	170	None		Aug-05	87	WAPITI	FA	Signal Control
20	336	NC	Dorchester Rd (SC-642) @ Olivia Dr	170	None		Jul-94	220	WAPITI	FA	Signal Control
19	332	NC	Dorchester Rd (SC-642) @ Bon Aire Blvd/Scarsdale Ave	170	None		May-07	66	WAPITI	FA	Signal Control
18	336	NC	Dorchester Rd (SC-642) @ W Montague Ave	170	None		Nov-01	132	WAPITI	FA	Safe Tran
17	*	NC	Dorchester Rd (SC-642) @ I-526 EB	*	None	operated by controller at I-526 WB	*	*	*	*	*
16	332	NC	Dorchester Rd (SC-642) @ I-526 WB	170	None		May-06	78	WAPITI	FA	Safe Tran
15	*	NC	Dorchester Rd (SC-642) @ Oscar Johnson Dr/Paramount Dr	*	None	operated by controller at I-526 WB	*	*	*	*	*
23	336	NC	Dorchester Rd (SC-642) @ Leeds Ave	170	None		Aug-01	135	WAPITI	FA	Signal Control
14	336	NC	Dorchester Rd (SC-642) @ Industrial Ave	2070	None		Sep-06	74	Apogee	FA	Signal Control
13	332	NC	Dorchester Rd (SC-642) @ Constitution Ave	170	None		Apr-08	55	WAPITI	FA	Safe Tran
12	336	NC	Dorchester Rd (SC-642) @ Burns Elementary	170	None		Jan-96	202	WAPITI	SA	Signal Control
11	*	NC	Dorchester Rd (SC-642) @ I-26 EB	*	None						*
10	336	NC	Dorchester Rd (SC-642) @ I-26 WB	170	None		Sep-01	134	WAPITI	FA	Signal Control
22	336	NC	Dorchester Rd (SC-642) @ Meeting St	170	None	3 RR tracks West of intersection	Aug-01	135	WAPITI	FA	Safe Tran
37	336	NC	Paramount Drive @ I-526 WB	170	None		Jun-03	113	WAPITI	FA	Signal Control
38	*	NC	Paramount Drive @ I-526 EB	*	None	operated by controller at I-526 WB	*	*	*	*	*
10-010-8	336	D6	Leeds Avenue @ I-526 EB	170	None		Jan-08	58	WAPITI	FA	Signal Control
10-010-9	336	D6	Leeds Avenue @ I-526 WB	170	None		Jan-08	58	WAPITI	FA	Safetran
29	336	NC	Leeds Avenue @ Azalea Dr	170	None		May-98	174	WAPITI	FA	Signal Control
53	336	NC	Leeds Avenue @ Bridgeview Dr	170	None		Apr-97	187	WAPITI	FA	Signal Control
63	336	NC	Azalea Dr@ Industrial Ave	170	None		Jan-01	142	WAPITI	FA	Safe Tran
25	336	NC	Azalea Dr@ Cosgrove Ave	170	None		Jul-03	112	WAPITI	FA	Safe Tran

Signal Equipement Inventory
Zone 7

Custom ID	Cabinet	Maintained By	Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
42	332	NC	Rivers Ave SB @ Mall Drive	170	Fiber		Apr-00	151	WAPITI	FA	Safe-Tran
39	332	NC	Rivers Avenue NB @ E Montague Avenue	170	Fiber		Apr-00	151	WAPITI	FA	Safe-Tran
40	332	NC	Rivers Avenue NB @ Morningside Drive	170	Fiber		Jan-00	154	WAPITI	FA	Safe-Tran
03	332	NC	Rivers Avenue @ Piggly Wiggly Drive (S-886)	170	Fiber		Apr-00	151	WAPITI	FA	Safe-Tran
04	332	NC	Rivers Avenue @ Meeting Street/Durant Avenue (S-39)	170	Fiber	RR tracks S.E. of intersection	Apr-00	151	WAPITI	FA	Safe-Tran
05	336	NC	Rivers Avenue @ Helm Avenue (S-60)	170	dial-up, no interconnect		Jan-93	238	WAPITI	SA	Safe-Tran
41	332	NC	Rivers Avenue @ McMillan Avenue(S-48)	170	Fiber		Jan-00	154	WAPITI	SA	Safe-Tran
43	336	NC	Rivers Avenue @ Dorchester Rd (SC-642)	170	Master Fiber		Jan-00	154	WAPITI	SA	Safe-Tran
06	336	NC	Rivers Avenue @ Cosgrove Avenue (SC-7)	170	Fiber		Aug-04	99	WAPITI	FA	Signal Control
07	336	NC	Rivers Avenue @ Reynolds Avenue (S-31)	170	Fiber		Dec-02	119	WAPITI	SA	Safe-Tran
08	336	NC	Carner Avenue (US 52) @ Clements Avenue	170	None		Jan-01	142	WAPITI	FA	Signal Control
33	332	NC	Spruill Avenue @ E Montague Avenue	170	None		Jan-00	154	WAPITI	FA	Safe Tran
46	336	NC	Spruill Avenue @ Buist Avenue	170	None		Jan-03	118	WAPITI	FA	Signal Control
47	336	NC	Spruill Avenue @ Aragon Street	170	None		Jan-00	154	WAPITI	FA	Signal Control
30	336	NC	Spruill Avenue @ MacMillan Avenue	170	None		Jul-98	172	WAPITI	FA	Signal Control
49	336	NC	Spruill Avenue @ Cosgrove Avenue	170	None		Jan-97	190	WAPITI	FA	Signal Control
24	336	NC	Spruill Avenue @ Reynolds Avenue	170	None		Jan-93	238	WAPITI	FA	Signal Control
50	336	NC	Spruill Avenue @ N Carolina Avenue	170	None		Jan-93	238	WAPITI	FA	Signal Control
44	336	NC	Spruill Avenue @ Viaduct Rd	170	None		Jan-93	238	WAPITI	FA	Signal Control
52	336	NC	Spruill Avenue @ I-26	170	None		Jan-95	214	WAPITI	FA	Signal Control
09	332	NC	Spruill Avenue @ Meeting St (US 52)	170	None		Aug-07	63	WAPITI	FA	Signal Control
8-042-9	332	D6	Murray Avenue/Hanahan @ RR/Highland Park	2070		RR west of intersection		1354			
8-043-0	336	D6	Murray Avenue @ Fort Dr/Recess Rd	170	None		Jan-96	202	WAPITI	FA	Signal Control
8-026-0	336	D6	Murray Avenue @ Yeamans Hall	170	None		Jul-02	124	WAPITI	FA	Safetran
10-099-0	336	D6	Remount Road (S-10-13) @ Yeamans Hall Rd (S-24)	170	None		Jul-03	112	WAPITI	FA	Safe-tran
10-102-0	336	D6	Remount Road (S-10-13) @ Attaway	170	None		Sep-98	170	WAPITI	FA	Signal Control
10-101-0	336	D6	Remount Road (S-10-13) @ N Murray (S-13)	170	None		Jan-01	142	WAPITI	FA	Signal Control
08-028-0	336	D6	Yeamans Hall Rd (S-24)@Loftis Rd	170	None		Jan-00	154	WAPITI	FA	Signal Control
34	336	NC	W Montague Avenue @ I-526 EB	170	None		Jan-98	178	WAPITI	FA	Signal Control
32	336	NC	W Montague Avenue @ I-526 WB	170	None		Jan-98	178	WAPITI	FA	Signal Control
59	332	NC	E Montague Avenue @ International Blvd	170	None		Jan-99	166	WAPITI	FA	Safe Tran
31	336	NC	E Montague Avenue @ I-26	170	None		Jan-00	154	WAPITI	FA	Signal Control
35	336	NC	E Montague Avenue @ Mall Dr	170	None		Dec-02	119	WAPITI	FA	Safe Tran
58	NEMA	NC	E Montague Avenue @ Piedmont Avenue/Morningside Drive	NEMA	None		Jan-87	310	NONE	FA	Gammatronix
57	336	NC	E Montague Avenue @ Mixon Avenue	170	None		Jan-95	214	WAPITI	FA	Signal Control
61	NEMA	NC	Mall Dr @ Lacross Road	NEMA	None		Jan-89	286	NONE	FA	Gammatronix
02	NEMA	NC	Mall Dr @ Red Lobster	NEMA	None		Jan-88	298	NONE	FA	Gammatronix
62	NEMA	NC	Mall Dr @ I-26 WB Off Ramp	NEMA	None		Jan-80	394	NONE	FA	Gammatronix
27	336	NC	International Blvd @ I-526 WB	170	Fiber	Fiber Between Aviation Ave, I-526 SB, I-526 NB, and Wal-Mart/Convention Center (Mas	Jan-98	178	WAPITI	FA	Signal Control
28	336	NC	International Blvd @ I-526 EB	170	Fiber	Fiber Between Aviation Ave, I-526 SB, I-526 NB, and Wal-Mart/Convention Center (Mas	Jan-98	178	WAPITI	FA	Signal Control
8-044-5	332	D6	North Rhett Ave (Henry Brown Jr Blvd) @ Tanner Ford Blvd	170	None		Aug-08	51	WAPITI	FA	Safe-tran
8-027-0	336	D6	North Rhett Ave (S-8-136) @ Yeamans Hall Rd (S-24)	170	None		Jan-04	106	WAPITI	FA	Safe-tran
10-102-3	336	D6	North Rhett Ave (S10-60) @ Remount Rd (S-10.13)	2070	None		Jun-07	65	Apogee	FA	Naztec
10-009-6	336	D6	North Rhett Ave (S10-60) @ I-526 WB	2070	None		Jun-09	41	Apogee	FA	Naztec
10-009-5	336	D6	North Rhett Ave (S10-60) @ I-526 EB	2070	None		Jun-06	77	Apogee	FA	Naztec
10-111-0	NEMA	D6	North Rhett Ave (S10-60) @ Braddock Ave (S-689)	NEMA	None		Jan-74	466	NONE	SA	Gammatronix

Signal Equipement Inventory
Zone 8

Custom ID	Cabinet		Intersection	Controller type	Existing Communications	Inventory Contrary Comments	Install Date	Age (months) (11/2012)	Software	Semi-Actuated/ Fully Actuated	Controller Manufacturer
10-078-3	336	D6	SC 517 (IOP Connector) @ Palm Blvd (SC-703)	170	None		Jan-00	154	WAPITI	FA	Safe-tran
10-102-8	336	D6	River Rd (S-10-54) @ Bohicket Rd/Betsy Kerrison Pkwy (S-10-20)	170	None		Jan-06	82	WAPITI	FA	Signal Control
10-102-5	336	D6	River Rd (S-10-54) @ Main Rd (S-10-20)	170	None		Jan-00	154	WAPITI	FA	Signal Control
10-092-0	336	D6	Maybank Hwy (SC-700) @ Old Maybank Hwy	170	None		Jan-05	94	WAPITI	FA	Signal Control
10-102-6	336	D6	Bees Ferry Rd (S-10-57) @ Main Rd (S-10-20)	170	None		Jan-07	70	WAPITI	FA	Safetran
10-020-0	332	D6	US 17 @ Davison Rd	170	None		Jul-03	112	WAPITI	FA	Safetran
10-019-0	336	D6	US 17 @ Main Rd (S-10-20)	2070	None		Sep-08	50	Apogee	FA	Naztec
10-016-9	332	D6	US 17 @ Carolina Bay/Croghans Landing Dr	2070	None		Oct-06	73	Apogee	FA	Naztec
10-017-0	336	D6	US 17 @ SC-165	170	None		Jan-03	118	WAPITI	FA	Safetran
10-066-3	336	D6	SC-162 @ SC-165	170	None		Jan-00	154	WAPITI	FA	Safetran
10-074-0	336	D6	SC-171 (Center St) @ Ashley Ave	170	None		Jan-00	154	WAPITI	FA	Signal Control
10-075-6	336	D6	SC-171 (Folly Rd) @ Sol Legare Rd	170	None		Jan-08	58	WAPITI	FA	Dynamic Traffic Systems
18-003-0	336	D6	US 15 @ George St	170	None		Jan-05	94	WAPITI	FA	Safetran
18-001-0	336	D6	US 15 @ US 78	170	None		Jan-05	94	WAPITI	FA	Signal Control
18-017-0	336	D6	US 78 @ Ridge St	170	None		Jun-96	197	WAPITI	FA	Signal Control