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Alignment Refinement Technical Memo

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

August 10, 2020

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Acronyms and Abbreviations

BCDCOG	Berkeley-Charleston-Dorchester Council of Governments
BRT	bus rapid transit
CHATS	Charleston Area Transportation Study
CIG	Capital Investment Grant
FTA	Federal Transit Administration
i-26*ALT*	I-26 Fixed Guideway Transit Alternatives Analysis
LCRT	Lowcountry Rapid Transit
LPA	locally preferred alternative
NEPA	National Environmental Policy Act
ROW	right-of-way
STOPS	Simplified Trips on Project Software

Executive Summary

The Lowcountry Rapid Transit (LCRT) is a bus rapid transit (BRT) system envisioned for the Lowcountry of South Carolina. The purpose of the LCRT project is to provide premium, high-capacity BRT service connecting the Town of Summerville, the City of North Charleston, and the City of Charleston that will address the following objectives:

- Improve mobility, accessibility, and connectivity of the transit system and region
- Promote a cost effective and accessible transit alternative
- Support land use and transit objectives in the region

The LCRT project was initiated in 2014 with the I-26 Fixed Guideway Transit Alternatives Analysis (i-26*ALT*), a study conducted by Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) to evaluate transit alternatives for the corridor between Summerville and Charleston. The i-26*ALT* study identified a recommended alignment and BRT as the preferred mode. The recommended alignment originated in downtown Summerville and terminated at Line Street and Meeting Street in the City of Charleston.

In 2016, Charleston County passed a local sales tax referendum to fund local projects, including transit. As a result of the tax referendum, BCDCOG initiated a four-phase effort to complete the next steps of the BRT project development effort as well as build and operate the BRT. Phase 1 expanded the original i-26*ALT* study recommendation to ensure the alignment met the project purpose and need, identified the Peninsula end-of-line location, and performed additional engagement with the public and stakeholders. The Phase 1 effort identified 12 alignment alternatives that were recommended to move forward into Phase 2 for further analysis and refinement (Figure ES.1). The 12 alignment alternatives included downtown Summerville and Nexton as northern termini for all alignments; variations included King Street Extension and Meeting Street as travel options in the North Charleston Neck Area, Crosstown, the Lowline, Meeting Street, and Calhoun Street as downtown Charleston variations, and the Medical District as the southern terminus for all alignments. The analysis documented in this memo summarizes the Phase 2 work completed to analyze the 12 alignment alternatives to identify a single alignment that can be further refined for evaluation in the National Environmental Policy Act (NEPA) environmental document for the project. Tables ES.1 and ES.2 illustrate a graphical summary of the analysis results.

Through the Phase 2 analysis, Alignment 1 scored highest of the 12 alignment alternatives. Alignment 1 is the recommended alignment to continue moving through the Federal Transit Administration (FTA) project development process to compete for federal funds in the Capital Investment Grant (CIG) New Starts program. Alignment 1 originates in downtown Summerville at Main Street, travels east on US Alt 17, south on 5th Street, continues south on US 78, continues south on Rivers Avenue/King Street Extension, east on Mt. Pleasant Street, south on Meeting Street, west on Calhoun Street, north on Courtenay Drive, east on Bee Street to a proposed terminus near the Medical District. However, with additional capital expenditure, Alignment 4 (traveling along Meeting Street in the Neck Area) may be a viable operating alternative. See Section 4.2 for additional detail.

A single alignment will need to be further refined through next steps of the LCRT project to meet the FTA project development requirements to compete for federal funds in the CIG New Starts program. Figure ES.2 illustrates the recommended alignment as well as the current proposed running way treatments for the alignment.

The next steps of LCRT project development that will further refine the recommended alignment include finalizing the specific project termini, finalizing the station locations, and detailing the locally preferred alternative (LPA) to advance through NEPA analysis.

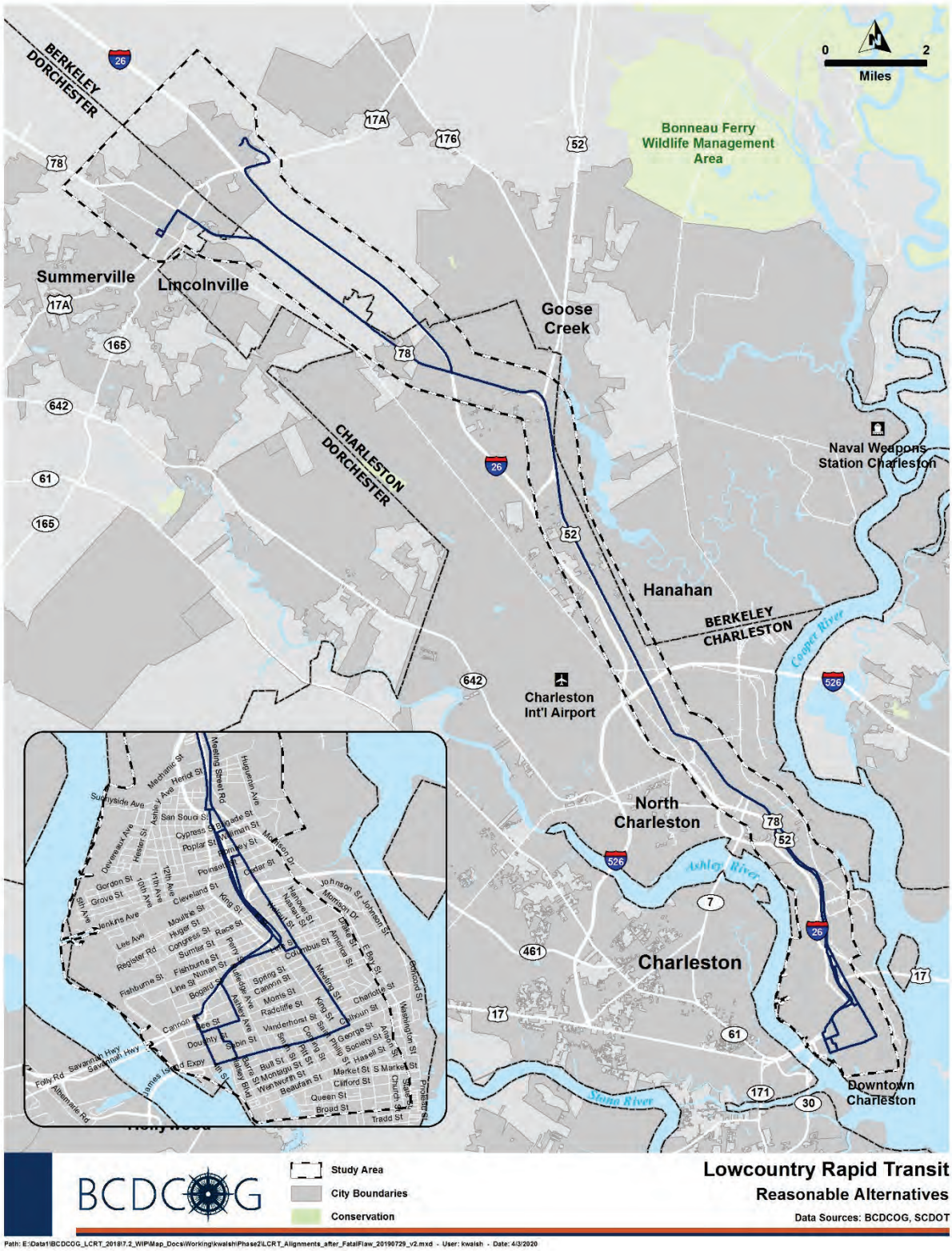

Figure ES.1 LCRT Alignment Alternatives

Table ES.1 Matrix Summary Results

LCRT Goals	Evaluation Category	Evaluation Criteria	Measurement	Alignment 1	Alignment 2	Alignment 3	Alignment 4	Alignment 5	Alignment 6	Alignment 7	Alignment 8	Alignment 9	Alignment 10	Alignment 11	Alignment 12
				Summerville; Rivers Ave; King St; Meeting/ Calhoun	Summerville; Rivers Ave; King St; Crosstown	Summerville; Rivers Ave; King St; LowLine	Summerville; Rivers Ave; Meeting St; Meeting/ Calhoun	Summerville; Rivers Ave; Meeting St; Crosstown	Summerville; Rivers Ave; Meeting St; LowLine	Nexton; Rivers Ave; King St; Meeting/ Calhoun	Nexton; Rivers Ave; King St; Crosstown	Nexton; Rivers Ave; King St; LowLine	Nexton; Rivers Ave; Meeting St; Meeting/ Calhoun	Nexton; Rivers Ave; Meeting St; Crosstown	Nexton; Rivers Ave; Meeting St; LowLine
Promote livable, transit-oriented development	Support existing and generate new development patterns	Land available for TOD development	Land available for TOD development within each station area for each alignment	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🔴	🟡	🟡	🔴	🟡
Create multimodal system; travel choice	Bicycle, pedestrian, and persons with limited mobility connectivity	Station accessibility	Existing bike facilities within each station area for each alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🟡	🟢
			Existing pedestrian facilities within each station area for each alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
			Planned bike facilities within each station area for each alignment	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🔴	🟡	🟡	🔴	🟡
			Planned pedestrian facilities within each station area for each alignment	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🔴	🟡	🟡	🔴	🟡
Minimize environmental impacts and promote a healthy human environment	Environmental Impacts	Cultural resources (Section 106)	Historic resources (structures) adjacent to and facing the alignment	🟡	🟢	🟢	🔴	🟢	🟡	🟡	🟢	🟢	🟢	🟡	🟢
			Historic districts each alignment traverses	🟡	🟢	🔴	🟡	🟢	🔴	🟢	🟢	🟡	🟢	🟢	🟡
		Section 4(f) properties	Section 4(f) properties adjacent to and facing each alignment	🟡	🟢	🟡	🟡	🟢	🟡	🟡	🟢	🟡	🟢	🟡	🟡
		Transit dependent populations	Population under 18 served within each station area (1/2-mile) by alignment	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🔴	🟡	🟡	🔴	🟡
			Population 65 + served within each station area (1/2-mile) by alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
			Disabled population served within each station area (1/2-mile) by alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
			Zero-auto households served within each station area (1/2-mile) by alignment	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢
		Environmental justice populations	Minority population served within each station area (1/2-mile) by alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
			Poverty population served within each station area (1/2-mile) by alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
Improve local, regional mobility, transit efficiency, and quality of service	Traffic Operations	Existing Roadway Crash Rate	Crash rate for each major road within an alignment, normalized by average daily traffic	🟡	🟡	🟡	🔴	🟡	🟡	🟢	🟢	🟢	🟢	🟢	🟢
		Potential to Impact Safety	Ability of BRT Project to enhance safety	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🔴	🟡	🟢	🔴	🟡

Table ES.2 Matrix Summary Results (continued)

LCRT Goals	Evaluation Category	Evaluation Criteria	Measurement	Alignment 1 Summerville; Rivers Ave; King St; Meeting/ Calhoun	Alignment 2 Summerville; Rivers Ave; King St; Crosstown	Alignment 3 Summerville; Rivers Ave; King St; LowLine	Alignment 4 Summerville; Rivers Ave; Meeting St; Meeting/ Calhoun	Alignment 5 Summerville; Rivers Ave; Meeting St; Crosstown	Alignment 6 Summerville; Rivers Ave; Meeting St; LowLine	Alignment 7 Nexton; Rivers Ave; King St; Meeting/ Calhoun	Alignment 8 Nexton; Rivers Ave; King St; Crosstown	Alignment 9 Nexton; Rivers Ave; King St; LowLine	Alignment 10 Nexton; Rivers Ave; Meeting St; Meeting/ Calhoun	Alignment 11 Nexton; Rivers Ave; Meeting St; Crosstown	Alignment 12 Nexton; Rivers Ave; Meeting St; LowLine
Improve local, regional mobility, transit efficiency, and quality of service (cont.)	Transit connections / integration	Integration with existing transit services	Total connections to existing transit routes	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢
	Reliability	Dedicated right-of-way	Percent of alignment in Exclusive Lanes	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🟡	🟢	🟢	🔴	🟢
		Dedicated right-of-way	Percent of alignment in Exclusive and Partial Lanes	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢
		Railroad crossings and disruption to service during peak periods	Number of active at-grade railroad crossings	🟢	🟢	🟢	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟡	🟡
	Travel times	Travel times	Travel times during PM peak period	🟡	🟢	🟡	🟡	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢
		Distance between stations	Average distance between stations per alignment	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🔴	🟡	🟡	🔴	🟡
Support economic development plans along the corridor	Population and employment	Existing population	Population within ½-mile of each station area along the alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
		Existing employment	Employment within ½-mile of each station area along the alignment	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
	Ridership potential	Ridership generators served	Ridership generators within ½-mile of each station along the alignment segment (activity nodes)	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
		Total ridership from FTA STOPS model	Annual Ridership (305 days)	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🔴	🟢	🟢	🔴	🟢
	On-street parking	On-street parking	Linear feet of potential impacted on-street parking	🟡	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟢
Project viability, costs, and implementation	Technical feasibility	Constructability issues	BRT constructability issues based on potential conflicts and technical challenges	🟡	🟢	🟡	🟡	🟢	🔴	🟢	🟢	🟡	🟡	🟢	🟡
	Financial sustainability	OPEX Cost Per Rider	OPEX (305 days) cost per rider (Operating Expense)	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🟡	🟢	🟢	🟡	🟢
		CAPEX Cost Per Rider	Cost per rider (Capital Cost)	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🔴	🟢	🟢	🟡	🟢

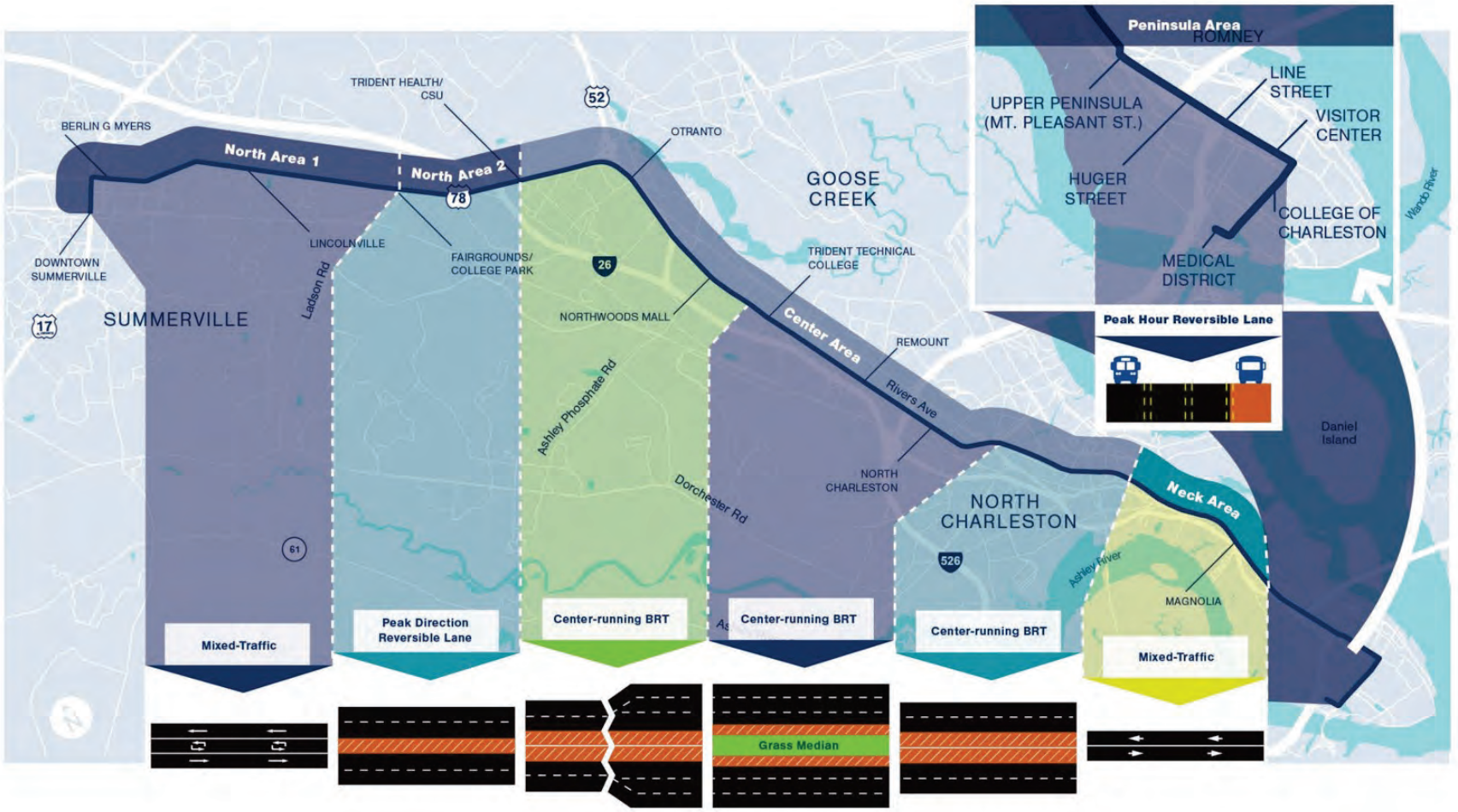

Figure ES.2 LCRT Guideway Treatments and Recommended Alignment for Further Refinement

1 Document Purpose and Organization

The purpose of this document is to summarize:

- LCRT project alignment development to date.
- The analysis performed to refine the 12 alignment alternatives identified in Phase 1 of the LCRT project into a single alignment.

The single alignment will be further refined in subsequent steps of the LCRT project. The single alignment refinement is required as part of the FTA 2-year project development process, which was granted to the BCDCOG for the LCRT in September 2019. The refinement of the single alignment is needed for a clearly defined project to assess its environmental impacts through the NEPA review process, develop 30 percent design plans, and perform additional steps of the FTA's CIG program. The additional refinement includes elements such as alignment start and end points, project running ways and station locations.

- The Executive Summary provides an overview of the document content and next steps.
- Section 1 defines the purpose and organization of this report.
- Section 2 provides an overview of the i-26*ALT* study, the Charleston County half-cent sales tax referendum passed to build the BRT system, a summary of Phase 1 of the LCRT project, and acceptance of the project into FTA project development.
- Section 3 briefly describes the measures, criteria, and ratings used to screen the 12 alignment alternatives.
- Section 4 describes the results of the screening efforts.
- Section 5 summarizes the project recommendations and next steps.
- Supporting Appendices.

2 LCRT Alignment Development and Refinement to Date

2.1 I-26 Fixed Guideway Transit Alternatives Analysis

BCDCOG is the designated metropolitan planning organization responsible for carrying out the federally mandated urban transportation planning process for the Charleston Area Transportation Study (CHATS). CHATS initiated the i-26*ALT* study to identify a fixed guideway transit alternative for the I-26 corridor connecting the Town of Summerville, the City of North Charleston, and the City of Charleston.

In 2014, CHATS embarked on an effort to aid regional mobility through the development of a BRT system now known as the LCRT. The i-26*ALT* study envisioned the LCRT to operate within existing right-of-way (ROW) in a mostly separate guideway dedicated for the BRT vehicles, using a combination of center-running semi-exclusive guideway and curbside priority lanes. The i-26*ALT* study concluded that the LCRT project would be designed to meet the FTA's CIG program eligibility requirements for New Starts program, which requires over 50 percent of the route operate in a separated ROW dedicated for public transportation use and that the

project include defined stations, traffic signal priority for buses, and frequent, bi-directional service[1].

The 15-month i-26*ALT* study was initiated in October 2014 and included a comprehensive operational analysis of the Charleston Area Regional Transportation Authority transit system and a fixed guideway transit alternatives analysis of the I-26 corridor. An extensive public involvement campaign was completed to solicit input throughout the process. Public engagement efforts undertaken for the i-26*ALT* study were focused on identifying the various audiences and stakeholders vested and impacted by the study; educating these groups on the purpose and need for the project, informing them of findings resulting from the analysis, and actively and meaningfully engaging them in the decision making process. Outreach efforts included surveys, public meetings, "Transit Talks," community meetings, development of a project website and newsletters, and utilization of Mindmixer, Facebook, and Twitter.

The study process incorporated guidelines and methodologies from the FTA CIG program to identify a recommended alternative to move forward into the program's project development phase. The study identified the overall project purpose and need, a preferred alignment, and a mode that would improve transit service and enhance regional mobility along the I-26 corridor in the Lowcountry of South Carolina primarily traveling within the US 78/US 52 (Rivers Avenue) corridor.

2.1.1 i-26*ALT* Study Purpose and Goals

The purpose of the i-26*ALT* was to improve transit service and enhance regional mobility along the 22-mile I-26 corridor connecting Summerville, North Charleston, and Charleston. The goals identified in the study were:

- Improve mobility, accessibility, safety, and connectivity of the transit system and region
- Promote a cost effective and financially feasible transit alternative
- Support local land use objectives
- Plan for projected growth in an environmentally sustainable manner
- Respond to community needs and support
- Support a diverse regional economy

2.1.2 The i-26*ALT* Study Recommended Alternative

The alternatives analysis process for the i-26*ALT* study included a three-tiered screening process to identify the best mode and alignment for a fixed guideway transit alternative to meet the purpose and goals of the project. The three tiered process included:

- Pre-Screening (Fatal Flaw)
- Screen One (Initial Screening)
- Screen Two (Detailed Screening)

[1] Source: FTA Capital Investment Grant Program Final Interim Policy Guidance, 2016

The study resulted in the recommendation of the following project elements to advance into FTA project development and pursue federal funds for project completion.

- Preferred alignment: originating from the northern termini in downtown Summerville, east on Main Street, south on US 78/Rivers Avenue, south on King Street Extension or Carner Avenue/Meeting Street, south on Meeting Street to Line Street at its southern termini.
- Alignment length: 23.1 miles
- Mode: BRT
- Guideway: mix of exclusive and semi-exclusive
- Stations: 18
- Operating assumptions:
  - Weekday service: 4:00 AM – 1:00 AM; 10-minute peak, 20-minute non-peak, 30-minute early/late
  - Saturday: 6:00 AM – 1:00 AM, 20-minute service
  - Sunday: 7:00 AM – 11:00 PM , 30-minute service

For the full i-26*ALT* study visit https://lowcountryrapidtransit.com/resources.html

2.2 Lowcountry Rapid Transit Phase 1

In November 2016, residents of Charleston County approved a half-cent sales tax referendum to fund transportation projects, including transit. The sales tax will contribute to the LCRT capital construction costs and operating funds to support the first 15 years of service. The LCRT will seek FTA matching funds for the completion of the project.

In 2018, the BCDCOG initiated Phase 1 of a four-phase effort; the phases are as follows:

- Phase 1–Advance Planning
- Phase 2–NEPA/Project Development
- Phase 3–Engineering
- Phase 4–Construction Management

The purpose of Phase 1 was to advance the LCRT project into the project development phase of FTA's CIG program. Phase 1 was composed of several tasks, including:

- Confirm and refine the project's purpose/need and goals/objectives
- Confirm the overall alignment with special attention to three key areas: the Town of Summerville (northern terminus), the Neck area, and the Peninsula (southern terminus)
- Assess the proposed BRT station locations
- Assess the existing FTA Simplified Trips on Project Software (STOPS) model and use it to compare ridership among different alignment alternatives
- Develop corridor design criteria
- Develop preferred BRT concepts
- Develop conceptual engineering drawings
- Assess potential impacts
- Continue public and stakeholder engagement

2.2.1 Refining Purpose and Need, Developing Goals and Objectives

At the beginning of Phase 1, through extensive public and stakeholder engagement, the project team refined the project's purpose and need[2], and from that, developed project goals and objectives.

The purpose of the LCRT project is to provide premium, high capacity BRT service connecting the Town of Summerville, the City of North Charleston, and the City of Charleston that will address the following objectives:

- Improve mobility, accessibility, and connectivity of the transit system and region
- Promote a cost effective and accessible transit alternative
- Support land use and transit objectives in the region

2.2.2 LCRT Alignment Refinement Process

At the beginning of Phase 1, through the advanced planning process, several alignment sections were developed. The purpose of these section options was to evaluate the northern terminus, downtown Summerville or the Nexton development, King Street or Meeting Street in the Neck Area, and options for connecting into the heart of downtown Charleston, including the Medical District.

Through this process the following section options were developed:

- Two northern section options, one serving downtown Summerville and the other serving the Nexton development.
- One single alignment section option was identified for the center portion of the corridor along Rivers Avenue.
- Two alignment section options were identified in the Neck area, running along either King Street or Meeting Street.
- Seven separate alignment section options were identified in the Peninsula area south of Mt. Pleasant Street, each of which eventually connected to the Medical District.

These alignment sections were linked in different combinations to create 16 end-to-end alignments. These 16 alignments were then evaluated through a fatal flaw analysis.

The purpose of the fatal flaw analysis was to understand if the LCRT could operate/maneuver in each specific area, in particular in the streets of downtown Charleston and principally south of Mt. Pleasant Street, given the existing constrained ROW and built environment. The fatal flaw analysis focused on the LCRT vehicle operability, including:

- Roadway geometry: Are there roadway constraints impacting the ability for a BRT vehicle to make the necessary turns along the route?
- Right-of-way availability: Is there sufficient right-of-way availability along the route for a BRT vehicle to operate in exclusive BRT lanes?
- BRT operability: Can the roadway accommodate a bi-directional exclusive BRT lane?

[2] https://lowcountryrapidtransit.com/docs/LCRT.Purpose_and_Need.pdf

Based on the fatal flaw analysis, four alignments were eliminated for further consideration, and the remaining 12 advanced for further detailed analysis in this memo as part of Phase 2 of the LCRT project (refer to Table 2.1 and Figure 2.1).

Figure 3.2 illustrates the various alignment refinement stages to date, beginning from the i-26*ALT* study through the development of the 12 alignments.

Table 2.1 LCRT Phase 1 Alignments

Alignment
Alignment 1 – Summerville; Rivers Ave; King St; Meeting/Calhoun
Alignment 2 – Summerville; Rivers Ave; King St; Crosstown
Alignment 3 – Summerville; Rivers Ave; King St; Lowline
Alignment 4 – Summerville; Rivers Ave; Meeting St; Meeting/Calhoun
Alignment 5 – Summerville; Rivers Ave; Meeting St; Crosstown
Alignment 6 – Summerville; Rivers Ave; Meeting St; Lowline
Alignment 7 – Nexton; Rivers Ave; King St; Meeting/Calhoun
Alignment 8 – Nexton; Rivers Ave; King St; Crosstown
Alignment 9 – Nexton; Rivers Ave; King St; Lowline
Alignment 10 – Nexton; Rivers Ave; Meeting St; Meeting/Calhoun
Alignment 11 – Nexton; Rivers Ave; Meeting St; Crosstown
Alignment 12 – Nexton; Rivers Ave; Meeting St; Lowline

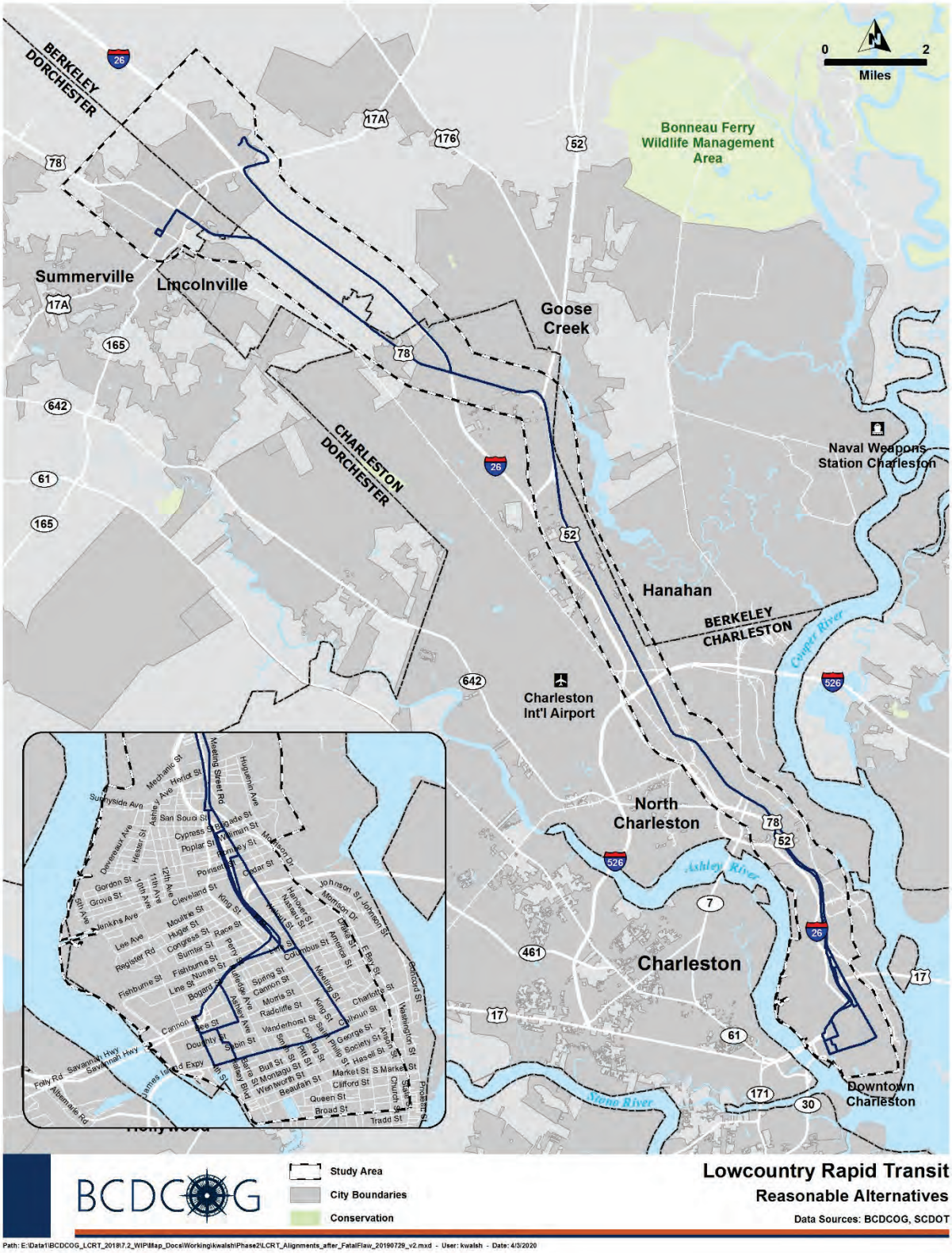

Figure 2.1 LCRT Alignment Alternatives

i-26*ALT* Study Recommendations

Alignment: Downtown Summerville, east on Main Street, south on US 78/Rivers Avenue, south on King Street Extension or Carner Avenue / Meeting Street, south on Meeting Street to Line Street where it terminates.

Alignment length: 23.1 miles	Mode: Bus Rapid Transit	Guideway: Exclusive & Semi-Exclusive	Total Stations: 18	Operating: Frequent 7 day Service

"X" denotes the roadway sections where full alignments travel on.

LCRT Phase 1

Project Scoping & Refinement for Project Development: i-26ALT alignment was expanded to ensure the alignment met the project purpose and need, identified the Peninsula end-of-line location, and performed additional engagement.

Alignment Sections	Alignment Area	LCRT Phase 1 Pre Fatal Flaw Alignments															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Downtown Summerville	North	x	x	x	x	x	x	x	x								
Nexton/I-26	North									x	x	x	x	x	x	x	x
US 78/US 52 (Rivers Ave.)	Center	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cosgrove Ave., Spruill Ave.	Neck								x								x
Meeting St.	Neck	x	x	x					x	x	x	x					x
King St. Ext.	Neck				x								x				
Brigade St./Romney St.	Peninsula						x								x		
Crosstown	Peninsula						x								x		
Lowline	Peninsula							x								x	
Spring St.	Peninsula			x								x					
Cannon St.	Peninsula					x								x			
Calhoun St.	Peninsula	x	x		x			x	x	x	x		x			x	x
Doughty St.	Peninsula	x			x			x	x	x			x			x	x
Courtenay Dr.	Peninsula						x	x							x	x	
Bee St.	Peninsula		x								x						
Lockwood Dr.	Peninsula			x		x						x		x			

Alignment numbering sequence restarted for the fatal flaw analysis.

Results of Fata Flaw Analysis Down to 12 Alignments

Alignment Sections	Alignment Area	LCRT Phase 1 Post Fatal Flaw Alignments											
		1	2	3	4	5	6	7	8	9	10	11	12
Downtown Summerville	North	x	x	x	x	x	x						
Nexton/I-26	North							x	x	x	x	x	x
US 78/US 52 (Rivers Ave.)	Center	x	x	x	x	x	x	x	x	x	x	x	x
Meeting St.	Neck				x	x	x				x	x	x
King St. Ext.	Neck	x	x	x				x	x	x			
Meeting St.	Peninsula	x	x	x	x			x	x	x	x		
Crosstown (Septima Clark Pkwy.)	Peninsula		x			x			x			x	
Lowline	Peninsula			x			x			x			x
Calhoun St.	Peninsula	x		x	x		x	x		x	x		x
Courtenay Dr.	Peninsula	x		x	x		x	x		x	x		x
Bee St.	Peninsula	x	x	x	x	x	x	x	x	x	x	x	x

End of LCRT Phase 1 Alignment Refinement

Figure 2.2 Alignment Refinement Process to Date

2.3 LCRT Phase 1 and FTA Project Development

The FTA responded to a Class of Action Determination request on June 11, 2019 with their NEPA determination that the LCRT qualifies for a Documented Categorical Exclusion (DCE). Following this determination, in July 2019, the BCDCOG formally requested FTA approval to allow the LCRT alignment alternatives identified in Phase 1 (Figure 2.1) to enter into the project development process as a New Starts project as a next step to pursuing FTA CIG funding. In September 2019, FTA approved the LCRT to enter into project development.

3 LCRT Phase 2 Alignment Refinement

Section 3 summarizes the criteria used to perform the analysis to refine the 12 alignment alternatives from the Phase 1 effort to a single alignment option. The single alignment option will be further analyzed and refined as the LCRT design advances and the DCE is drafted.

To conduct the evaluation of the 12 alignments, a number of measures were identified based on the developed goals and objectives. These measures were chosen on the basis of relevance, priority, FTA criteria, recently completed planning work for the Regional Transit Framework Plan[3], industry BRT standards criteria[4], and support of the project's purpose and need.

Table 3.1 provides a summary of the criteria used to analyze and refine the 12 alignment alternatives identified in Phase 1 of the LCRT project. Appendix A includes the maps of the individual alignments and associated stations used for the analysis. Appendix A provides greater detail in terms of the measures identified for the Phase 2 refinement effort.

3.1 Measures

The subsequent text provides a brief overview of each evaluation measure used in the refinement process. The measures are grouped by the goals developed from the LCRT's purpose and need discussed in Section 2.1.1.

[3] https://bcdcog.com/transportation-planning/framework/
[4] Institute for Transportation and Development Policy

Table 3.1 LCRT Goals, Evaluation Criteria, and Measurements

LCRT Goals	Evaluation Category	Evaluation Criteria	Measurement
Promote livable, transit-oriented development	Support existing and generate new development patterns	Land available for transit oriented development	Land available for transit oriented development within each station area for each alignment
Create multimodal system; travel choice	Bicycle, pedestrian, and persons with limited mobility connectivity	Station accessibility	Existing bike facilities within each station area for each alignment
			Existing pedestrian facilities within each station area for each alignment
			Planned bike facilities within each station area for each alignment
			Planned pedestrian facilities within each station area for each alignment
Minimize environmental impacts and promote a healthy human environment	Environmental impacts	Cultural resources (Section 106)	Historic resources (structures) adjacent to and facing the alignment
			Historic districts each alignment traverses
		Section 4(f) properties	Section 4(f) properties adjacent to and facing each alignment
		Transit dependent populations	Population under 18 served within each station area (1/2-mile) by alignment
			Population 65 + served within each station area (1/2-mile) by alignment
			Disabled population served within each station area (1/2-mile) by alignment
			Zero-auto households served within each station area (1/2-mile) by alignment
		Environmental justice populations	Minority population served within each station area (1/2-mile) by alignment
			Poverty population served within each station area (1/2-mile) by alignment
Improve local, regional mobility, transit efficiency, and quality of service	Transit connections / integration	Integration with existing transit services	Total connections to existing transit routes
	Reliability	Dedicated right-of-way	Percent of alignment in exclusive lanes
		Dedicated right-of-way	Percent of alignment in exclusive and partial lanes
		Railroad crossings and disruption to service during peak periods	Number of active at-grade railroad crossings
	Travel times	Travel times	Travel times during PM peak period
		Distance between stations	Average distance between stations per alignment
	Traffic operations	Existing roadway crash rate	Crash rate for each major road within an alignment, normalized by average daily traffic
		Potential to impact safety	Ability of BRT project to enhance safety
Support economic development plans along the corridor	Population and employment	Existing population	Population within ½-mile of each station area along the alignment
		Existing employment	Employment within ½-mile of each station area along the alignment
	Ridership potential	Ridership generators served	Ridership generators within ½-mile of each station along the alignment segment (activity nodes)
		Total ridership from FTA STOPS model	Annual Ridership (305 days)
	On-street parking	On-street parking	Linear feet of potential impacted on-street parking
Project viability, costs, and implementation	Technical feasibility	Constructability issues	BRT constructability issues based on potential conflicts and technical challenges
	Financial sustainability	Operating expense cost per rider	Operating expense per rider
		CAPEX cost per rider	Cost per rider (capital cost)

Note: Data supporting the development of the goals outlined above can be found in the LCRT Purpose and Need Report[5].

[5] https://lowcountryrapidtransit.com/docs/LCRT.Purpose_and_Need.20200501pdf.pdf

3.1.1 LCRT Goal: Promote Livable, Transit-oriented Development

This measure focused on the LCRT station area redevelopment potential, specifically four key criteria: suitability, redevelopment probability, building age, and parcels with zero redevelopment probability. The following is a brief explanation of each criteria:

- Suitability: Building-to-land value ratio where the value of existing structures on the parcel is compared to the land value of where the parcel sits.
- Redevelopment probability: Redevelopment probability assigned to parcels relative to land use and building-land value ratio.
- Building age: Where data was available, building age factored into the redevelopment probability for parcels with office land uses.
- Redevelopment probability: Redevelopment probability assigned to parcels relative to land use and building-land value ratio.

Table 3.2 summarizes the max rating, or score, for the measure analyzed for each alignment as well as the individual rating, or score, for each alignment.

Table 3.2 Measure for Promote Livable, Transit-oriented Development Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
Land available for TOD development within each station area for each alignment	20	19.4	16.0	20.0	19.4	16.0	20.0	9.6	6.3	10.2	9.6	6.3	10.2

3.1.2 LCRT Goal: Create Multimodal System; Travel Choice

Users of the LCRT system will most likely reach a station area as a pedestrian or cyclist. Providing connectivity to all users, including persons with limited mobility, is important for a multimodal system. This measure focused on linear miles of existing and planned bicycle and pedestrian infrastructure within each station area.

Table 3.3 summarizes the max rating for the measures analyzed for each alignment as well as the individual rating for each alignment.

Table 3.3 Measures for Creating Multimodal System; Travel Choice Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
Existing bike facilities within each station area for each alignment	10	10.0	3.8	6.5	10.0	3.8	6.5	10.0	3.8	6.5	10.0	3.8	6.5
Existing pedestrian facilities within each station area for each alignment	10	9.0	3.7	9.2	9.0	3.7	9.2	8.0	2.7	8.2	8.0	2.7	8.2
Planned bike facilities within each station area for each alignment	5	5.0	3.5	5.0	5.0	3.5	5.0	2.8	1.3	2.8	2.8	1.3	2.8
Planned pedestrian facilities within each station area for each alignment	5	5.0	3.9	4.9	5.0	3.9	4.9	2.6	1.5	2.4	2.6	1.5	2.4

3.1.3 LCRT Goal: Minimize Environmental Impacts and Promote a Healthy Human Environment

Environmental Impacts

Cultural Resources (Section 106)

This measure focused on historic structures and cultural resources. The analysis used historic structures and properties adjacent to and facing each of the alignments and calculated the total number of each for the alignments. For historic districts, the analysis calculated the total number of districts that each of the alignments traversed.

Section 4(f) Properties

Section 4(f) refers to the original section within the U.S. Department of Transportation Act of 1966, which provided for consideration of park and recreation lands, wildlife and waterfowl refuges, and historic sites during transportation project development. This analysis focused on Section 4(f) properties immediately adjacent to the alignments and actually facing the alignment.

Transit-dependent Populations

Transit-dependent analysis focused on concentrations of populations within a half-mile of each station area that generally rely on transit to reach destinations such as employment, educational centers, medical appointments, and shopping. For this effort, transit-dependent populations are defined as those populations under 18, elderly individuals 65 and over, disabled individuals and those with limited mobility, and households without an automobile.

Environmental Justice Populations

Environmental justice populations are defined as those populations considered minority, low-income, or with a limited English proficiency[6]. The environmental justice analysis focused on populations within a half-mile of each station area.

Table 3.4 Measures for Minimizing Environmental Impacts and Promote a Healthy Human Environment Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
Historic resources (structures) adjacent to and facing the alignment	10	3.9	9.7	6.8	2.4	8.3	5.3	5.3	10.0	8.3	9.7	3.9	6.8
Historic districts each alignment traverses	10	5.4	8.2	2.7	5.4	8.2	2.7	8.2	10.0	5.4	10.0	8.2	5.4
Section 4(f) properties adjacent to and facing each alignment	10	4.2	9.4	4.2	4.2	9.4	4.2	5.9	10.0	5.9	10.0	5.9	5.9
Population under 18 served within each station area (1/2-mile) by alignment	10	9.9	6.7	10.0	9.9	6.7	10.0	5.8	2.5	5.9	5.8	2.5	5.9
Population 65 + served within each station area (1/2-mile) by alignment	10	9.4	4.7	9.8	9.4	4.7	9.8	7.1	2.3	7.4	7.1	2.3	7.4
Disabled population served within each station area (1/2-mile) by alignment	10	9.5	4.8	9.8	9.5	4.8	9.8	7.1	2.3	7.4	7.1	2.3	7.4
Zero-auto households served within each station area (1/2-mile) by alignment	10	8.9	3.3	8.7	8.9	3.3	8.7	8.5	3.0	8.4	8.5	3.0	8.4
Minority population served within each station area (1/2-mile) by alignment	15	14.2	6.8	14.4	14.2	6.8	14.4	11.1	3.6	11.2	11.1	3.6	11.2
Poverty population served within each station area (1/2-mile) by alignment	15	13.9	6.0	13.9	13.9	6.0	13.9	11.8	3.8	11.8	11.8	3.8	11.8

3.1.4 LCRT Goal: Improve Local, Regional Mobility, Transit Efficiency, and Quality of Service

The LCRT study area has existing transit service as part of a larger service operation. To maximize the mobility opportunities for the region, the LCRT should integrate into the rest of the public transit network to provide customers convenient and seamless transfers between routes. This analysis took the sum of the total number of connections to existing transit routes within a half-mile of a station area.

[6] https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_EJ_Circular_7.14-12_FINAL.pdf

Reliability

Dedicated Right-of-Way

FTA identifies Fixed Guideway BRT as the majority of the corridor (50 percent or more) operating in a separate, or exclusive, dedicated ROW for public transportation use during peak periods. A semi-exclusive guideway includes portions of dedicated guideway and portions of mixed-traffic. This analysis measured the percent of each alignment in exclusive and semi-exclusive guideway.

This measure included a separate alignment guideway treatment analysis. The resulting LCRT Guideway Treatment Analysis memo is provided in Appendix B and documents the process and recommendations for the most optimal running way treatment for the alignments. Treatments analyzed included dedicated/exclusive, semi-exclusive, or mixed traffic BRT, as well as areas where the BRT should be center running or side running. The memo also describes the process employed to identify the best lane running way treatment for the alignments, potential impacts to vehicular traffic, and identification of potential safety treatments and accessibility improvements. The analysis notes potential parking impacts in certain areas of the corridor depending on the running way treatments.

Railroad Crossings and Disruption to Service during Peak Periods

The Charleston region has seen and continues to see sustained growth. Part of that growth includes a very active port system and the active railroad infrastructure required to service the port. Active at-grade railroad crossings could reduce the overall speed and reliability of BRT service. To better understand the potential impact of railroads to speed and reliability of the LCRT BRT service, the total number of active at-grade railroad crossings along each of the 12 alignments was measured. The following summarizes the location and number of existing at-grade railroad crossings that the BRT project crosses.

- Downtown Summerville: one crossing along Main Street
- Rivers Avenue: two crossings (one at Taylor Street, and one near Durant Avenue)
- King Street: one crossing at Discher Street
- Meeting Street: three crossings (one at Cherry Hill Lane, one at Milford Street, and one near Cunnington Avenue)

Travel Times

Travel Times during the PM Peak Period

This measure focused on travel time. Travel time relates to how long it would take the LCRT to travel from alignment end point to end point. Travel times were developed for each of the 12 alignments. The travel time by alignment took into account elements such as alignment length, distance between stations, posted travel speed, span of service, LCRT headways, and passenger boarding/alighting time. For more information, see Appendix C.

Average Distance between Stations

The measure examined distance between stations to better understand the potential impacts to passengers who would need to walk to stations. The distance between each station for each alignment was measured and an average of the distance for each alignment was determined.

Traffic Operations

Existing Roadway Crash Rate

For this measure, the analysis focused on weighted crash rate per alignment normalized by average daily traffic. Crash information was used to better understand the potential for existing crash rates to impact LCRT reliability and user safety. A BRT vehicle in its own lane is still vulnerable to disruptions in travel time at intersections; therefore, dedicated guideway sections are still susceptible to roadway crash rates. The analysis focused on the crash rate per million vehicle miles traveled weighted by length for each alignment within the following areas of the project:

- Summerville to University Boulevard both via US 78 and I-26.
- Rivers Avenue at Cosgrove Avenue to Mount Pleasant Street both via Rivers Avenue and King Street as well as Rivers Avenue and Meeting Street.
- Mount Pleasant Street to Hospital District via I-26 and the Crosstown, Meeting Street and Calhoun Street, and the Lowline, Meeting Street, and Calhoun Street.

Potential to Impact Safety

This measure focused on identifying if the proposed alignment design(s) has the potential to impact pedestrian and motorist safety, with an emphasis on each alignment's potential to improve conditions. Pedestrian safety was based on new signals (especially at locations with a history of pedestrian crashes), the potential to improve pedestrian infrastructure (crosswalks, sidewalks, mid-block crossings), and the potential for median refuges to be installed. Motorist safety was based on new signals (especially at locations with a history of severe or fatal crashes), access control at unsignalized intersections due to medians, and the need for intelligent transportation system countermeasures to aid in the safe operations and maintenance of the dynamic lanes. Data used in this evaluation includes the 2015–2019 crash records provided by SCDOT, and best known design concepts at the time of this evaluation. For more information, see Appendix D.

Table 3.5 summarizes the max rating for the measures analyzed for each alignment as well as the individual rating for each alignment.

Table 3.5 Measures for Improving Local, Regional Mobility, Transit Efficiency, and Quality of Service Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
Total connections to existing transit routes	10	8.6	3.1	8.6	8.6	3.1	8.6	8.6	3.1	8.6	8.6	3.1	8.6
Percent of alignment in exclusive lanes	5	4.4	1.4	4.3	4.2	1.5	4.1	4.5	1.8	4.4	4.4	1.6	4.3
Percent of alignment in exclusive and partial lanes	10	8.7	3.0	8.6	8.5	3.0	8.4	8.9	3.3	8.8	8.7	3.2	8.6
Number of active at-grade railroad crossings	10	8.4	8.4	8.4	3.5	3.5	3.5	10.0	10.0	10.0	5.2	5.2	5.2
Travel times during PM peak period	10	3.5	7.7	3.6	3.8	7.7	3.8	7.2	10.0	7.3	7.3	10.0	7.3
Average distance between stations per alignment	5	4.8	3.9	4.8	4.9	3.9	4.8	2.9	1.1	2.9	2.9	1.1	2.9
Crash rate for each major road within an alignment, normalized by average daily traffic	5	2.1	2.8	2.3	1.6	2.4	1.9	4.5	5.0	4.7	4.1	4.9	4.3
Ability of BRT project to enhance safety	5	5.0	3.4	4.6	5.0	2.8	4.0	4.0	1.7	2.8	3.4	1.1	2.3

3.1.5 LCRT Goal: Support Economic Development Plans along the Corridor

Population and Employment

Existing Employment

Providing employees with transportation options is a critical component to a comprehensive transportation network. Total employment within a half-mile buffer around station areas was measured.

Existing Population

Similar to the employment analysis, providing access to premium transit service is part of a comprehensive transportation network strategy. The total population within a half-mile buffer around station areas was measured.

Ridership Potential

Ridership Generators Served

Key activity centers are ridership generators. This analysis measured key activity centers within a half-mile radius of station areas. Key activity centers considered were: regional centers, including hospitals, colleges/universities, and interstate transit facilities; corridor centers, including shopping centers, clinics, and civic centers; and neighborhood centers, including community centers, K-12 schools, and local parks.

Total Ridership from FTA STOPS Model

STOPS is an FTA ridership (i.e., passenger boarding) estimation modeling tool designed exclusively for fixed guideway systems such as commuter rail, light rail, subway, BRT, and streetcar. It was developed by FTA to assist project sponsors in developing ridership forecasts for their New Starts or Small Starts projects. This analysis compared ridership estimates for each of the 12 alignments.

On-street Parking

The linear feet of potentially-impacted, on-street parking in areas of exclusive and semi-exclusive LCRT guideway was measured. In particular, the analysis focused on Charleston with approximate boundaries of the Medical District on the west side of the Peninsula, Meeting Street on the east side of the Peninsula, Calhoun Street on the south side of the Peninsula, and Mt. Pleasant Street on the north side of the Peninsula.

Table 3.6 summarizes the max rating for the measures analyzed for each alignment as well as the individual rating for each alignment.

Table 3.6 Measures for Supporting Economic Development Plans along the Corridor Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
Population within ½-mile of each station area along the alignment	20	18.9	9.1	19.3	18.9	9.1	19.3	14.6	4.8	15.0	14.6	4.8	15.0
Employment within ½-mile of each station area along the alignment	20	18.4	7.8	18.5	18.4	7.8	18.5	15.8	5.2	15.9	15.8	5.2	15.9
Ridership generators within ½-mile of each station along the alignment segment (activity nodes)	10	9.4	3.9	9.1	9.4	3.9	9.1	8.1	2.6	7.8	8.1	2.6	7.8
Annual Ridership (305 days)	30	28.7	11.0	27.1	28.4	10.8	27.0	24.4	8.6	23.9	24.2	8.4	22.3
Linear feet of potential impacted on-street parking	5	1.8	4.9	3.5	1.8	4.9	3.5	1.8	4.9	3.5	1.8	4.9	3.5

3.1.6 LCRT Goal: Project Viability, Costs, and Implementation

Technical Feasibility

This measure focuses on constructability issues for each of the 12 alignments. The analysis considered many factors, including freight activity and the number of at-grade railroad crossings, flooding issues, existing infrastructure, and construction in a tight urban areas. Constructability issues are:

- Interchange constructability from Nexton to the US 78/I-26.
- Parallel running rail lines along the King Street alternative between Carner Avenue and Mount Pleasant Street.

- Existing and one proposed rail crossing along the Meeting Street alternative between Carner Avenue and Mount Pleasant Street.
- Replacement of existing traffic signal mast arms at intersections along the Meeting Street and Calhoun Street alignment in downtown Charleston.
- Constructability issues along the Lowline.
- Flooding and flood mitigation along Calhoun Street in downtown.

Although not a factor in the selection criteria in this subsection, the Hagood Avenue Extension roadway improvement was analyzed per stakeholder request. The results of the analysis are documented in Appendix E.

Financial Sustainability

Operating Expense Cost Per Rider

This measure focused on the magnitude of LCRT operating cost per rider. The LCRT operating costs were estimated for each alignment based on alignment length and assumed inputs such as days of service, level of service, vehicle operating speed, and number of stations. Ridership comes from the STOPS ridership model runs done for each alignment.

Total Cost per Rider (Capital Cost)

This measure focused on the magnitude of total capital costs for each alignment. Capital costs for the project were estimated using FTA's Standard Cost Category template.

Table 3.7 summarizes the max rating for the measures analyzed for each alignment as well as the individual rating for each alignment.

Table 3.7 Measures for Project Viability, Costs, and Implementation Goal

		Alignment											
		1	2	3	4	5	6	7	8	9	10	11	12
Measurement	Max Rating	Rating Per Alignment											
BRT constructability issues based on potential conflicts and technical challenges	15	8	12	6	6	10	4	11	15	9	9	13	7
OPEX (305 days) cost per rider (Operating Expense)	10	8.5	2.4	8.0	8.4	2.4	7.9	9.2	4.1	9.1	9.1	4.0	8.4
Cost per rider (Capital Cost)	30	25.8	8.1	25.6	28.4	10.2	27.1	23.6	8.8	25.8	24.4	11.0	25.9

3.2 Maximum Rating and Scoring Refinement

A maximum number of points, denoted as "max rating" in the result summary tables in this report, were assigned to each measure. The maximum rating number of points for each measure sum up to a total max score that could be achieved per alignment. Below is a brief summary of the maximum rating of measures and the scoring of the 12 alignments.

3.2.1 Maximum Rating of Measures

The maximum rating developed for each measure to evaluate LCRT alignments is similar to those applied in the CHATS project evaluation criteria and methodology, which were used in evaluating and prioritizing the visionary roadway improvement projects. Variations from the CHATS criteria are due to the purpose and need of this BRT project and the FTA project rating process used to evaluate CIG projects. Established FTA guidelines include an increased level of up-front environmental review during the project development process in order for a project to enter into engineering as part of the competitive CIG program. Although additional emphasis is placed on environmental review, the measures and maximum rating included in the LCRT Phase 2 alignment refinement process incorporate each of the 12 criteria developed for the project evaluation conducted by CHATS.

The measures for this alignment refinement memo were based on the purpose, need, and goals and were scored based on an assessment of their relative value to stakeholders through input gathered since the i-26*ALT* study and through the current phase of project development. The maximum rating for each measure was based on its prioritization and value under the FTA CIG rating criteria. The maximum rating was assigned by giving a higher maximum possible score to measures with greater priority, and a lower maximum possible score to measures with lesser priority. The maximum rating per LCRT goal is as follows: promote livable, transit-oriented development (20 points); create multimodal system and travel choice (30 points); preserve a healthy environment (110 points); improve local, regional mobility, transit efficiency, and quality of service (50 points); support economic development plans along the corridor (85 points); project viability, costs, and implementation (55 points). Although a single LCRT goal is noted as a mobility measure, in reality mobility measures are contained in other LCRT goals such as supporting economic development plans along the corridor. For example, total employment densities can be supportive to mobility goals as an alignment can connect residents to an area that has a higher job density. The maximum rating demonstrates the focus of the project is on the improvements to the community first while balancing the highest priority criteria of the FTA CIG program. These maximum rating scores ranged from 5 to 30 across each measure and resulted in a total possible score of 350 points, see Appendix F, Evaluation Matrix, for the detailed breakdown of the maximum rating per measure.

3.2.2 Scoring of Measures

Once the maximum rating for each measure was defined, each alignment was scored. These scores were based on the value of each alignment's performance on each measure, for example, potential ridership. The analysis used both quantitative and qualitative measures based on data availability. Qualitative measures received a preliminary score based on individual assessments, while quantitative measures were assessed based on their direct numerical performance, such as total cost. The score for each measure was based on interpolating along a trend line generated by assigning scores to the average value for that criteria and to the values one and two standard deviations away from the average. The average measure value was set to correspond with 60 percent of the highest rated score. Measure values equal to or greater than one standard deviation higher than the average for that measure corresponded to the highest rated score. A measure value one standard deviation below the

average corresponded to 40 percent of the highest max rating, and a value two standard deviations below the average corresponded to 20 percent of the highest score. Beyond two standard deviations below the average, the maximum rating went toward zero. The purpose of this methodology was to limit the qualitative subjectivity. Using a method of trend analysis gives repeatability for each of the measures. All but one of the measures, constructability, implemented a value-based comparison. By using the 60, 40, and 20 percent correlations, the method attempted to cause measures above one standard deviation to be less impactful to the score, but measures below one standard deviation to demonstrate a significant loss of points.

4 LCRT Phase 2 Alignment Refinement Results

The cumulative results of the end to end alignment analysis are presented in Table 4.1. The complete table with the measures and scoring of each alignment can be found in Appendix F. Supportive maps provided in Appendix G provide a visual reference of the analysis results along the corridor.

Table 4.1 Ranking of Twelve Alignments

Rank	Total Score (350 max)	Alignment
1	294	Alignment 1 – Summerville; Rivers Ave; King St; Meeting/Calhoun
2	287	Alignment 3 – Summerville; Rivers Ave; King St; Lowline
3	287	Alignment 4 – Summerville; Rivers Ave; Meeting St; Meeting/Calhoun
4	279	Alignment 6 – Summerville; Rivers Ave; Meeting St; Lowline
5	266	Alignment 10 – Nexton; Rivers Ave; Meeting St; Meeting/Calhoun
6	264	Alignment 7 – Nexton; Rivers Ave; King St; Meeting/Calhoun
7	260	Alignment 9 – Nexton; Rivers Ave; King St; Lowline
8	248	Alignment 12 – Nexton; Rivers Ave; Meeting St; Lowline
9	183	Alignment 2 – Summerville; Rivers Ave; King St; Crosstown
10	176	Alignment 5 – Summerville; Rivers Ave; Meeting St; Crosstown
11	153	Alignment 8 – Nexton; Rivers Ave; King St; Crosstown
12	135	Alignment 11 – Nexton; Rivers Ave; Meeting St; Crosstown

4.1 Key Findings and Recommendations – End to End Alignment Results

The cumulative scores of the 12 alternative alignments allowed for preliminary recommendations based on: a northern origin of either Summerville or Nexton; traveling through the Neck Area on either the King Street Extension or Meeting Street; and, reaching a Medical

District peninsula destination via the Crosstown, the Lowline, or Meeting Street and Calhoun Street. The recommendations are discussed below.

All alignments considered included proposed center running BRT along Rivers Avenue in the center section of the corridor and therefore,did not require further analysis. Based on the Guideway Treatment Analysis memo that was conducted (Appendix B), Rivers Avenue in the center of the corridor contains sufficient ROW to provide a dedicated center-running BRT treatment and will also provide several improvements to address existing safety issues within this portion of the corridor. Further, as development and redevelopment occur, this portion of the corridor will become very important to future operations and reliability of the BRT service. For guideway treatments in other portions of the alignment alternatives please refer to Appendix B.

4.1.1 Recommendation: Elimination of Nexton Alignments (Alignments 7, 8, 9, 10, 11, and 12)

The northern alignment alternatives associated with the Nexton alignments (7, 8, 9, 10, 11, and 12) performed well in terms of fewer historic districts, less impacts to traffic operations, and fewer railroad crossings. These alignment alternatives under-performed compared to Summerville alternatives due to several factors:

- Fewer station areas which results in less land available for redevelopment
- Fewer transit-dependent and environmental justice populations served
- Fewer transit connections to existing service
- Less BRT in dedicated guideway
- Fewer population densities and employment areas served
- Less overall ridership

For these reasons, the Nexton alignments were eliminated from further consideration.

4.1.2 Recommendation: Selection of Summerville Alignments (Alignment 1, 3, 4, and 6)

The northern alignment alternatives associated with the Summerville alignment alternatives 1, 3, 4, and 6, performed the best out of the 12 end-to-end alignments. The key functions that cause Summerville alignment alternatives 1, 3, 4, and 6 to score higher than those alternatives originating in Nexton are:

- Connects a high number of transit-dependent neighborhoods
- High overall ridership
- Capital cost per rider is competitive as compared to other alignments
- Operating expenses per rider are low as compared to other alignments
- Summerville alignments have more miles with service traveling on the local roads than Nexton alignments which travel on the interstate

4.1.3 Recommendation: Elimination of Crosstown Alignments (Alignment 2 and 5)

Summerville alignment alternatives 2 and 5 performed the lowest in comparison to the rest of the Summerville alternatives. Alignment alternatives 2 and 5 traveled along the Crosstown. These Crosstown alignments have existing high traffic volumes and, as such, SCDOT will not approve removal of existing general purpose lanes from this roadway. In addition, there is no

directional bias in the traffic volume which would support the reduction of one general purpose lane in order to utilize reversible lanes to maintain existing number of lanes in peak hour travel direction. Furthermore, due to the narrow existing ROW, dedicated guideways would require additional ROW purchase. Due to the close proximity of buildings to the existing ROW, acquisition of additional ROW would result in the displacement of these buildings. The number of displacements would be deemed impactful to buildings and area residents and expensive to the extent that the project could not support such impacts. Therefore, the selected method of accommodating BRT on this corridor has been considered to be mixed traffic. The primary advantage of the Crosstown alignment is the ability to bypass downtown traffic using an elevated connection to the I-26 freeway network and therefore would offer some benefits such as lower total trip time. It also bypasses a known flooding issue along Calhoun Street and bypasses downtown traffic from the Medical District to Mt. Pleasant Street. However, it underperformed compared to other alignments due to several factors:

- Less re-developable acres than the top performing alignments
- Lower overall station accessibility compared to the top performing alignments
- Fewer transit dependent and environmental justice populations
- Fewer transit connections to existing service
- Less BRT in dedicated guideway
- Fewer population and employment densities served
- Lower overall ridership than the top performing alignments

For these reasons, these Crosstown alternatives were eliminated from further consideration in the alignment recommendation.

4.2 Further Alignment Refinement Analysis (Alternatives 1, 3, 4, 6)

As noted above, based on the findings of the cumulative scores of the 12 alignment alternatives, eight of the 12 end-to-end alignments were eliminated. Alignments 1, 3, 4, and 6 are the remaining alignment alternatives and required further analysis both in the Neck Area of the corridor and in the Peninsula/Downtown portion. Alignment alternatives 1 and 4 have two roadway travel options in the Neck Area: traveling on the King Street Extension or on Meeting Street.

4.2.1 Recommendation: Elimination of Lowline Alternatives in the Peninsula Area (Alignments 3 and 6)

The remaining end-to-end alignment alternatives included alignments 3 and 6 utilizing the Lowline in the Peninsula. The Lowline alignment would utilize a city-owned abandoned rail line and create a new, integrated transit and a bike/pedestrian connection to downtown using a bi-directional dedicated BRT lane. While this new connection would not impact existing traffic patterns or parking in the downtown area, several factors determined the decision to eliminate the Lowline alternatives, including:

- Long-term master plans include rebuilding this corridor as a park facility with a bicycle and pedestrian focus rather than transit-based focus. While these projects are not yet funded, community and stakeholder input through the development of the project

determined these master planning efforts are an important element in regional master planning activities and, therefore; the Lowline should be retained for that use.

- Through additional conversations with the Lowline team, it was requested that if the BRT were to travel in the Lowline alignment the BRT vehicle speeds be capped at 15 mph for bike/pedestrian safety; the 15 mph was slower than estimated for the analysis in this memo. This speed change reduced the estimated advantage of the vehicle traveling in the Lowline versus Meeting/Calhoun alignment. The speed capping would result in slower vehicle speed, limit ability to improve frequency, and limit future system expansion for additional BRT lines using the alignment.
- As a former freight rail corridor there is an anticipated existence of hazardous material that may require additional funds for remediation.

4.2.2 King Street Extension (Alignment 1)

Similar to Route 78 near Summerville, the King Street Extension is a two-lane local roadway. If this alignment is considered, mixed traffic operations is most appropriate and recommended for the LCRT. While only one railroad crossing occurs along King Street, the relative population and employment densities suggest an investment in BRT on King Street Extension will yield limited ridership productivity but greater travel time reliability. The presence of an elevated I-26 and adjacent railway lines limits the constructability of neighboring lands. There are no anticipated residential or business relocation impacts for the King Street Extension section. The King Street Extension alignment avoids impacting the proposed Mary Davis Memorial park that the Lowcountry Alliance for Model Communities (LAMC) organization has received an Environmental Protection Agency (EPA) grant to build along Meeting Street (the proposed park is bound Meeting Street to the east, Hackemann Avenue to the north, the railroad tracks to the west, and the port access bridge to the south). The local community, which is predominantly an Environmental Justice community, has expressed that the King Street Extension is their preferred alignment as a safer alternative to the Meeting Street alignment. In addition, Alignment 1 proposes a pedestrian bridge to connect King Street Extension to communities along Meeting Street. The pedestrian bridge would provide access for transit dependent populations to cross the road safely and also to connect to the BRT.

4.2.3 Meeting Street (Alignment 4)

The cross-section of Meeting Street is similar to the northern and southern portions of Rivers Avenue. Portions of Meeting Street narrow, eliminating the two-way left turn lane common in other locations along the corridor. The street has significant redevelopment and urban intensification opportunities with several environmental justice neighborhoods. Building footprints are often set back from the roadway and fronted by parking. The alignment abuts to and can impact the proposed Mary Davis Memorial park. If this alignment is considered, an exclusive center running alignment with grade crossings is recommended. With three at-grade railroad crossings along this alignment, delay is expected to impact the reliability of BRT vehicles. It is noted that grade separation would have significant costs requiring a commitment of additional capital expenditure and would have environmental impacts to adjacent residential and business parcels requiring relocation.

4.2.4 Recommendation: Elimination of Meeting Street and Selection of King Street Extension

It is recommended the LCRT operate on King Street Extension in mixed traffic due to several factors:

- The Meeting Street section would have environmental impacts to adjacent residential and business parcels requiring relocation, the King Street Extension would not result in impacts requiring relocation.
- The crossing adjacent to Cunnington Avenue, along the Meeting Street section, is constrained by the location of the Bethany Cemetery. This cemetery is a potentially eligible Section 4(f) resource; the footprint of the Meeting Street bridge and associated general purpose lanes would potentially encroach into the boundary of the cemetery.
- As observed in CARTA bus delay data, due to existing train traffic at three separate rail crossings on Meeting Street, grade separation would be required at each crossing in order to maintain BRT travel times. These grade separations have projected costs in excess of $80 million and would involve significant coordination with the railroad owners for right-of-way access, design review, and construction scheduling – impacting the overall LCRT BRT project schedule.
- Operating along King Street Extension in mixed traffic demonstrates minimal impacts to travel time.
- Growth along King Street is expected to increase due to Magnolia and several smaller developments, but traffic through the corridor is not over-capacity.
- The King Street Extension alignment avoids impacting the proposed Mary Davis Memorial park.
- The local community in the Neck Area has expressed that the King Street Extension is their preferred alignment.
- Along King Street Extension, the intersection at Mt. Pleasant Street and King Street, the railroad crossing at Hackemann Avenue, and the railroad crossing at Discher Street show traffic congestion due to increased traffic and rail events. Spot queue jump lanes and queue bypasses would be implemented at these locations in order to address this congestion.

Additional analysis of travel time, delay, and grade separation associated with King Street Extension and Meeting Street sections is included in Appendix B, Attachment C.

Continuing south along the King Street Extension, the LCRT alignment connects to Mt. Pleasant Street and continues further south on Meeting Street then west on Calhoun Street to connect to the Medical District. This Meeting Street/Calhoun Street portion of the alignment would provide a combination of curb-side mixed traffic and reversible peak-hour BRT lane configurations to provide the greatest transit speed and reliability improvements in this area of the corridor while also working within limited ROW. While this alignment would require some removal of on-street parking to accommodate a peak-hour reversible lane, the reversible lane is needed to provide transit time and reliability improvements in the Peninsula and downtown portion of the corridor. Without these changes and improvements, travel time and reliability of the BRT would not be

enhanced over existing local bus service. As design advances, further block-by-block analysis and coordination with local business owners will help to address specific business owner concerns about delivery and parking needs.

5 Recommendations and Next Steps

5.1 Recommendations

Based on the review of the 12 alignments alternatives Alignment 1– Summerville; Rivers Ave; King St; Meeting/Calhoun is recommended. Alignment 1 originates in downtown Summerville at Main Street, travels east on US Alt 17, south on 5th Street, continues south on US 78, continues south on Rivers Avenue/King Street Extension, east on Mt. Pleasant Street, south on Meeting Street, west on Calhoun Street, north on Courtenay Drive, east on Bee Street to a proposed terminus near the Medical District. However, with additional capital expenditures to overcome constraints, Alignment 4 (traveling along Meeting Street in the Neck Area) may be a viable operating alternative; see section 5.2 for additional information.

Based on the running way treatment analysis noted in section 4.1.4, the recommended treatment for Alignment 1 is depicted on Figure 5.1 and further detailed in Appendix B.

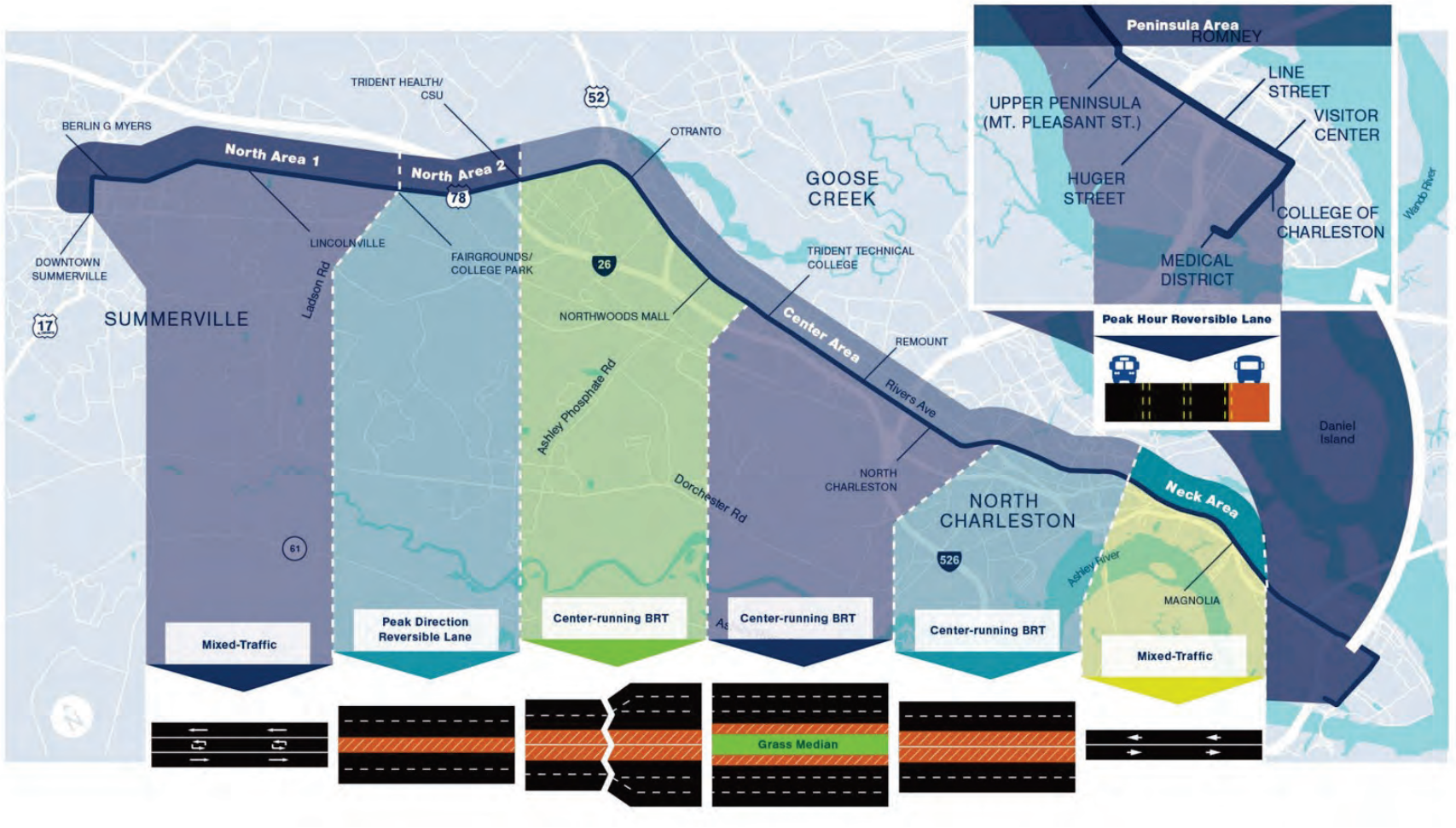

Figure 5.1 LCRT Guideway Treatments and Recommended Alignment for Further Refinement

5.2 Next Steps

The alignment refinement analysis is a critical step in the LCRT BRT project development phase, but there is still work to be done to finalize the project definition. Alignment 1 recommended in this memo will be refined in the next steps of project development to finalize the project termini, station locations, and remaining details of the LPA that will advance through the NEPA analysis.

The alignment and other aspects of the LPA will be subject to more advanced engineering and design decisions. Station locations will continue to be refined through the transit-oriented development study and design process with the general number and locations established to define the LPA.

The existing and subsequent analysis on the recommended alignment, running way, and stations will inform the project definition necessary to initiate environmental review under NEPA. As more detailed environmental analysis and design continues in the NEPA process, more detailed information regarding traffic impacts, parking impacts, and potential mitigation will be further discussed with municipal and roadway operating agencies.

For project definition, FTA requires identification of mode and alignment, as well as a reasonable financial plan that demonstrates design, construction, and operation capacity in the plan. Station locations and costs can change, as long as the funding can support future modifications. As the LCRT project moves through project refinement, a final project definition will be developed for submission to the FTA CIG program. Several key project definition items will be addressed through ongoing project refinement, stakeholder coordination, and public engagement. Key items include, but are not limited to:

- An operations plan that refines the LCRT BRT level of service, vehicle capacity, number and location of stations, and total alignment length.
- Design guideway treatments for pending alignment areas, intersection geometry, access management, parking plan, utility and railroad coordination.
- Design such as the roadway plan, which will be developed to a 30 percent level for FTA CIG submittal, detailed concept plans for the final alignment, and station architecture concept design.

L C
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Appendix A: Phase 2 Alignment Refinement Criteria & Measures

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

August 10, 2020

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Contents

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A. Phase 2 Alignment Refinement Criteria and Measures

This appendix summarizes the process taken and measures selected to perform the analysis to refine the 12 alignment options from the Phase 1 effort to a single alignment option. Note that the single alignment option will be further analyzed and refined in subsequent LCRT steps.

The process undertaken is as follows:

- Defined evaluation categories to align with project goals/objectives
- Defined evaluation criteria based on evaluation categories
- Identified performance measures for each evaluation criteria
- Determined the calculation for each performance measure
- Determined the value of each performance measure for each alignment
- Defined weighting for each performance measure
- Developed weighted score for each performance measure
- Summarize weighted scores for each alignment for a total alignment score
- Eliminate lowest performing alignments

A.1 Criteria

To conduct the evaluation of the 12 alignments 30 measures were identified based on the goals of the project purpose and need. These measures were chosen on the basis of relevance, importance, FTA criteria, recently completed planning work for the Regional Transit Framework Plan[1], industry BRT standards criteria[2], and support of the project's purpose and need.

Table A.1 provides a summary of the criteria used to analyze and refine the 12 alignment options identified in Phase 1 of the LCRT project. The maps of the individual alignments and associated stations used for the analysis can be found at the end of this appendix (Appendix A).

[1] https://bcdcog.com/transportation-planning/framework/
[2] Institute for Transportation and Development Policy

Table A.1 LCRT Goals, Evaluation Criteria, and Measurements

LCRT Goals	Evaluation Category	Evaluation Criteria	Measurement
Promote livable, transit-oriented development	Support existing and generate new development patterns	Land available for TOD development	Land available for TOD development within each station area for each alignment
Create multimodal system; travel choice	Bicycle, pedestrian, and persons with limited mobility connectivity	Station accessibility	Existing bike facilities within each station area for each alignment
			Existing pedestrian facilities within each station area for each alignment
			Planned bike facilities within each station area for each alignment
			Planned pedestrian facilities within each station area for each alignment
Minimize environmental impacts and promote a healthy human environment	Environmental impacts	Cultural resources (Section 106)	Historic resources (structures) adjacent to and facing the alignment
			Historic districts each alignment traverses
		Section 4(f) properties	Section 4(f) properties adjacent to and facing each alignment
		Transit dependent populations	Population under 18 served within each station area (1/2-mile) by alignment
			Population 65 + served within each station area (1/2-mile) by alignment
			Disabled population served within each station area (1/2-mile) by alignment
			Zero-auto households served within each station area (1/2-mile) by alignment
		Environmental justice populations	Minority population served within each station area (1/2-mile) by alignment
			Poverty population served within each station area (1/2-mile) by alignment
Improve local, regional mobility, transit efficiency, and quality of service	Transit connections / integration	Integration with existing transit services	Total connections to existing transit routes
	Reliability	Dedicated right-of-way	Percent of alignment in Exclusive Lanes
		Dedicated right-of-way	Percent of alignment in Exclusive and Partial Lanes
		Railroad crossings and disruption to service during peak periods	Number of active at-grade railroad crossings
	Travel times	Travel times	Travel times during PM peak period
		Distance between stations	Average distance between stations per alignment
	Traffic Operations	Existing Roadway Crash Rate	Crash rate for each major road within an alignment, normalized by average daily traffic
		Potential to Impact Safety	Ability of BRT Project to enhance safety
Support economic development plans along the corridor	Population and employment	Existing population	Population within ½-mile of each station area along the alignment
		Existing employment	Employment within ½-mile of each station area along the alignment
	Ridership potential	Ridership generators served	Ridership generators within ½-mile of each station along the alignment segment (activity nodes)
		Total ridership from FTA STOPS model	Annual Ridership (305 days)
	On-street parking	On-street parking	Linear feet of potential impacted on-street parking
Project viability, costs, and implementation	Technical feasibility	Constructability issues	BRT constructability issues based on potential conflicts and technical challenges
	Financial sustainability	OPEX Cost Per Rider	Operating Expense (OPEX) per rider
		CAPEX Cost Per Rider	Cost per rider (Capital Cost)

A.2 Measures

The subsequent text provides information for each evaluation measure; with each measure grouped by the goals of the LCRT's purpose and need. This refinement screening is based on the best available information at the time. Additional analysis will be done as part of the overall LCRT process on the single refined alignment, for example, refining the length of the single alignment and narrowing down the total number of station areas in order to make the LCRT a competitive project in the FTA CIG rating criteria.

A.2.1 LCRT Goal: Promote Livable, Transit-oriented Development

This measure focused on the LCRT station area redevelopment potential. The analysis focused on four key criteria: suitability, redevelopment probability, building age, and parcels with zero redevelopment probability; the following is a brief explanation of each criteria:

- Suitability
  - Building to land value ratio where the value of existing structures on the parcel is compared to the land value of where the parcel sits.
- Redevelopment probability
  - Redevelopment probability assigned to parcels relative to land use and building-land value ratio. Parcels with lower ratios received a higher probability of redevelopment, see Table A.2 and Table A.4.

Table A.2 Station Area Redevelopment Potential – Commercial Uses

Land Use	Building to Land Ratio	Redevelopment Probability
Retail	0-1	90%
	1.01-3	80%
	3+	40%
Office	0-1	80%
	1.01-3	20%
	3+	0%
Industrial	0-1	80%
	1.01-3	40%
	3+	0%
Vacant	1	100%
Agricultural	1	100%

- Building age
  - Where data was available, building age factored into the redevelopment probability for parcels with office land uses:
  - Parcels with buildings 30 years or older have a higher redevelopment probability, while newer buildings received a lower probability. Buildings 120 years or older were considered historic, see Table A.3.

Table A.3 Station Area Redevelopment Potential – Building Age

Structure Age	Building to Land Ratio 3+	Building to Land Ratio 1.01-3	Building to Land Ratio 0-1
120 years	0	0	0
119-30 years	0.2	0.4	0.8
29 or newer	0	0.1	0.4

- Zero redevelopment probability land uses
  - Single Family
  - Multifamily
  - Institutional

Table A.4 Station Area Redevelopment Potential – Residential Land Uses

Land Use	Building to Land Ratio	Redevelopment Probability
Single Family	NA	0%
Multifamily	NA	0%
Institutional	NA	0%

For the analysis, half-mile non-overlapping station areas were developed for each alignment. For parcels with designated wetlands, the actual wetlands acreage was netted out, with the remaining acreage contributing to the station total and redevelopable land acreages. Additionally, there are several parcels in the corridor with active developments underway that are either approved for development or have started construction. Those parcels were counted as redevelopment/development parcels as well. For each station area a total acreage was calculated using assessor parcel data; each parcel within the station areas was assigned a redevelopment probability per the tables above and the acreage of those parcels was aggregated. The aggregate of the redevelopable parcels within the station area was then divided by the total acreage of the station area, yielding a percent of redevelopable land. Once a single alignment has been identified, additional station area analysis will be performed, and data refined to develop station area place types, profiles, policies, a market analysis will be performed to understand future growth in the station areas, and refinements to the final set of station areas along the final recommended LCRT alignment will take place. Updated station area and county assessor parcel data was used.

The station areas used for this analysis came from the updated set of station areas from the LCRT Phase 2 effort. In September 2019 the LCRT TOD study was initiated. The purpose of the study, with community and stakeholder outreach and support, is to identify new and/or refine previously identified LCRT station areas within the LCRT corridor, develop station area place types, profiles, policies, perform a market analysis to understand future growth in the station areas, and refine the final set of station areas along the final recommended LCRT alignment.

Through stakeholder engagement, public workshops, and key informant interviews the TOD study refined several station areas from the initial set of stations identified in the LCRT Phase 1 effort. In January 2020, the LCRT TOD team presented the stakeholder and public engagement work completed to date and coordinated with various LCRT project discipline tasks and BCDCOG staff to further refine the station areas that will be analyzed as part of the TOD study and alignment analysis. Currently 27 station areas are recommended to move forward for additional analysis. Figure A.1 shows the revised station areas. The final set of stations will be refined and documented through the NEPA process being completed for the project and identified in the Project Definition of the Federal Transit Administration (FTA) Capital Investment Grant (CIG) program submittal.

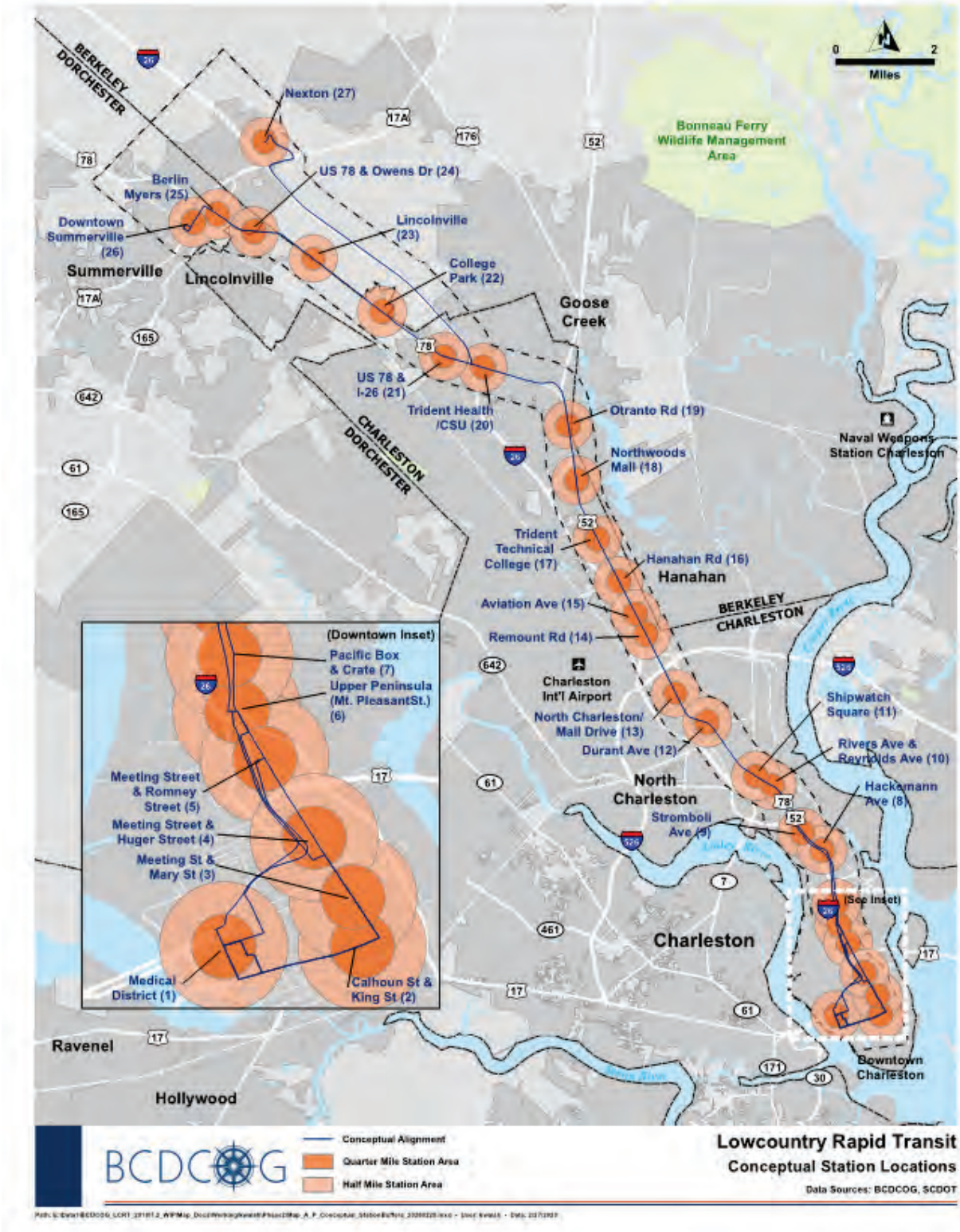


Figure A.1 LCRT Revised Station Areas

A.2.2 Create Multimodal System; Travel Choice

A.2.3 Bicycle, Pedestrian and Persons with Limited Mobility Connectivity

Users of the LCRT system will most like reach a station area as a pedestrian or cyclist. Providing connectivity to all users is important for a multimodal system. To understand this, the project team utilized the documented infrastructure network described in the Existing Conditions report from Phase 1[3] for each station area along all 12 end-to-end alignments. Using half-mile station buffers for each of the 12 alignments, the project team performed the analysis by using the intersect function in GIS to determine linear miles of existing and planned bicycle and pedestrian infrastructure within each station area.

A.2.4 Preserve a Healthy Environment

Environmental Impacts

Cultural Resources (Section 106)

The City of Charleston and the surrounding region is known for its history and its many historic structures. To better understand the location, amount, and proximity of these existing cultural resources along each of the 12 alignments, the project team reviewed and evaluated the resources that were identified and documented in the Existing Conditions report from Phase 1. For cultural resources, the analysis focused on historic structures, historic districts, and historic properties. The project team identified the historic structures and properties that were adjacent to and facing each of the alignments and calculated the total number of each for the alignments. For the historic districts, the project team calculated the total number of districts that each of the alignments traversed and entered those results into the master evaluation matrix.

Section 4(F) Properties

Section 4(f) refers to the original section within the U.S. Department of Transportation (U.S. DOT) Act of 1966 which provided for consideration of park and recreation lands, wildlife and waterfowl refuges, and historic sites during transportation project development. The law applies only to the U.S. DOT and is implemented by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) through the regulation 23 Code of Federal Regulations (CFR) 774[4]. The project team reviewed the information documented in the Existing Conditions report from Phase 1 as the foundation for the evaluation of Section 4(f) properties. Similar to historic structures, the Section 4(f) properties that were identified were those that were immediately adjacent to the alignments and actually facing the alignment.

Transit Dependent Populations

Transit dependent metric was defined through a variety of resources. The project team reviewed FTA guidelines, STOPS Modeling Guidelines, previous transit planning efforts of the BCDCOG and industry-wide standards. The analysis focused on concentrations of populations that generally rely on transit to reach destination such as employment, educational centers, medical

[3] https://lowcountryrapidtransit.com/docs/05_LCRT.EC.MultimodalAccess.pdf
[4] https://www.environment.fhwa.dot.gov/env_topics/4f_tutorial/overview.aspx?h=e

appointments, and shopping. Transit dependent analysis focused on concentrations of populations within a half-mile of each station area. For this effort transit dependent populations are defined as those populations under 18, elderly individuals 65+, disabled individuals and those with limited mobility, and households without an automobile. Individuals under 18 years of age are typically more reliant on transit services as they may not be licensed to drive and/or lack access to a private vehicle. Individuals over the age of 64 years of age are more likely to have mobility limitations and thus rely on alternative transportation modes such as transit to access destinations, especially medical facilities. Persons with disabilities often have mobility limitations and are thus reliant on alternative transportation modes such as transit. Households that lack access to automobiles are forced to use alternative transportation modes such as transit to meet their mobility needs. This analysis used the US Census' American Community Survey (ACS) data.

Environmental Justice Populations

Environmental justice (EJ) populations are defined as those populations that are considered minority and those that are below poverty[5]. The environmental justice analysis focused on populations within a half-mile of each station area. For the purpose of transportation analysis, the term minority refers to any population that does not identify as non-Hispanic white. Minority populations utilize transit services at higher rates than non-Hispanic white populations. Persons below poverty are less likely to have access to private vehicles and thus have a higher propensity to use transit services. This analysis used American Community Survey (ACS) data.

A.2.5 Improve Local, Regional Mobility, Transit Efficiency, and Quality of Service

Traffic Operations

Existing Roadway Crash Rate

Safety along this corridor is a primary concern and a focus point for this project. Areas along the corridor, especially along Rivers Avenue have been identified as having higher-than-average crash rates based on historical crash data. For this measure, the analysis focused on weighted crash rate per alignment normalized by average daily traffic. The SCDOT process for determining areas of high crash rates which creates a million vehicle miles traveled (MVMT) which is then compared to statewide averages to determine locations of greatest concern as documented in Appendix C of the Existing Conditions report from Phase 1[6]. The crash information was used to better understand the potential for existing crash rates to impact LCRT reliability and user safety. The purpose of this analysis was to establish a linear crash rate for major roads serving the reasonable alternatives. The analysis focused on the crash rate per million vehicle miles traveled (MVMT) weighted by length for each alignment within the following areas of the project:

[5] https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_EJ_Circular_7.14-12_FINAL.pdf
[6] https://lowcountryrapidtransit.com/docs/Appendix_C_Safety_and_Operational_Issues_Memo.pdf

Summerville to University Boulevard

- Via US 78
- Via I-26

Rivers Avenue at Cosgrove Avenue to Mount Pleasant Street

- Via Rivers Avenue and King Street
- Via Rivers Avenue and Meeting Street

Mount Pleasant Street to Hospital District

- Via I-26 and the Crosstown
- Via Meeting Street and Calhoun Street
- Via the Lowline, Meeting Street, and Calhoun Street

The intent of this metric is to quantify recent crash frequency, to help identify those routes which are less likely to jeopardize reliability and rider safety. Five of the seven sections outlined above consist of some or all shared or partially-shared guideway, which will likely be affected by roadway incidents such as crashes. The remaining two sections consist of a dedicated guideway but it is known from crash records that the majority of crashes on King Street and Meeting Street between Rivers Avenue and Mount Pleasant Street took place at intersections. A BRT vehicle in its own lane is still vulnerable to disruptions in travel time at intersections, and therefore, dedicated guideway sections are still susceptible to roadway crash rates.

Potential to Impact Safety

This measure focused on identifying if proposed alignment design(s) has the potential to impact pedestrian and motorist safety, with an emphasis on each alignment's potential to improve conditions. A qualitative score based on potential to improve safety for both pedestrians and motorists was derived.

This metric is selected as a way to equivalently compare each alignment using concepts at the time of the evaluation. The three sections of each alignment which differ are defined in Section 2.5.2.1 which do not differ between alignments, (i.e., Rivers Avenue between University Boulevard and Cosgrove Avenue) are excluded from this analysis, as they would not affect the cumulative score.

Pedestrian safety was based on new signals (especially at locations with a history of pedestrian crashes), the potential to improve pedestrian infrastructure (crosswalks, sidewalks, mid-block crossings), and the potential for median refuges to be installed. Motorist safety was based on new signals (especially at locations with a history of severe or fatal crashes), access control at unsignalized intersections due to medians, and the need for ITS countermeasures to aid in the safe operations and maintenance of the dynamic lanes.

Data used in this evaluation includes the 2015-2019 crash records provided by SCDOT, and best known design concepts at the time of this evaluation. The safety impact potential was scored for each alignment by first sub-dividing each section outlined above into individual

segments characterized by the assumed design concept for each. For more information, see Appendix D. Once sub-divided, each individual roadway segment of the sections defined above was scored qualitatively on a scale of 1 to 5 for both pedestrian safety and motorist safety.

The pedestrian and motorist scores were then added together to create a score between two and 10 for each individual roadway segment. Those scores were aggregated into a section score weighted by segment length for comparing the different alignment options. The score for each comprehensive LCRT alignment alternative was then calculated by summing these weighted average section scores to arrive at a total cumulative alignment score. See Appendix B for a detailed explanation of how these scores were assigned.

For instance, the cumulative alignment score for Alternative 1 is calculated as the sum of the weighted average section scores for the section of US 78 between the interchange with I-26 and US 17A, the section along Rivers Avenue and King St/King St Extension between Cosgrove Avenue and Mount Pleasant Street, and the section downtown along Meeting Street and Calhoun Street between Mount Pleasant Street and the hospital district.

Transit Connections/Integration

The LCRT study areas has existing transit service as part of a larger service operation. To maximize the mobility opportunities for the region, the LCRT should integrate into the rest of the public transit network to provide customers convenient and seamless transfers between routes. This convenience saves travel time for the customers. This analysis took the sum of the total number of connections to existing transit routes within the ½-mile of a station area.

Reliability

Dedicated Right-of-Way

The goal of the project is to move vehicles efficiently through the corridor, to accomplish this the project is trying to emulate the features of a rail project with guideway features. Specific to BRT and the CIG program for FTA identifies Fixed Guideway BRT where the majority of the corridor (50% or more) operates in a separate, dedicated right-of-way for public transportation use during peak periods. A semi-exclusive guideway includes portions of dedicated guideway and portions of mixed-traffic. The LCRT project must meet the FTA CIG requirement have at least 50 percent or more its operation in a dedicated guideway. Transit reliability and travel time savings can be directly tied to the treatment of the guideway. The project team for this analysis is using two terms exclusive and partial. Locations where the vehicle travels in its own travel lane it is exclusive. If there is a time dependent aspect where the BRT lane only operates in a direction during a peak hour then it is defined as partial. To complete this analysis, the project team utilized the percent of each alignment in exclusive and partially exclusive guideway.

Railroad Crossings and Disruption to Service during Peak Periods

The Charleston region has seen and continues to see sustained growth. Part of that growth includes a very active port system. The Port of Charleston is one of the largest ports in the country and many freight trains come in and out of the Port. There are several very active railroads along this corridor. The activity along each of these lines can have a negative impact

on transit reliability. Therefore, to better understand the potential impact to speed and reliability of the BRT service, the project team measured the total number of active at-grade railroad crossings along each of the 12 alignments. The following summarizes the location and number of existing at-grade railroad crossings that the BRT project crosses.

- Downtown Summerville – (1) one crossing along Main Street
- Rivers Avenue – (2) two crossings (one at Taylor Street, and one near Durant Avenue)
- King Street – (1) one crossing at Discher Street
- Meeting Street – (3) three crossings (one at Cherry Hill Lane, one at Milford Street, and one near Cunnington Avenue)

The project team continues to coordinate with the SCDOT and the railroads to establish relationships and gather relevant data to better inform the BRT project.

Travel Times

Travel Times during the PM Peak Period

Planning level travel time estimates, i.e. how long it would take the LCRT to travel from end point to end point, were developed for the 12 alignments. The travel time by alignment took into account:

- i-26*ALT* study running time: the study identified a 60 minute travel time from the Town of Summerville to the Line Street and Meeting Street proposed end of line.
- Alignment length: the average of the north and southbound in-revenue service length of each alternative.
- Distance between stations: the distance between the BRT stations using the alignment known above.
- Posted travel speed: the posted travel speed in the corridor which varied by area along the alignments.
- Span of service: the total number of hours of service in the day
  - The span of service was based on the i-26*ALT* Recommended Alternative service plan, see Table 1.5.

Table A.5 Span of Service by Time Period

Span of service by time period	
Weekday	4 AM – 1 AM
Saturday	6 AM – 1 AM
Sunday	7 AM – 11 AM

- Headway: the average interval of time between transit vehicles moving in the same direction on the same route.
  - The headways were based on the i-26*ALT* Recommended Alternative service plan, see Table 1.6.

Table A.6 Frequency by Time Period and Day of Week

Frequency by Time Period and Day of Week					
			Weekday	Saturday	Sunday
Peak	6 AM – 9 AM	4AM - 7PM	10 min.	20 min.	30 min.
Base	9 AM - 4PM	7PM - 9PM	20 min.	20 min.	30 min.
Early/Late	4AM - 6AM	9PM - 1AM	30 min.	30 min.	30 min.

- Vehicle acceleration and deceleration: the speed and time a vehicle takes to reach maximum assigned travel speed and time needed to come to a complete stop, for this analysis 2.5 mph/s was assumed for both. This assumption is based on the specifications for the New Flyer xcelsior vehicle.[7]
- Boarding/alighting time: the time provided for passengers to board and/or exit the transit vehicle, for this analysis was 20 seconds.
- In person field time survey: field observations along each alignment and the distance it would take to travel in a vehicle the full length of the alignments traveling at the posted speed limit.
- Travel Time – Single Occupancy Vehicle (SOV) on LCRT Route: Google maps allows the opportunity to identify day of week, time of day, and direction of travel analysis as well as expected congestion and delays in the corridor.

The level of service information was also used to develop annualized operating costs and peak vehicle needs. The following inputs were used to develop the annual operating costs for the 12 alignments:

- One way end to end travel time for each alignment based on the average of the northbound and southbound travel time.
- Vehicle cycle time including a 10% vehicle layover factor.
- Distance for each alignment based on the average of the northbound and southbound alignment distance.
- Days of service: 252 weekdays, 52 Saturdays and 61 Sundays / holidays
- Level of service per day of week taking into account peak and off peak hours per day and peak and off peak headways.
- A $90 per hour estimated operating cost per hour from the i-26*ALT* study.

For comparison purposes a travel time comparison between vehicular travel and the LCRT travel times and an on-time performance review of Route 10 was done, see Appendix C.

[7] https://www.newflyer.com/site-content/uploads/2017/10/Xcelsior-CHARGE-Competitive-Comparison.pdf

Average Distance between Stations

The distance between stations was used to better understand the potential impacts to passenger who would need to walk to stations. There are industry best practices for station spacing, however, every community is different and these best practices were only used as a guide.

The project team used this guidance to understand the current average distance between stations for each of the 12 alignments. Currently there are 27 total stations and the distance between the stations varies. As the project progresses through the NEPA phase, the project team will utilize this information to optimize the station distances along the preferred alignment. The analysis measured the distance between each station for each alignment and then took an average.

A.2.6 Support Economic Development Plans Along the Corridor

Population and Employment

Existing Employment

Providing employees with transportation options is a critical component to a comprehensive transportation network. One of the goals of this project is to ensure that it can serve the major employment hubs within the Charleston region. Several of the region's largest employers are located along the corridor. To complete this analysis the project team used a ½-mile buffer around the stations, which is considered an industry standard walk shed, or a 10-minute walk from the station stop. The resource used for this analysis was the US Census Longitudinal Employer-Household Dynamics dataset.[8]

Existing Population

Similar to the employment analysis, providing access to premium transit service is part of a comprehensive transportation network and to better understand how the project could serve the existing population, the project team used the sum of the total existing population within ½-mile of each station area (walk shed) along each of the 12 alignments. The resource used for this analysis was the US Census American Community Survey dataset.[9]

Ridership Potential

Ridership Generators Served

Key activity centers are ridership generators. This analysis identified activity centers within the LCRT study area within a ½-mile radius of each station area based on three types of activities: regional centers, corridor centers, and neighborhood centers. Regional centers include hospitals, colleges/universities and interstate transit facilities (e.g. Amtrak). Corridor centers include shopping centers, clinics, and civic centers. Neighborhood centers include community centers, K-12 schools, and local parks.

[8] https://lehd.ces.census.gov/data/

[9] https://www.census.gov/programs-surveys/acs

Total Ridership from FTA STOPS Model

STOPS is a ridership estimation modeling tool designed exclusively for fixed guide-way systems such as commuter rail, light rail, subway, BRT and streetcar. It was developed by FTA to assist project sponsors in developing ridership forecasts for their New Starts or Small Starts projects. It is also used by FTA to evaluate ridership forecasts for all projects (whether they use STOPS or any other tool) applying for New Starts and Small Starts funds on a level playing field.

STOPS model mimics the standard four-step modeling process used by most planning agencies. Some of the major inputs STOPS model uses include:

- Census journey to work trip flow data
- Transit schedules -general transit feed specification (GTFS) format
- Local population and employment data
- Highway travel time data

The model is designed to produce all the travel demand related statistics required for New Starts/Small Starts submission. To support the LCRT ridership analysis, a STOPS model was used to test different alternatives. Several ridership statistics such as daily transit boardings, number of trips that switched modes from auto to transit, reduction in vehicle miles of travel (VMT) and station/stop boardings can be generated for each new alternative being analyzed.

On-Street Parking

On-street parking can be a vital asset to businesses and residents. Along the LCRT corridor, the majority of on-street parking is located in the Peninsula. The project is still in the early stages of identifying exactly where the BRT vehicles will operate within the right-of-way along each of these streets, however it is important at a high level to understand where the parking is and how it might be impacted. It is also good to complete this analysis now to better inform the future phases of this project.

To complete this analysis the project team utilized parking data that was compiled during the development of the Charleston Comprehensive Parking Study completed in January 2019. The study boundary and the data ended at Huger Street on the north side of the Peninsula. Since the alignments extend further north along Meeting Street, the project team completed a field visit to supplement the data and to improve its accuracy.

Once the field visit was completed, the project team evaluated the total linear footage of on-street parking that existed along each of the alignments where exclusive and semi-exclusive operations is assumed based on the design to date.

A.2.7 Project Viability, Costs, and Implementation

Technical Feasibility

When reviewing each of the alignments and the project's overall technical feasibility within those alignments, the project team considered many factors, including freight activity and the number of at-grade railroad crossings, flooding issues, existing infrastructure, and construction in a tight

urban areas. The score of the measure will later reduce the score based on more impactful issues. For example:

- From Nexton to the US 78 / I-26 interchange constructability issues were rated low if a bus on shoulder treatment is implemented due the reduced construction investment that would be required in comparison to other alignments. (minus 2 points)
- Along the King Street alternative, between Carner Avenue and Mount Pleasant Street, parallel running rail lines are located on each side of the roadway. Constructability issues are present along this entire section as coordination and approval from each individual rail company will be required to perform any work along this section of roadway. (minus 3 points)
- Along the Meeting Street alternative, between Carner Avenue and Mount Pleasant Street, there are three existing and one proposed rail crossings. Each of these rail crossings will require coordination and approval from each individual rail company to perform any construction work in the vicinity of these crossings. There is a significant cost to construction of any overpass, but even simple grade crossing modifications require significant coordination and create construction delays with flagging rules. (minus 5 points)
- Along the Meeting Street and Calhoun Street alignment in downtown Charleston, construction includes the replacement of existing traffic signal mast arms at intersections, and the addition of mast arms mid-block to accommodate the proposed reversible lane option for BRT. Given the high amount of development and potential utility impacts, there may be minor constructability issues associated with this alternative. (minus 2 points)
- Along the Lowline, constructability issues include stakeholder coordination with proposed reactivation of the corridor including potential hazardous materials within the former rail corridor. Along the Meeting Street and Calhoun Street alignment in downtown Charleston, there are existing drainage and flooding issues present, see Figure 1.2 (minus 2 points)
- From a review of data since 2015 from the City of Charleston, there is on average three to four times per year that Calhoun Street is closed (Figure 1.2). There are significant more closures of the side streets between Smith Street and Lockwood Drive, but these side street closure events are not anticipated to impact the BRT operations. As part of the LCRT project, mitigation to address these drainage and flooding issues are a potential requirement of project development which increases the overall costs and presents constructability issues for this alternative. (minus 2 points)

There were 22 closures of Calhoun Street due to flooding from August 2015 until December 2019. There were also at least 22 events that partially flooding the corridor over the same timespan but did not resulting in traffic closures. As part of the LCRT project, mitigation to address these drainage and flooding issues are a potential requirement of project development which increases the overall costs and presents constructability issues for this alternative. (minus

2 points). Although not a factor in the selection criteria in this subsection, the Hagood Avenue Extension roadway improvement was analyzed per stakeholder request. The results of the analysis are documented in Appendix F.

Figure 1.2 Downtown Charleston Flooding Typical Areas

Financial Sustainability

Operating Expense (OPEX) per Rider

This measure focused on the magnitude of operating cost per rider. The FTA CIG New Starts program categorizes the operating cost per rider as a cost effectiveness measure for project evaluation. The LCRT operating costs were estimated for each alignment based on alignment length and assumed inputs such as days of service, level of service, vehicle operating speed and number of stations. Ridership comes from the STOPS ridership model runs done for each alignment. This analysis helped identify those alignments that had the strongest cost per rider benefit for the project. The operating costs per rider should not be considered a formal estimate of operating costs, further operating cost refinement will occur through the next steps of the project.

Total Cost per Rider (Capital Cost)

This measure focused on the magnitude of total capital costs for each alignment. Capital costs for the project were estimated using FTA's Standard Cost Category (SCC) template. All major

transit investments potentially pursuing federal funding through the FTA grant programs must organize project costs according to the agency's SCC structure. The SCC ensures that capital cost estimates can be fairly compared from one project to another. The most recent FTA capital costing format was used for providing totals for each category as required for New Starts funding, which the LCRT is expected to pursue. Unit costs for each category were developed based on local data from previous projects. This analysis yielded "order of magnitude" cost estimates to provide a general framework for comparing the alignments. These capital costs should not be considered a formal estimate of costs and are not for programming purposes, additional work is needed in the next phases of the project in order to take them to that level.

Beyond the costs developed for this alternative refinement analysis, an additional estimate was developed to understand order of magnitude capital costs for improvements along US 78, between Berlin G Myers Parkway and the US 78 / I-26 interchange. The current proposed operating configuration has BRT in mixed-traffic. From the intersection with Berlin G Myers Parkway to Market Road, US 78 consists of a two-lane roadway with roadside ditches. Widening the roadway to add exclusive BRT lanes along this section was evaluated. To widen the roadway to allow for exclusive BRT lanes, the project cost would increase by at least $60 million plus soft costs such as professional services, contingencies and contractor mark-ups. The planned improvements would involve widening US 78 from the existing two lanes to a typical section that provides two lanes for general purpose traffic, two lanes for BRT guideways, curb and gutter with closed drainage, and six foot wide sidewalks on both sides of the roadway.

An alternative to the Nexton alignment is to have the BRT operate in a shoulder lane when the speed of the mainline lanes fall below 25 mph. The bus would operate no higher than 40 mph. Bus on shoulder transit operations helps reduce the variability in transit travel speeds and increases reliability. The cost of this addition includes widening the two overpass bridges at Royal Road and College Park Road. The shoulder widths are too narrow to safely operate on the shoulder in these areas. Additionally, several other upgrades including ITS sensors to observe any lane blockages. The cost of this is approximately $45 million plus soft costs.

A.3 Maximum Rating and Scoring Refinement

The analysis reviewed specific measures and areas of each of the 12 alignments in order to understand and highlight key differences in the alignments and to advance one alternative into NEPA analysis and documentation with the intent to make the LCRT a competitive project for the FTA CIG rating criteria. After selection of the measures and the gathering of the data inputs, the next step in the process included scoring each criteria for each alignment. The analysis resulted in a final score per alignment by adding the score for each criteria, with a total possible score of 350 points. After the analysis, the score of each alignment was compared against the others. Only the top ranked alignments were considered to warrant further analysis through the NEPA process.

A.3.1 Maximum Rating of Measures

Using the measures identified in this memo, the analysis was completed for the 12 end-to-end alignments, and the stations associated with each one (note: number of station areas varies per

alignment). Points were assigned for each measure based on an assessment of their relative importance to stakeholders input beginning since i-26*ALT* study (e.g. development of purpose and need as well as stakeholder and community input through Phase 2).

The maximum rating for each measure was based on an assessment of their relative importance to stakeholders, NEPA review, and overall project FTA CIG rating. The maximum rating was assigned by giving a higher maximum possible score to measures with greater priority, and a lower maximum possible score to measures with lesser priority. These maximum rating scores ranged from 5 to 30 and resulted in the total possible score of 350, as mentioned above.

The maximum ratings for each measure used to evaluate LCRT alignments are similar to those applied in the CHATS Long Range Transportation Plan (LRTP) project evaluation criteria and methodology, which are used in evaluating and prioritizing roadway improvement projects. Differences between the LCRT maximum rating and the CHATS LRTP criteria are due to the purpose and need of this BRT project and the FTA rating used to evaluate CIG projects. Established FTA guidelines include an increased level of up-front environmental review during the project development process in order for a project to enter into engineering as part of the competitive CIG program. Although additional emphasis is placed on environmental review, the measures and maximum rating included in the LCRT Phase 2 alignment refinement process incorporate each of the 12 criteria developed for the project evaluation conducted by CHATS.

A.3.2 Scoring of Measures

Once the maximum rating for each measure was defined, each alignment was scored. These scores were based on the value of each alignment's performance on each measure, for example, potential ridership. (It should be noted that the analysis uses both quantitative and qualitative measures, based on data availability. Qualitative measures received a score based on individual assessments as described in Section 2, while quantitative measures were assessed based on their direct numerical performance, such as total project cost.) These values were used to score the alignments between 0 and the maximum score for each measure, based on a statistical method which was developed for the project and is described below.

The score for each measure was based on interpolating along a trend line generated by assigning scores to the average value for that criteria and to the values one and two standard deviations away from the average. The average measure value was set to correspond with 60 percent of the highest rated score. Measure values equal to or greater than one standard deviation higher than the average for that measure corresponded to the highest rated score. A measure value one standard deviation below the average corresponded to 40 percent of the highest max rating, and a value two standard deviations below the average corresponded to 20 percent of the highest score. Beyond two standard deviations below the average, the maximum rating went toward zero.

See Figure 1.3 for an example of how this process was developed and implemented for the "employment" measure. The maximum score for employment was 20 points, which is assigned to correspond with approximately 50,500 jobs; the maximum of 20 points is one standard

deviation above the average value for the employment metric across all the alignments. The average of the employment metric was approximately 43,500 jobs; an alignment with 43,500 jobs received a score of 12, which is 60 percent of 20 points; and so forth. The actual scores that each alignment received for employment were based on interpolation along this trend line in the example below.

The purpose of this methodology was to limit the qualitative subjectivity. Using a method of trend analysis gives repeatability for each of the measures. All but one of the measures, constructability, implemented a value-based comparison. By using the 60, 40, and 20 percent correlations, the method attempted to cause measures above one standard deviation to be less impactful to the score, but measures below one standard deviation to demonstrate a significant loss of points.

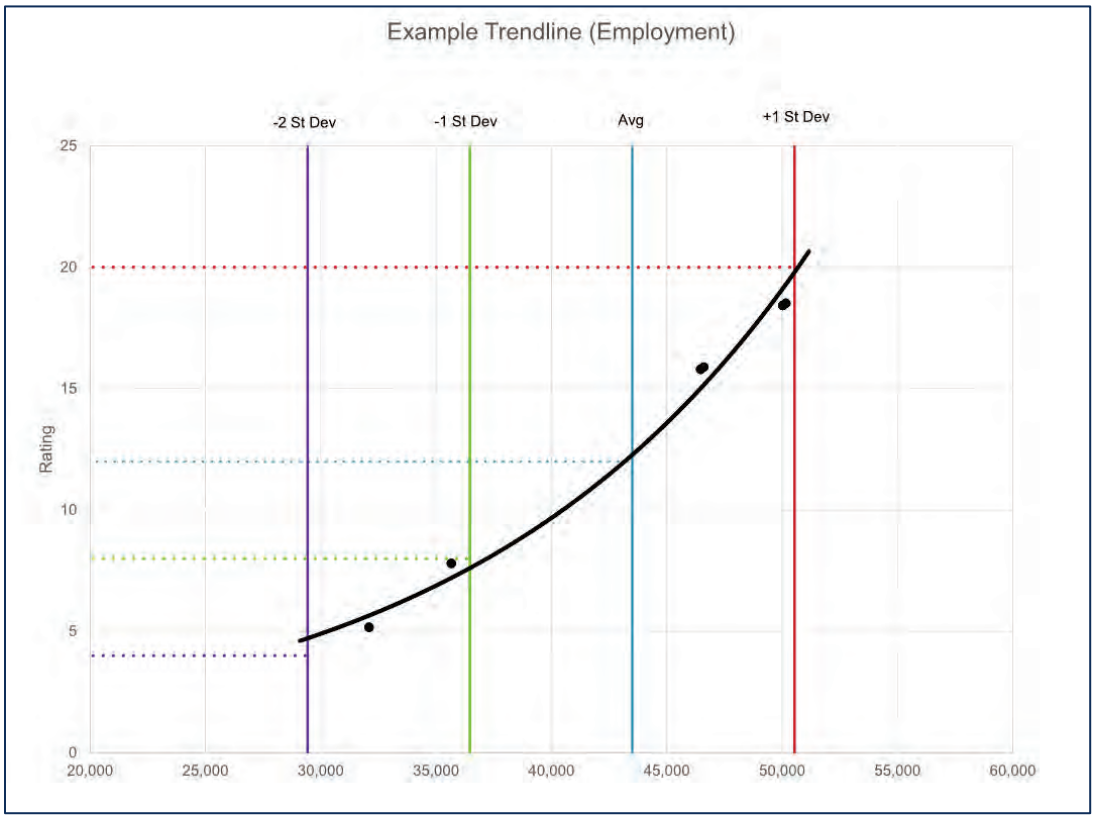
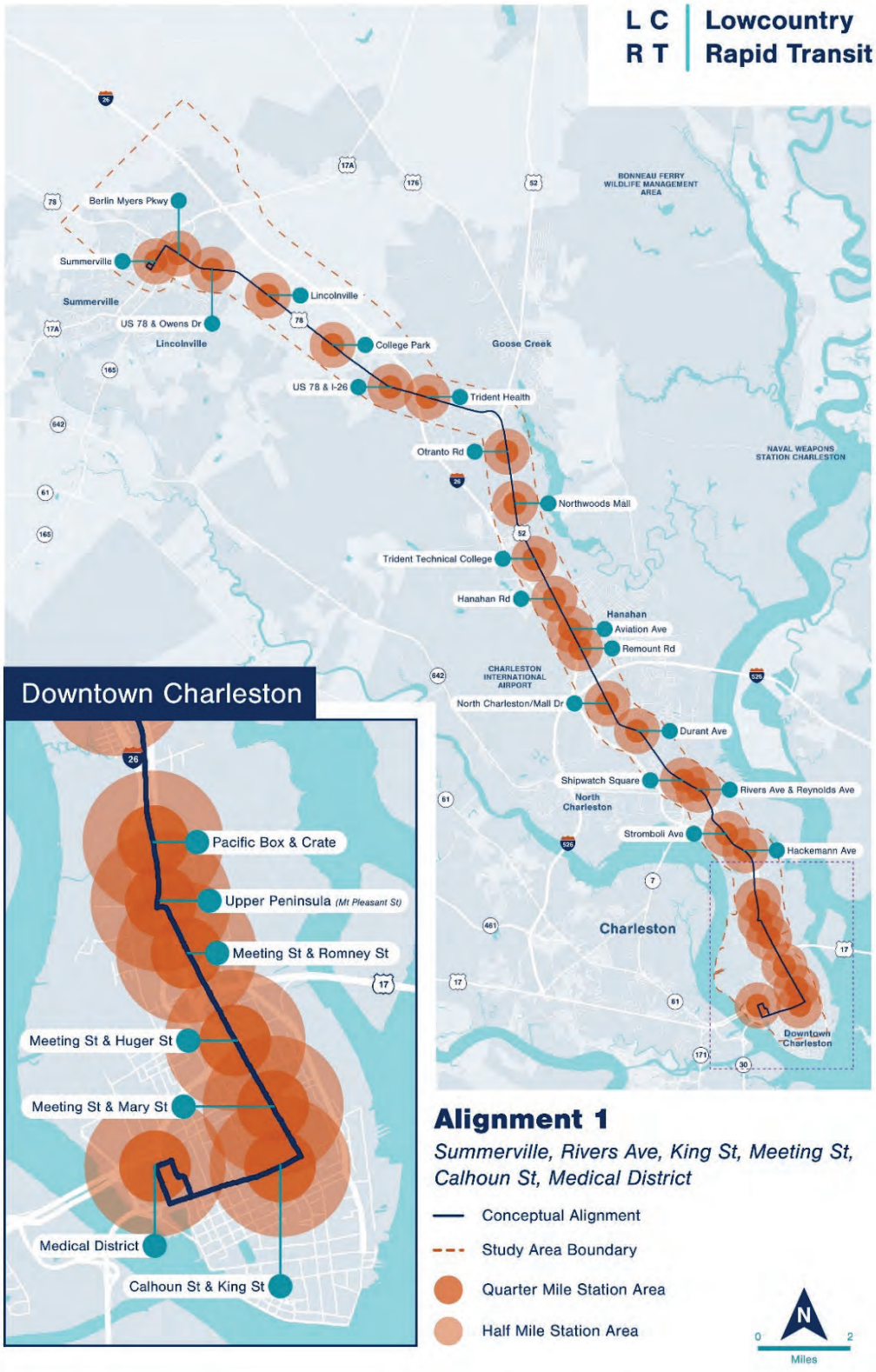
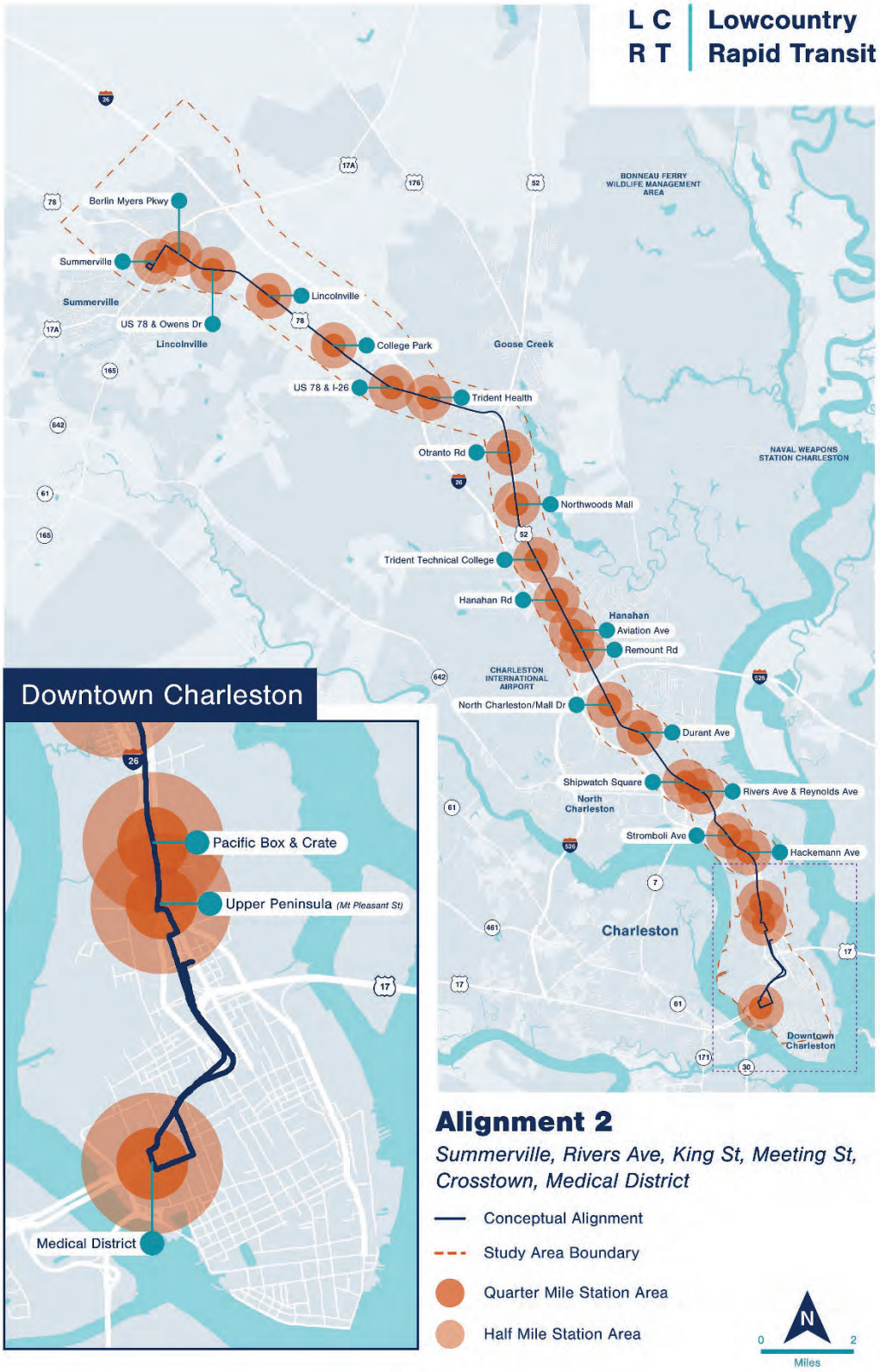


Figure 1.3 Example of Score to Demonstrate Standard Deviation

A.4 End-To End Alignment Evaluation

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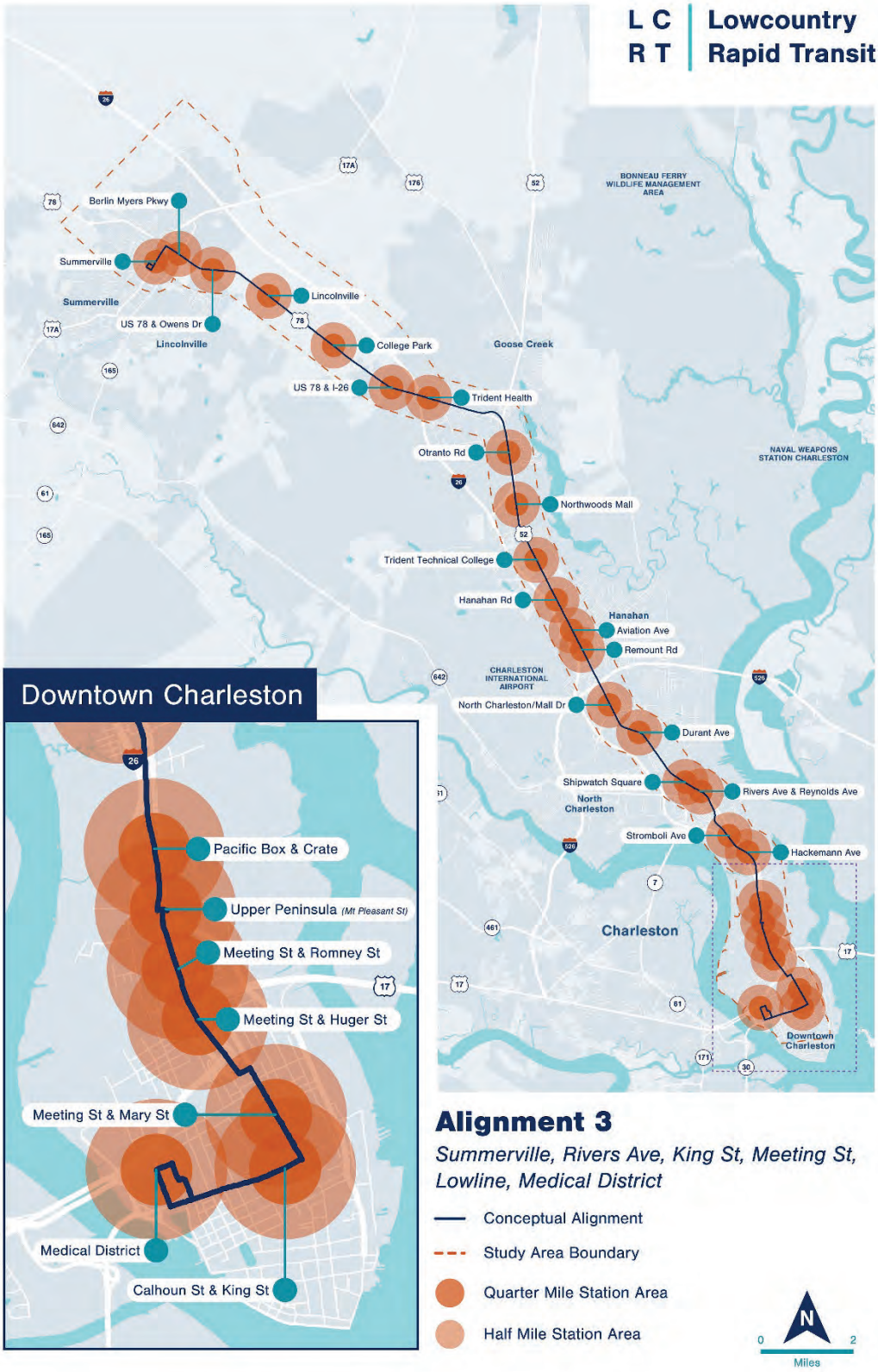
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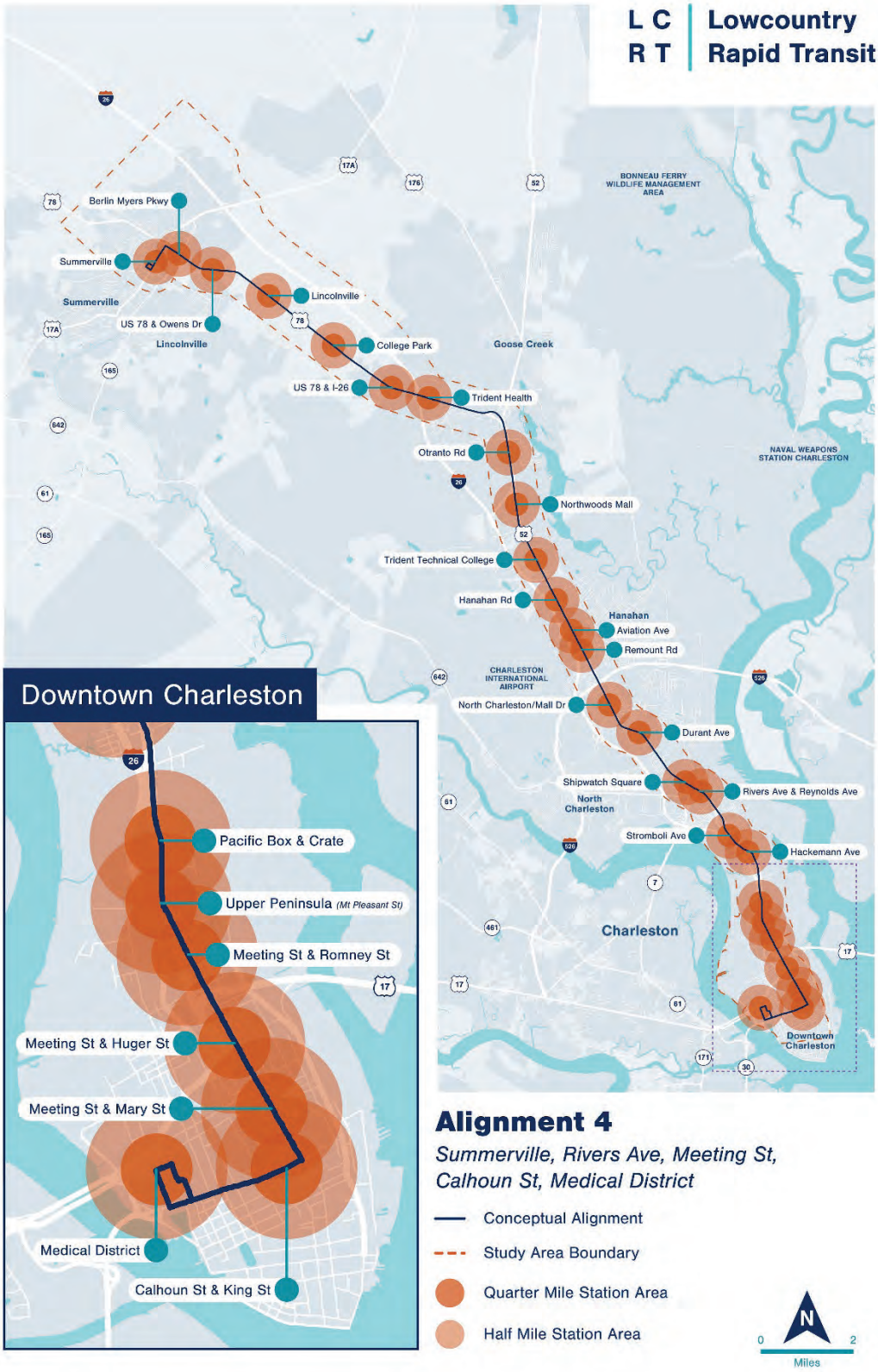
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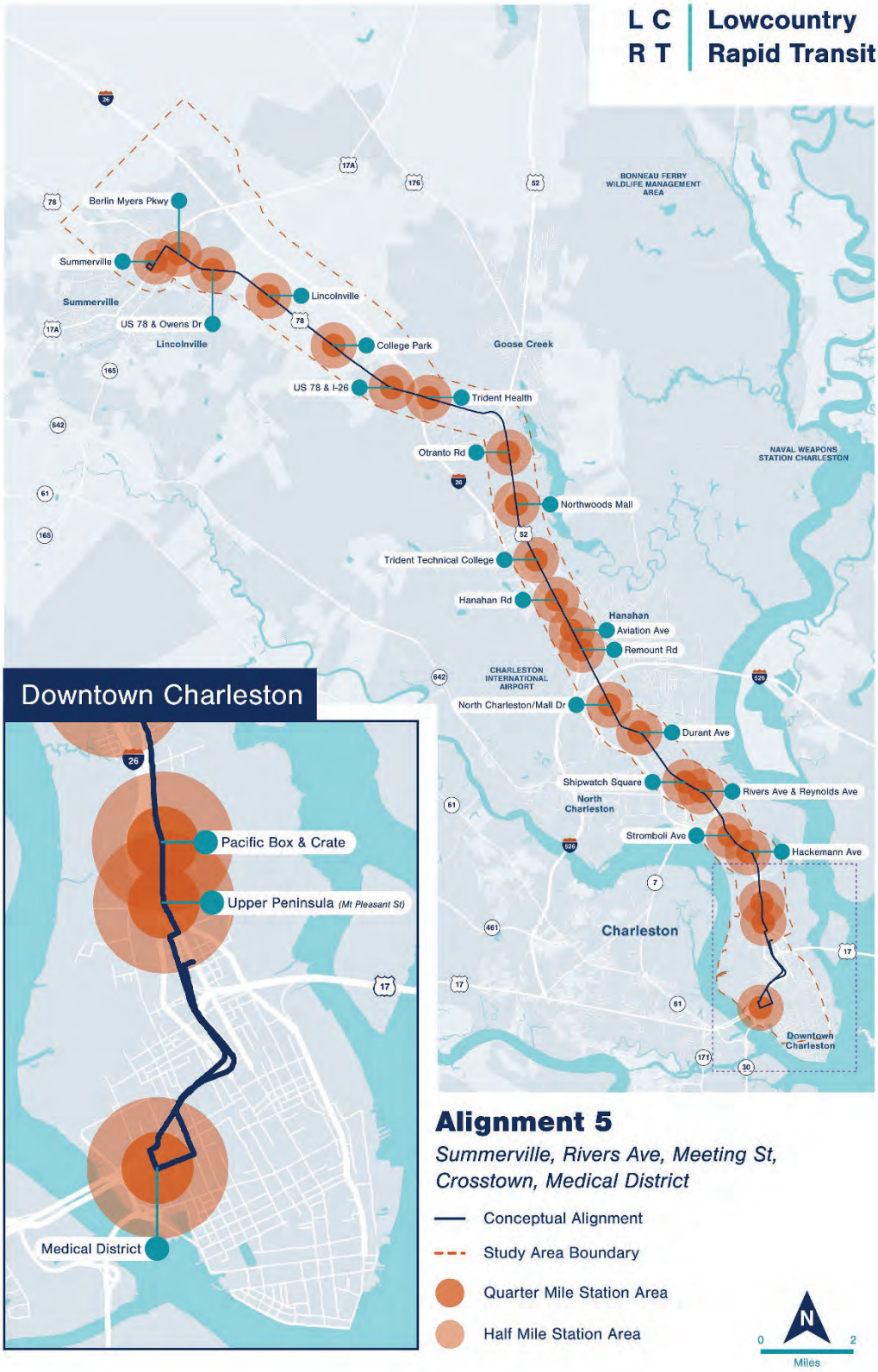
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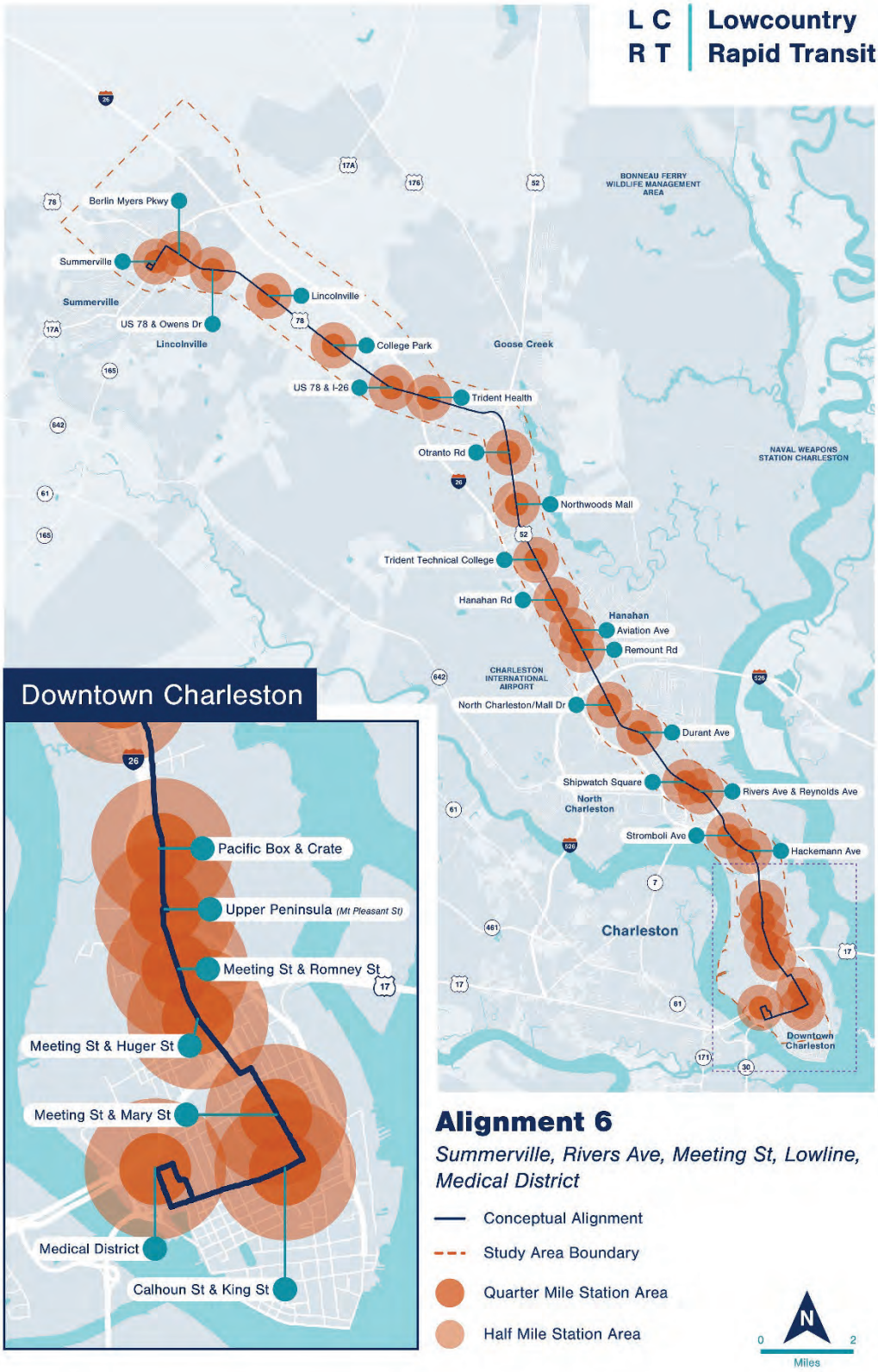
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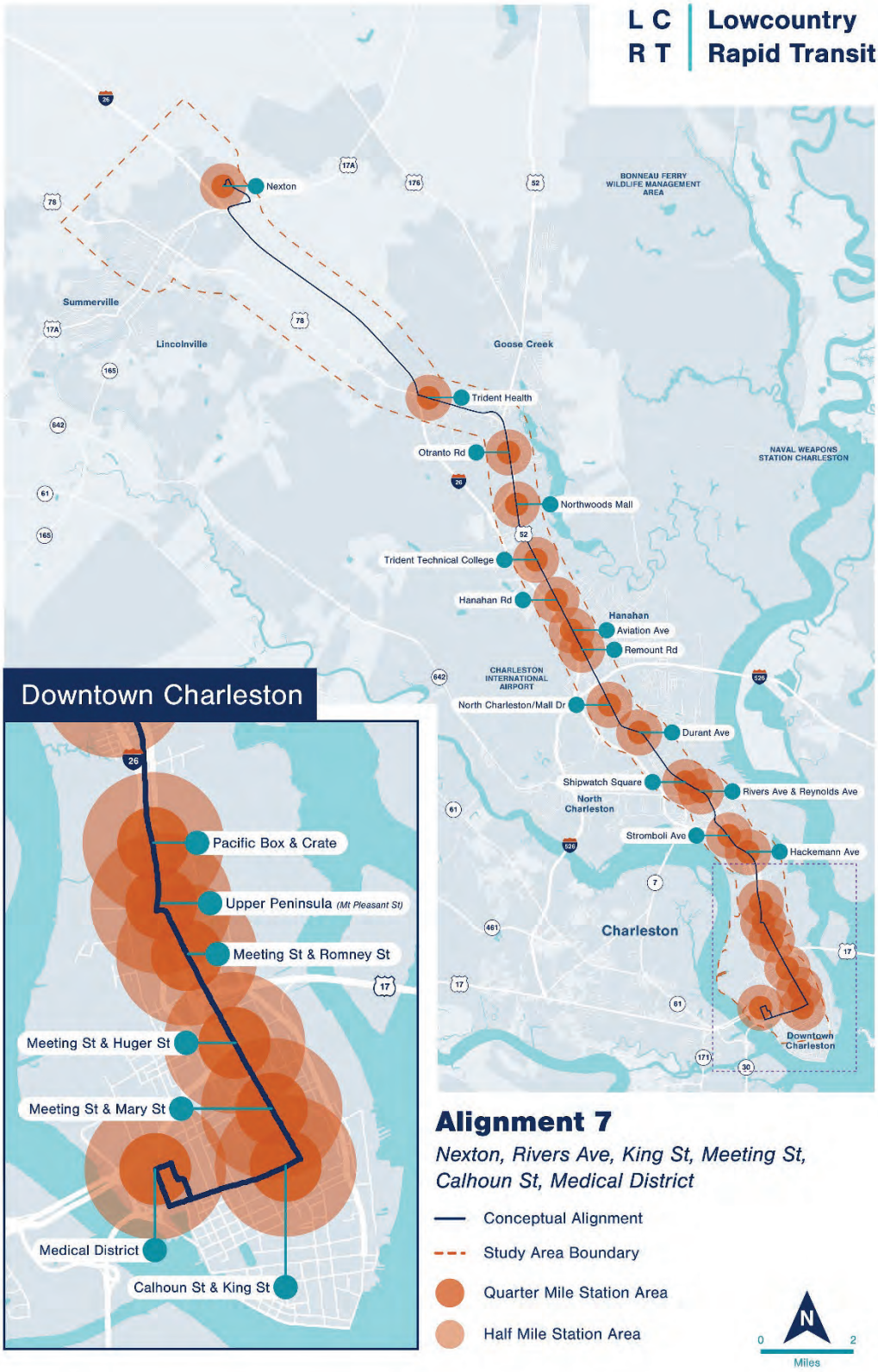
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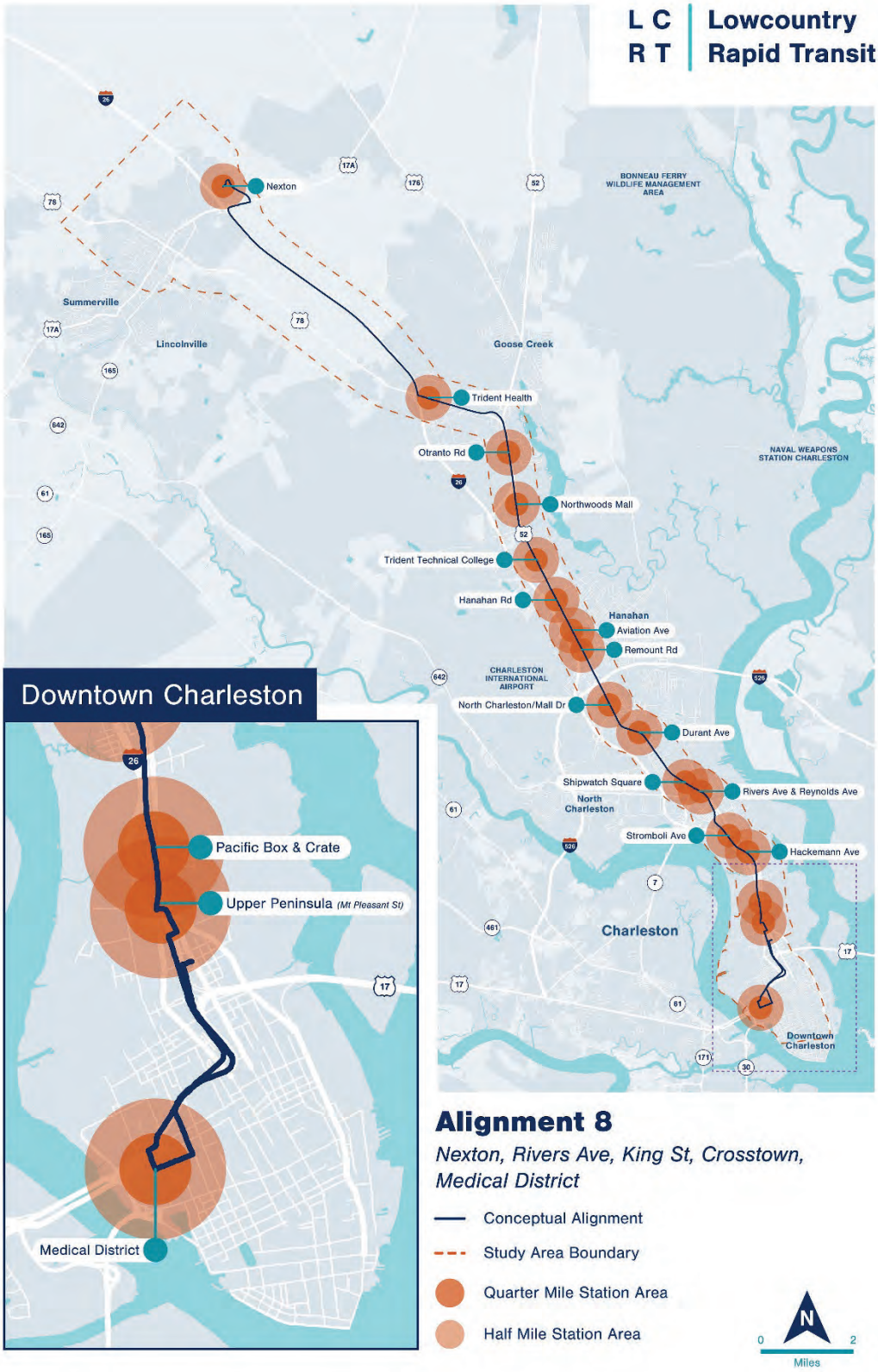
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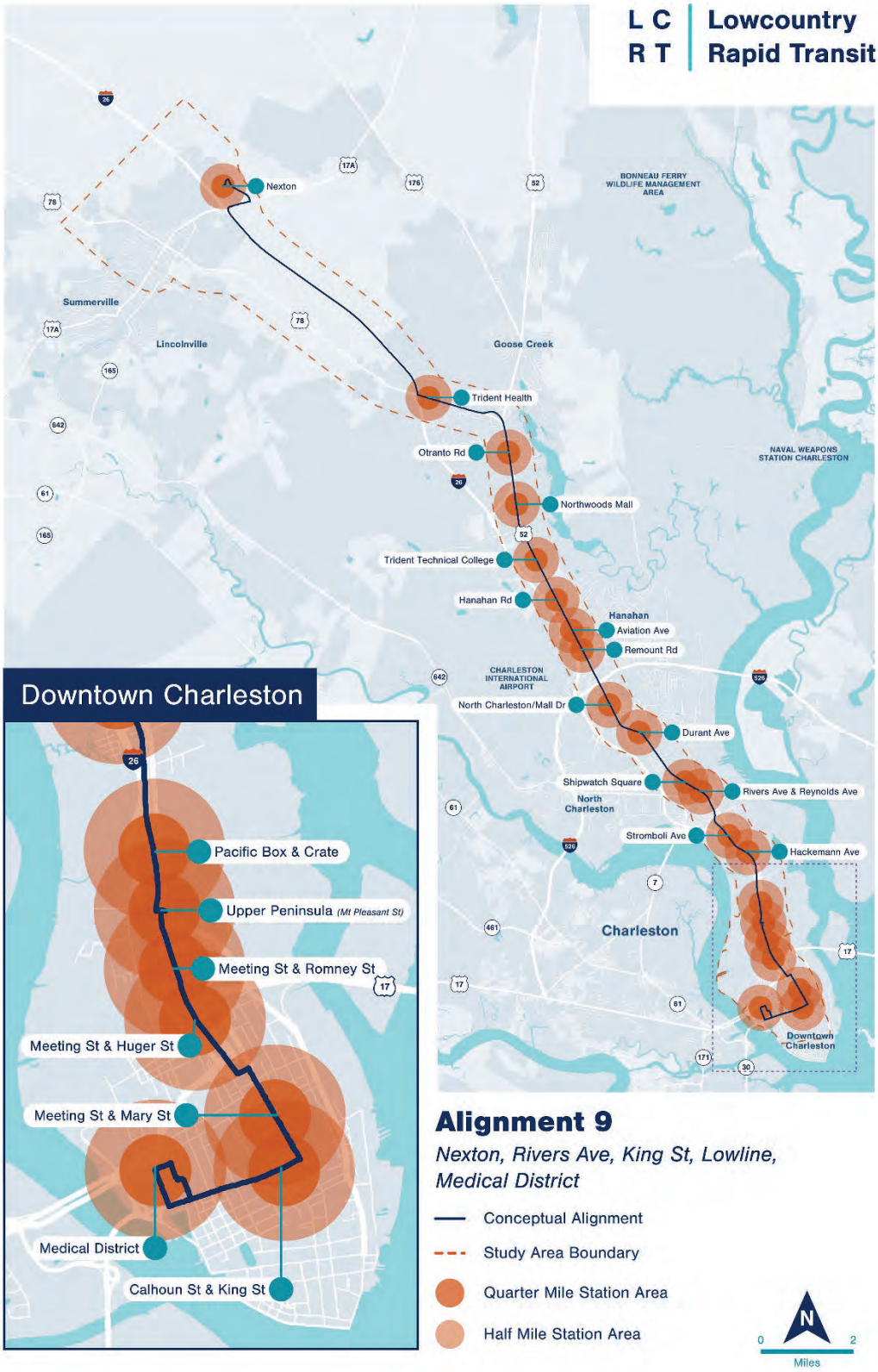
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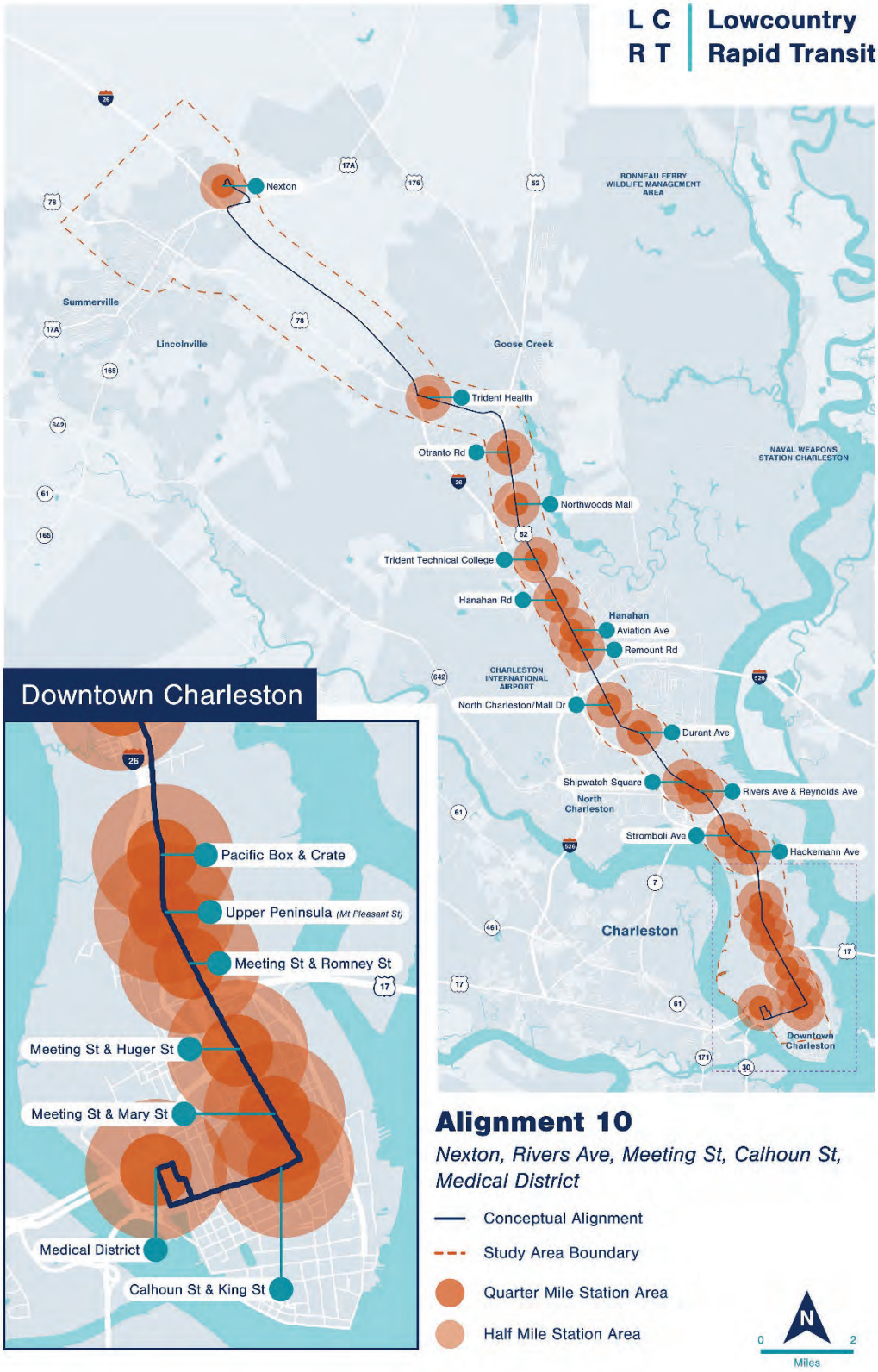
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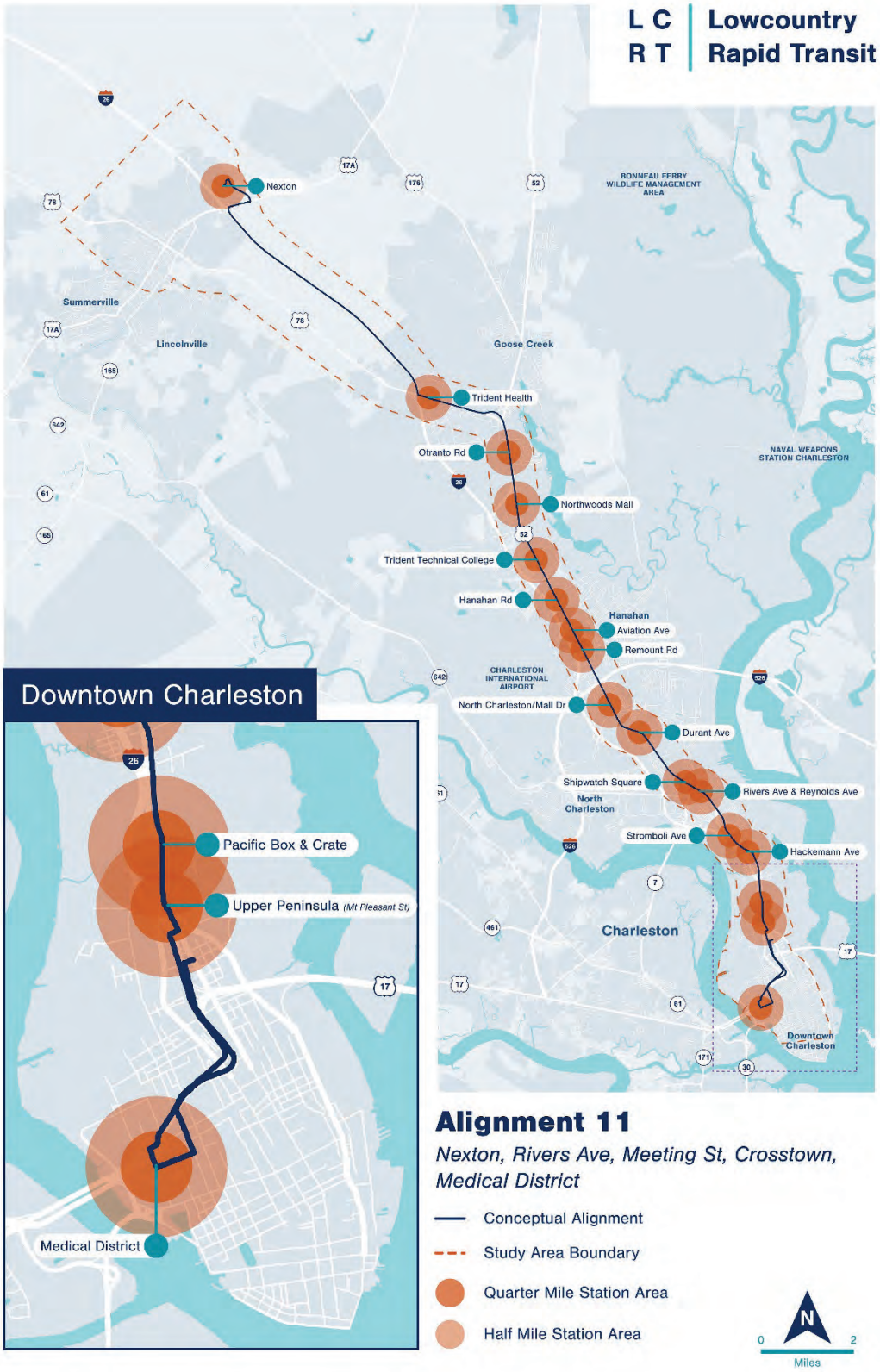
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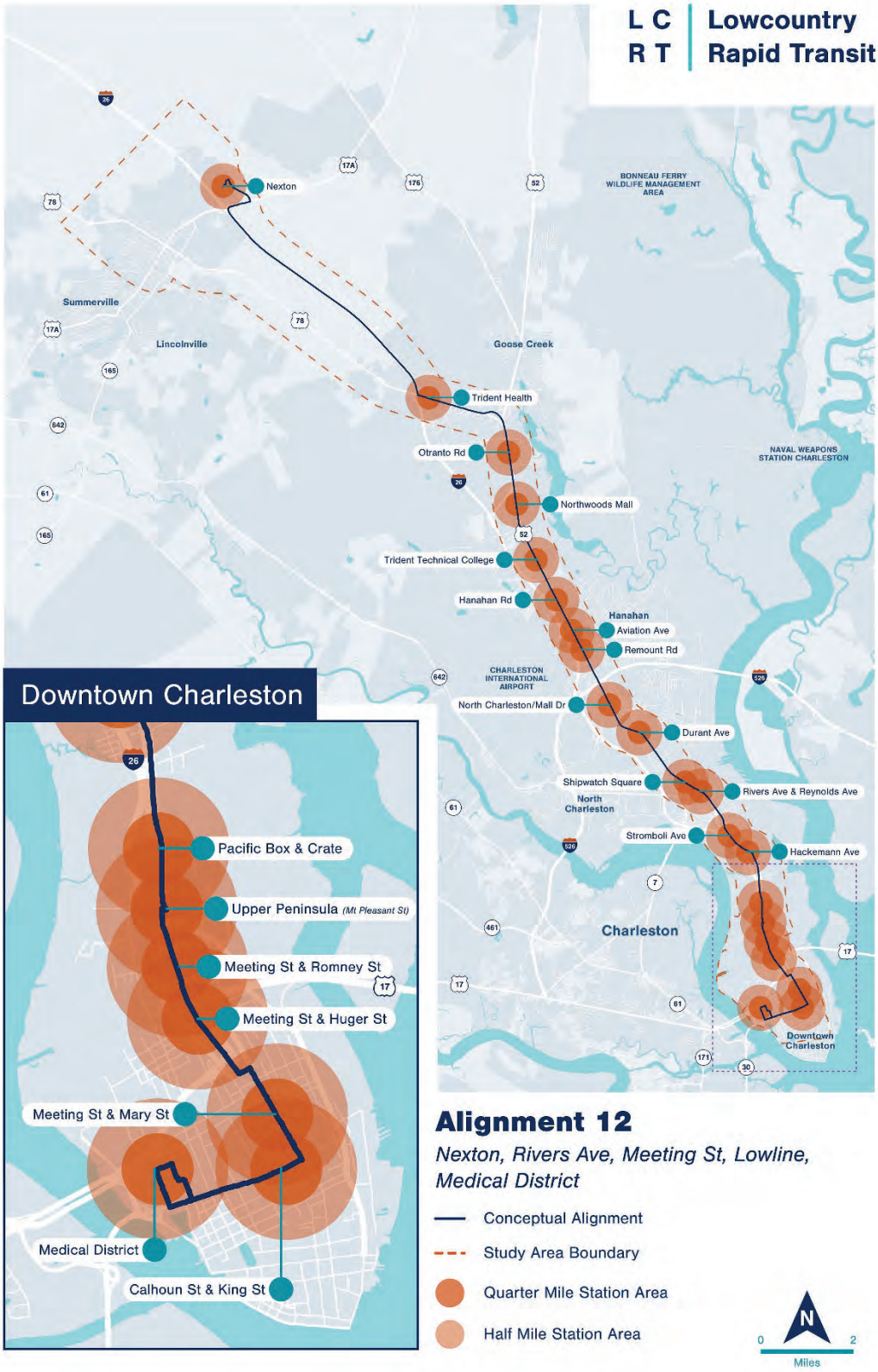
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Downtown Charleston
Pacific Box & Crate
Upper Peninsula (Mt Pleasant St)
Meeting St & Romney St
Meeting St & Huger St
Meeting St & Mary St
Medical District
Calhoun St & King St
Alignment 12
Nexton, Rivers Ave, Meeting St, Lowline, Medical District
Conceptual Alignment
Study Area Boundary
Quarter Mile Station Area
Half Mile Station Area
N
0
2
Miles

L C
R T

Appendix B: Guideway Treatment Analysis

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

August 10, 2020

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Acronyms and Abbreviations

BAT	business access and transit
BCDCOG	Berkeley-Charleston-Dorchester Council of Governments
BRT	bus rapid transit
CIG	Capital Investment Grant
DCE	Documented Categorical Exclusion
FTA	Federal Transit Administration
i-26*ALT*	I-26 Fixed Guideway Transit Alternatives Analysis
LCRT	Lowcountry Rapid Transit
mph	miles per hour
NEPA	National Environmental Policy Act
ROW	right-of-way
TSP	transit signal priority

B Guideway Treatment Analysis

B.1 Introduction

The purpose of this memo is to document the process and recommendations for the most optimal guideway treatment for the Lowcountry Rapid Transit (LCRT) project corridor. The memo also describes the multi-step process employed to identify the "best lane" guideway treatment for LCRT; the potential impacts to vehicular traffic within the corridor; and the identification of safety treatments and accessibility improvements along the corridor for all customers (motorized and non-motorized).

B.2 Background

The Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) is planning the addition of a bus rapid transit (BRT) system for the LCRT project, serving residents and visitors to Charleston, North Charleston, and Summerville. Funding for the project will likely include a mix of Federal Transit Administration (FTA) funds and local funds.

B.2.1 Alternatives Analysis Process to Date

Several planning efforts have been completed as part of the analysis process to this point. These include the I-26 Fixed Guideway Transit Alternatives Analysis (i-26*ALT)* study, the Alignment Options and Study Area, and the LCRT Phase 1 Analysis. These planning efforts have been a systematic process of increasingly detailed analysis to develop a project that addresses the LCRT's purpose and need. For this guideway assessment, these past studies help inform the optimal configuration of the proposed corridor to sustain transit reliability into the future while maintaining vehicle throughput and access to adjacent properties by other forms of transportation.

B.2.2 Importance of BRT Guideway and FTA CIG Project Definition Criteria

The FTA's discretionary Capital Investment Grant (CIG) program provides funds for fixed guideway transit investments, including corridor-based BRT projects that emulate the features of a rail project. Specific to BRT and the CIG program, FTA defines two forms of BRT: Fixed guideway BRT and corridor-based BRT. While there are similarities between both forms of BRT project types, there are subtle differences between them that can have a significant effect on a project's definition and subsequently affect the approach taken when pursuing CIG funds. Table B.1 provides a definitional framework from FTA of what distinguishes a fixed guideway BRT project from a corridor-based BRT project.

The LCRT BRT project is pursuing an exclusive fixed guideway BRT due to funding and its higher level of performance enhancement. Consideration of and conformance to the CIG definition is important in the decision-making process because the project must meet the FTA's outlined criteria. Many areas of the corridor provide ample right-of-way (ROW) of center medians; dedicated guideways are preferred.

B.2.3 NEPA Evaluation

Based on information developed and submitted as part of the Phase 1 efforts, FTA determined the LCRT National Environmental Policy Act (NEPA) class of action would be a Documented Categorical Exclusion (DCE). Through the development of the DCE, environmental impacts associated with the selected build alternative will be assessed, avoided or minimized (when possible), and documented. It is anticipated that through this early design work, the selected alternative will minimize these environmental impacts to the extent practicable, and be modified to accommodate stakeholder or public input where necessary. This design progression is a standard component of the NEPA process when advancing concept plans and entering into engineering and development of 30 percent design plans.

Table B.1 BRT Definitions in Fixing America's Surface Transportation Law Requirements

Fixed Guideway BRT	Corridor-based BRT
Majority of the corridor (50% or more) operates in a separate, dedicated ROW for public transportation use during peak periods (exclusive or semi-exclusive).[1]	BRT operates in mixed-traffic.
Represents a substantial investment in a defined corridor as demonstrated by features that emulate rail including: • Defined stations • Traffic signal priority • Short headway bi-directional service (substantial part of weekdays and weekends) • Other features the Secretary of Transportation may determine	Represents a substantial investment in a defined corridor as demonstrated by features that emulate rail, including: • Defined stations • Traffic signal priority • Short headway bi-directional service (substantial part of weekdays) • Other features the Secretary of Transportation may determine

Source: Federal Transit Administration, 2018

[1] The FTA's definition of fixed guideway BRT does permit other traffic to make turning movements through the separated guideway if necessary.

The following terms are defined by FTA:

- **Defined Stations**: Provide sheltered waiting space that meets ADA accessibility criteria, with common passenger amenities (public furniture) and wayfinding/transit system information.
- **Traffic Signal Priority**: For guideway BRT projects, active signal priority for transit is required, while queue-jump bypass lanes or active signal priority is permissible for non-exclusive lanes.
- **Short Headway Bi-directional Services**: At a minimum, projects should strive to provide a 14-hour span of service on weekdays at headways of 15 minutes or less during off-peak periods, 10 minutes or less during peak periods, and 20 minutes maximum at other times (e.g., night service). On weekends, projects should strive to provide 10-hour spans of service, with 30-minute or less headways.
- **Other Features**: Any other features the Secretary of Transportation may determine are necessary to produce high-quality public transportation services that emulate the services provided by rail fixed guideway public transportation services. Included in this definition are separate and consistent brand identity to stations and vehicles from regular fixed-route service.

B.3 BRT Guideways

A number of transit industry design resources are available that discuss the definitions and application of different BRT running way designs. Among the resources relevant to this technical memorandum are the American Public Transportation Association's Bus Rapid Transit Working Group, which has published recommended practices on the design of BRT running ways as part of American Public Transportation Association's Standards Development Program. Additionally, the Transit Cooperative Research Program has published BRT design guidelines and *Transit Cooperative Research Program Synthesis 83, Bus and Rail Transit Preferential Treatments in Mixed Traffic.* Finally, the National Association of City Transportation Officials has published the *Transit Street Design Guide* that provides guidance on transit lane configurations in different environments.

A benefit of BRT compared to other high-occupancy transit modes is the inherent flexibility the mode offers to tailor the application within the existing built environment. According to American Public Transportation Association's BRT running ways report, "Running way types vary in the degree of grade separation and lateral segregation from general purpose traffic." BRT running ways are classified in this technical memorandum into two principal types: (1) exclusive and (2) semi-exclusive guideways. Within these types of BRT guideways are variations that may be considered. The National Association of City Transportation Officials' Transit Street Design Guide helps illustrate different configurations. See Figure B.1 for an illustration of various guideway treatments.

Figure B.1 BRT Guideway Treatments

B.3.1 Exclusive Treatments

Exclusive transit lanes enable transit vehicles to bypass traffic on busy roadways. While expensive to construct, the separation between automobiles and transit vehicles makes exclusive lanes one of the most important features of a successful rapid transit system. Drivers also benefit by not platooning behind stopped transit vehicles boarding or alighting passengers, and the higher transit speeds and reliable service encourage mode shift to transit. While not essential, many systems use some form of barrier to physically separate dedicated lanes from general traffic lanes to help keep unauthorized vehicles out. Common barriers include low

curbs, parking stops, or flex-posts to enable emergency vehicles to access the lanes or for a disabled vehicle to exit.

Dedicated or Exclusive Arterial Guideway

A dedicated guideway refers to a road or guideway dedicated to buses built in its own alignment or as a reconfiguration of existing arterial roadways. This can include at-grade and grade separated intersections with cross streets and free-flow ramps. These types of guideways are often physically defined using curbing or other low-profile barriers on the outside of the guideway to steer BRT vehicles. Depending on space, dedicated transit lanes should range between 11 feet to 13 feet wide. Lanes can be as narrow as 10 feet wide where vehicles are traveling slowly (particularly around BRT stations or in a constricted urban environment); however, this is not recommended often due to safety and operational considerations.

Figure B.2 Exclusive Guideway for Buses in Disney Springs, Orlando, Florida

Freeway Guideway

Most commonly located within the median that separates directional freeway traffic, the guideway's geometry is controlled by the geometry of the freeway. Free-flow ramps are used to access stations located on overpasses and/or for access to the urban street grid. High-occupancy vehicle or high-occupancy toll lanes mix transit and other vehicles and, while not providing as much exclusivity (such as a median busway), they do help transit maintain schedules. Where freeway lanes are already restricted, buses are sometimes permitted to use the outside shoulder lane of the general traffic lanes during peak or other periods. However, the use of the shoulder lanes can limit travel speeds as the roadway shoulders are often not designed and constructed for freeway speeds; impaired vehicles can cause blockages in the shoulder lanes that disrupt transit utilization.

Figure B.3 Minneapolis Metro Red Line in Center Median of Freeway ***Source: streets.mn***

B.3.2 Semi-exclusive Treatments

Semi-exclusive options are considered when ROW is limited, or in congested corridors where transit lane dedication is not possible for maintaining general traffic flow and safety. Semi-exclusive lanes take advantage of unused space on the roadway, and can often be implemented with minimal construction activity such as simple roadway restriping. The most common operational configuration is to allow permitted right turning vehicles from the transit lane. This configuration is called a business access and transit (BAT) only lane. It is important to note that semi-exclusive lanes are susceptible to traffic conditions where automobile traffic and transit are mixed.

Figure B.4 Semi-exclusive Lanes in Downtown Orlando ***Source: HDR Inc.***

Queue jump lanes are a treatment for BRT that can provide short segments of semi-exclusive lanes through congested signalized intersections. Queue jump lanes can be left-side or right-side lanes, depending on the operational needs. The most common configuration is to extend right-turn lanes, allowing the BRT vehicles and right-turns to move past congested through lanes. The BRT would have a trigger point that allows a phase to be inserted to move the BRT vehicle in front of the through traffic or dock at a far-side BRT station. Figure B.5 provides an example of the BRT queue jumping

Figure B.5 Queue Jump Lane, with Right Turn Lane to Station ***Source: HDR Inc.***

Mixed Traffic

In this configuration, buses and automobiles share roadway space. Often, this configuration is selected when there are restrictions on ROW space for lane expansion (either environmental restrictions or for cost reasons). Intersection treatments are most commonly viewed as the optimal improvement to deliver transit service in the corridor, through transit signal priority (TSP).[1]

Figure B.6 Mixed Traffic Lane Assignment in Metro Transit C Line, Minneapolis, Minnesota ***Source: HDR Inc.***

[1] Transit signal priority refers to traffic signal improvements that use technology to reduce dwell time at traffic signals for transit vehicles by holding green phases longer or shortening red phases.

Peak-hour Lanes

Peak-hour lanes are restricted lanes for BRT use only during morning and evening commutes for set time spans. Most commonly located along the curbside, peak-hour lanes use general purpose lanes or parking lanes (with or without loading zones) exclusively for transit. A challenge for these types of lanes is enforcement, as a single vehicle blocking the lane can dramatically affect transit operations. Figure B.7 shows the configuration of the Kansas City peak-hour lane. The lane control sign is shown in Figure B.8.

Figure B.7 Kansas City MAX in Peak Hour Shared Lane ***Source: mopublictransit.org***

Figure B.8 Peak Hour Sign for BAT Lane ***Source: nacto.org***

Bi-directional

Bi-directional BRT uses a single guideway controlled at either end by signal control. The BRT vehicle waits or dwells at a station or bypass area until it can be given the green signal to pass though the section in the other direction. This is a preferred strategy to bypass known congestion with limited ROW using a single lane (a 12-foot-wide lane being desirable). Headways that are over 5 minutes allow for a longer distance between multiple blocks. The signal system like those used in Albuquerque have safeguards that “block out” the section so that only one BRT vehicle can be in the section at a time. Bi-directional lanes can provide improved reliability over congested mixed-traffic operations. Bi-directional lanes also have constraints in terms of capacity, i.e., they can eventually accommodate only a limited number of BRT vehicles before the reliability degrades, which may have an impact on existing and future year capacity needs.

Figure B.9 Bi-directional BRT Lanes near ART Stop, Albuquerque, New Mexico ***Source: Google Earth***

The reversible section of the Albuquerque guideway is in the green boxes; the station allows for the BRT vehicles to pass each other. The lane is signal controlled.

Reversible Lanes

Less common are reversible transit lanes that allow BRT vehicles to use a lane in one direction during a morning peak period, and in the opposite or contra-flow direction during the afternoon peak period. This configuration is sometimes used when there is an imbalance between traffic volumes during peak periods. In cases where there is a balance between traffic both in the morning and afternoon commutes, this configuration is not recommended.

Figure B.10 Reversible Lane Section (between Yellow Lines) in Albuquerque, New Mexico ***Source: Google Earth***

B.3.3 Guideway Treatments and Performance

Sections B.3.1 and B.3.2 provided a summary of potential treatments for the BRT. This section provides a brief summary of the effects of guideway treatments on important system performance factors such as travel time, reliability, and accessibility. These system performance factors are taken into consideration from the 2009 FTA Characteristics of Bus Rapid Transit for Decision-Making report, first published in 2004. The report states “BRT systems are largely defined by the running way type. BRT’s flexibility means that a single BRT route can operate on several different segments of different running way types. Two sub-characteristics define the running way type—right-of-way location and the level of running way priority”. Table B.2 was retrieved from the report and summarizes the system performance benefits associated with the different types of BRT running ways.

Table B.2 Summary of Effects of Running Way Elements on System Performance

	System Performance					
	Travel Time Savings	Reliability	Identity and Image	Safety and Security	Capacity	Accessibility
Running Way Location • On-Street • Off-Street	Off-street running ways normally reduce running time more than on-street but may increase access time.	Off-street running ways should provide greater reliability except on congested freeways.	Exclusive busways can become part of the image of a BRT and the subject of a marketing a campaign. An off-street transitway can be used as the primary branding element of a BRT. An on-street running way can be part of an overall street-scape renovation or upgrade.	Segregation from other traffic and pedestrians may decrease BRT vehicle collisions compared to on-street operations.	Off-street running ways may have higher capacity due increased number and frequency of transit vehicles that the bus lanes can accommodate. Off-street running ways may allow multiple lanes, which accommodates more vehicles and express or limited stop service as well as all-stop service.	On-street running ways, are generally closer to land uses, require less walking and access time, and have fewer physical barriers.
Level of Transit Priority On-Street • Mixed-Flow with Queue Jumper • On-Street Bus Lane	Priority measures, if effectively implemented and enforced, should reduce running time, particularly in congested situations.	Priority measures should improve reliability.	Clear, enforced priority for running ways operating on regular streets improves the visibility and image of transit.	Separation of BRT vehicles from other traffic can reduce collisions.	Priority measures that reduce congestion delay also increase throughout.	
Off-Street • At-Grade Transitway • Grade Separated Transitway	Off-street running ways with at-grade intersections may offer lower travel time benefits than fully grade-separated running ways.	Both at-grade and grade-separated running ways demonstrate good travel time reliability.	Both grade-separated and at-grade transitways can be used as the system's central branding element.	Potential conflict points such as cross-street intersections and other at-grade vehicle and pedestrian crossings must be addressed.	Busways that bypass street-level intersections can accommodate higher vehicle numbers and frequency.	

	System Performance				
	Higher Ridership	Capital Cost-Effectiveness	Operating Cost-Efficiency	Transit-Supportive Land Development	Environmental Quality
Running Way Location • On-Street • Off-Street	Off-street running ways can speed service and thus attract riders, but they may not be well located.	Newly-created off-street running ways are expensive and thus need high ridership to justify their cost.	Higher travel speeds greatly reduce hourly operating costs. However, off-street rights-of-way will increase maintenance costs compared to shared infrastructure.	Off-street running ways generally offer more opportunities for development of new areas. On-street running ways may better promote redevelopment of existing urban areas. On-street project that include streetscape and/or utility renovations can attract developers.	New off-street running ways such as busways will require considerable construction and environmental permitting. Off-street running ways may be able to isolate noise away from populated areas.
Level of Transit Priority On-Street • Queue Jumper • Arterial Bus Lane	Priority measures can increase ridership to the extent that they increase service quality.	Costs vary enormously, depending on type of priority treatment. In general, greater levels of transit priority correlate with higher costs.	The major cost is additional enforcement.	More substantial running way investments may attract developers by indicating permanence and a high-quality image.	Affects primarily through-service quality. Separated running ways may permit more landscaping and bike and pedestrian paths.
Off-Street • At-Grade Transitway • Grade Separated Transitway	Grade-separated transitways may attract more riders by ensuring higher speeds and safety from accidents with unauthorized vehicles.		Faster speed and more riders.	More permanent running way investments tend to attract more development.	Grade-separated transitways will allow higher average speeds with reduced stopping, which lowers emissions.
Running Way Marking • Signage & Pavement Markings • Raised Lane Delineators • Pavement Color & Material	Running way markings help ensure compliance with priority restrictions, thus reducing delays and the potential for accidents, which may damage rider perception of service.	Costs vary enormously, depending on type of priority treatment. In general, greater levels of transit priority correlate with higher costs.	The major cost is additional enforcement.	Affects only through-service quality.	Affects only through-service quality. Certain distinctive pavement markings and colors can also create a more attractive visual impact.
Running Way Guidance Type • Curb Guidance • Single Rail Guidance • Optical Guidance	Guidance can help improve travel times, which may bring higher ridership.	Costs vary enormously, depending on type of priority treatment. In general, greater levels of transit priority correlate with higher costs.	The major cost is additional enforcement.	Affects only through-service quality	Curb guidance can minimize need for widening rights-of-way. Other effects through-service quality.

Source: Federal Transit Administration, Characteristics of Bus Rapid Transit for Decision-Making, 2009

B.3.4 Center vs Side Running Guideway

For the exclusive guideway configuration of the LCRT, primarily located within the City of North Charleston, the proposed treatment identified in the i-26*ALT* served as the starting point and was reviewed through the LCRT Phase 1 planning and engineering tasks. Internal design workshops, concept development, crash data analysis, corridor safety, pedestrian connectivity, existing infrastructure, connectivity to other transit routes, neighborhood impacts, best practices review, and business access concerns were all taken into account, which resulted in center running guideway chosen as the preferred method where applicable. Table B.3 provides a summary of the comparison of center- and right-side running configurations.

The LCRT purpose is to deliver a premium transit system that is visible and attracts ridership. Evaluation of the various guideway treatments available shows that a center running guideway helps achieve that purpose best. For example, when compared to side running, center running provides a more reliable BRT service with higher BRT vehicle speed and reduced pedestrian crossing length to reach platforms. It also allows BRT and through traffic to progress at the same time and avoids BRT vehicles from stopping general traffic. In addition, other BRT projects around the country prove the permanence provided by a center-running guideway increases opportunities for transit oriented development. While, a side running model allows the use of standard right-hand boarding vehicles and may be closer to local bus service stops, center-running features such as greater reliability, higher vehicle speed, and pedestrian safety provide greater benefit to the user and result in attracting more riders to the system.

Table B.3 Comparison of Center Running vs. Side Running Options

Criteria	Center Running (Exclusive Bus Only Lane)	Side Running (Bus & Business Access Only Lane)
Reliable rapid transit	Dedicated lanes allow for greater reliability	Reliability is impacted due to conflicts with vehicles turning or temporarily stopped in shared use lane
BRT vehicle speed	Speed is reliable and predictable	Vehicle speeds fluctuate as a result of traffic in shared use lane
Left-turning movement of vehicles	Improves left turns by moving them to signalized intersections	Does not improve lefts from the median
is Right-turn movements	Avoids conflicts with vehicles turning right	Increases conflicts between bus and vehicles turning right
Pedestrian access/mobility from BRT platform	Reduces pedestrian crossing distance	Pedestrians have to cross all vehicle travel lanes
Economic development	Infrastructure shows permanence for development community	No strong presence of permanent infrastructure
BRT roadway capacity	Retains all existing traffic lanes	Reduces lanes for general traffic because outside lane is restricted to bus or right turning vehicles only
BRT vehicle capital cost	Could require left and right side boarding BRT vehicles	Able to use standard right-hand boarding vehicles

Criteria	Center Running (Exclusive Bus Only Lane)	Side Running (Bus & Business Access Only Lane)
Station capital costs	Able to accommodate one station platform in the median	Requires stations on either side of the road
Right-of-way acquisition	No ROW acquisition needed	Possible ROW acquisition to accommodate station platforms
Connectivity to other buses	Transfers occurs at marked pedestrian connections	Transfers may occur at shared transit stops
Roadway obstruction	BRT vehicle boarding does not impact vehicles in traffic lanes	Other buses using corridor would also use lane which could delay BRT vehicles and traffic

Exclusive bus lane – physically separated BRT lane
Shared lane – BAT lane only. No improvements to current roadway configuration, including left turn and U-turn movements within the median.

B.3.5 Guideway Enforcement

Per FTA's Characteristics of Bus Rapid Transit, "Maintaining exclusive bus lanes usually requires police enforcement. Less enforcement may be needed when such lanes are visually distinct from general lanes and when violations are more noticeable. Enforcement generally requires the cooperation of a police force, often not under the control of the transit agency. Fines need to be high enough to deter violations with a sustainable amount of enforcement activity. Physical barriers and other design measures to improve compliance must conform to standards such as the Manual on Uniform Traffic Control Devices and state highway design manuals. Enforcement strategies frequently must also accommodate the operation of vehicles from other transit agencies and from emergency services such as police, ambulance, and fire services. Busways, including those on-street that are designed for curb-guided buses, are too narrow to be used by unauthorized traffic and therefore eliminate the need for policing."

B.4 Planning Approach

B.4.1 Identification of Optimal BRT Running Way Treatments

Determining an optimal alignment type and location evaluates the complete cross section of each segment, considers how the ultimate design of the roadway can facilitate not just BRT service but also other modes of transportation, and takes into account corridor safety treatments, property access, traffic progression, and capital costs (among other factors considered). Prescribing a "one-size fits all" approach to any alignment from one end to end, ignores the unique challenges and opportunities, disrespects the historic built and social environments of the surrounding communities, and is often unrealistic in terms of project capital costs and impacts to human and natural environmental resources.

The process to identify and recommend the highest performing BRT running way for a LCRT project area differs from the decision process for determining station locations. For transit stations, ridership potential is often the primary factor considered, but station location decisions are also influenced by examining access to regional destinations, connections to other transit routes and services, economic development potential, and transit access equity, among other factors. Consideration of traffic conditions is part of the evaluation. The Existing Conditions

Traffic Report Chapter 8 analyzes the current conditions. (https://lowcountryrapidtransit.com/docs/08_LCRT.EC.TrafficConditions.pdf).

As part of the planning process (Phase 1) for the LCRT project, the corridor was subdivided into four planning areas based on a variety of factors including, but not limited to, roadway characteristics and land use. Subdividing a corridor into areas is not an uncommon planning practice, as it helps to distinguish corridor characteristics and urban areas from one another to identify unique needs, opportunities, and challenges. For this analysis, a qualitative assessment of the highest performing guideway configuration was conducted for each planning area. The project purpose and need identified transit benefits as a stated goal. The project team started with the best transit preforming transit guideway treatment and if major logistical or operational issues arose, the treatment type was reduced. For example, a center-running guideway was considered in one area but the associated cost of widening was not feasible; thus, it was ultimately recommended to be mixed traffic. Additionally, the i-26*ALT* study defined center-running guideways as the preferred treatment. The following is a brief description of the four planning areas, which are illustrated on Figure B.11.

Northern Area

Originates from N Main Street (US 17ALT) in downtown Summerville on the west side of I-26 and extends to Nexton Town Center on the east side of I-26, traveling south from Summerville on US 78 and south from Nexton I-26 to the intersection of the US 78 and I-26 interchange.

Center Area

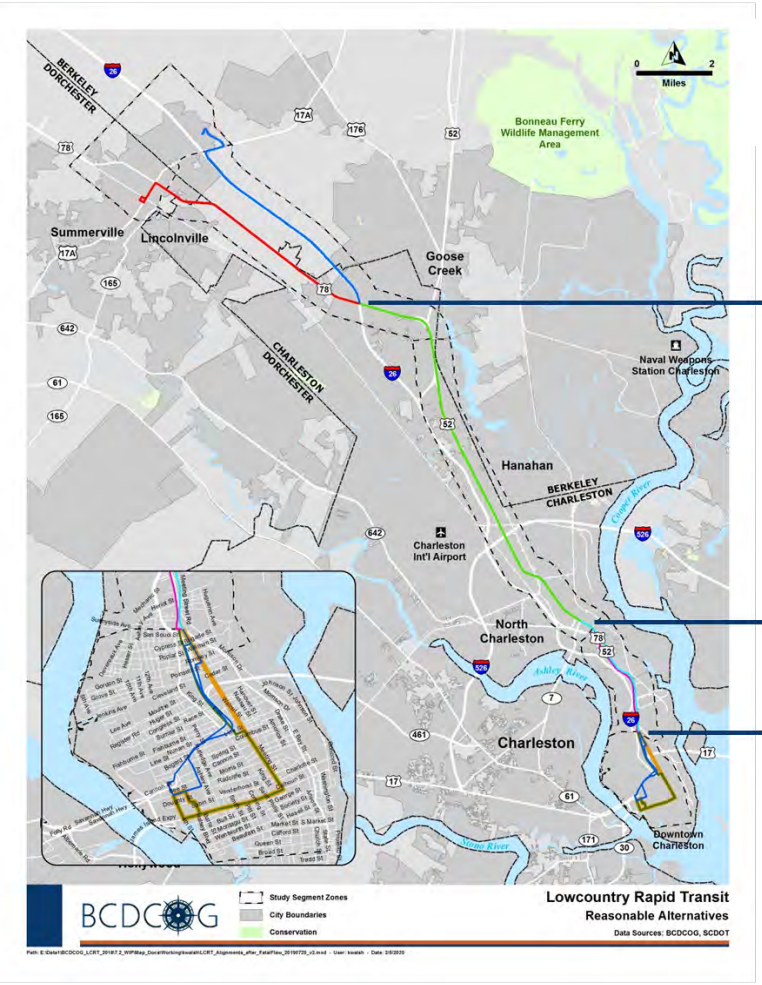
Originates from the interchange of US 78 and I-26 traveling south on Rivers Avenue to Carner Avenue where the roadway splits into two roadways, one being the King Street Extension, and the other being Carner Avenue/Meeting Street.

Neck Area

Originates where the Rivers Avenue roadway splits into two roadways, one being the King Street Extension, the other Carner Avenue/Meeting Street. The Neck Area ends at Mt. Pleasant Street.

Peninsula (Downtown) Area

The Peninsula Area encompasses the City of Charleston's downtown area from Mt. Pleasant Street to Broad Street.



North Area	Summerville Nexton
Center Area (Rivers Ave.)	Rivers Avenue
Neck Area	Meeting Street King Street
Peninsula Area	Meeting/Calhoun LowLine/Meeting/Calhoun Crosstown

Figure B.11 LCRT Study Area Character Areas

B.4.2 Reasonable Alternatives

The evaluation process used a combination of evaluation methods to determine the reasonableness and feasibility of alternatives considered.

The FTA provides project sponsors with guidance for conducting alternatives analyses that discusses reasonable alternatives. While this guidance does not establish rules governing what constitutes a reasonable alternative or range of alternatives, it notes that alternative concepts must be bound in some notion of feasibility and reality for any proposed project. For the purpose of this project, and for identification of the best lane configuration, a definition of reasonable alternatives was established:

> *Reasonable alternatives include those that are practical or feasible from a technical and fiscal standpoint, and based on common sense. Each alternative should be defined in a way that makes it competitive within the overall set of alternatives under consideration. The alternatives must, within the limits of their technology, respond to the transportation needs in the corridor.*

The goal of a guideway evaluation process is to optimize the performance of transit along the streets the BRT vehicle would travel. Each alignment has different opportunities and limitations. Consequently, it is important that each alignment be refined to maximize the use of public ROW, physical facilities, and help enhance transit productivity and performance, while meeting the FTA cost per rider evaluation for the overall project.

Each of the four planning areas had a variety of lane treatment types. Several were eliminated from consideration early in the i-26*ALT* process; the remaining treatment types were further evaluated.

Table B.4 Best Lane Alternatives Considered for Each Area Alignment

BRT Treatment				Alignments Studied in LCRT Project												
		ROW	Exclusivity	North Area			Center Area				Neck Area		Peninsula Area			
				Nexton	Summerville to Fairgrounds	Fairgrounds to US 78/I-26	US 78/I-26 to US 52	US 78 to Ashley Phosphate	Ashley Phosphate to Piggly W.	Piggly W. to Carner Ave.	King St. Ext.	Upper Meeting	Crosstown	Lowline	Meeting St.	Calhoun St.
Busway		Dedicated	Exclusive	Eliminated in i-26*ALT* Study												
Freeway BRT		Dedicated	Exclusive	√												
Arterial/ Collector/Local	Exclusive Center Running Lanes	Dedicated	Exclusive		√	√	√	√	√	√	√	√	√	√	√	√
	Side (Curb) Running Lanes	Dedicated	Exclusive		√	√	√	√	√	√		√	√		√	√
	Side (Curb) Running Lanes - BAT	Dedicated	Semi-Exclusive		√	√	√	√	√	√		√	√		√	√
	Bi-directional Lane	Dedicated	Exclusive			√					√	√	√	√	√	√
	Median Reversible BRT Lane	Dedicated	Exclusive			√							√		√	√
	Side (Curb) Reversible Lanes	Dedicated	Exclusive												√	√
	Side (Curb) Reversible Lanes	Dedicated	Semi-Exclusive												√	√
	Business Access & Transit (BAT)/Peak Hour Lanes	Dedicated	Semi-Exclusive				√	√	√	√		√	√		√	√
	Mixed Traffic	Mixed	Mixed	√	√	√	√	√	√	√	√	√	√		√	√

Eliminated Previously

Reviewed √

B.4.3 Evaluation Method

The optimal guideway evaluation process used a set of criteria that quantitatively and qualitatively assessed design concept configurations for alignment placement and location. The intent was to identify tradeoffs between the guideway configurations, assist in identifying preferred transit operations, safety treatments, and adjacent property accessibility. The design concepts were evaluated to enable the project team to determine the optimal running way configuration for each segment to be included in the NEPA evaluation and to be advanced further through design. There are several key areas where additional analysis is required to choose between two options that are closely ranked. This additional analysis is noted.

B.4.4 Criteria

The evaluation criteria and approach used in comparing alignment location concepts are described in Table B.5. These measures were developed with consideration of the project's goals, purpose and need, and the project design criteria.

Table B.5 Evaluation Criteria and Rating Approach

Criteria	Evaluation Approach
Corridor safety treatments	Rating based on improvements in access to transit; non-motorized separation/protection from adjacent auto lanes; non-motorized modes comfort; other safety improvements.
BRT and automobile interaction	Rating based on the number of at-grade traffic intersections crossed by, or curb-cuts adjacent to, the BRT alignment.
Capital Cost	Rating based on planning level capital cost estimate using a preliminary line item cost buildup of roadway, signal, and transit facility improvement costs, including appropriate contingency.
Transit travel time improvements	Rating based on transit travel time impact(s) resulting from the level of transit priority included in each design concept.
Future network transfer opportunities	Rating based on the number of direct network transfer opportunities between future BRT stations and fixed-route service. Direct network transfers refer to connections between routes made at the stations, but not for all stops within a one-quarter mile radius of a station.
Exclusivity and guideway enforcement	Rating based on the distance, in miles, of exclusive BRT ROW not shared with any other transportation mode.
Auto travel time impacts	Rating based on impacts to auto travel time resulting from operational adjustments to other modes and/or out of direction travel required, reviewing intersection level-of-service, and traffic volumes.
Property (ROW) impacts	Rating based on square foot estimate of adjacent parcel impact(s) and the number of buildings potentially impacted by the assumed cross sections.
Business and residential access impacts	Rating based on the level of impact(s) from business/residential access restrictions, circulation changes, and/or driveway impacts.
Parking/loading zones	Rating based on the number of parking stalls or loading zones removed with implementation of the project.

The assessment of an optimal guideway uses a three-point rating scale for each evaluation criteria for each concept design. The rating compares each option to the baseline condition of no improvement. Table B.6 describes the evaluation key for the evaluation criteria considered in the comparative assessment.

Table B.6 Evaluation Key

Criteria	High	Medium	Low
Corridor safety treatments	Best safety improvements for all modes	Moderate safety improvements for all modes	Limited safety improvements for all modes
BRT and automobile interaction	Less intersection crossings and curb-cuts	Moderate intersection crossings and curb-cuts	Higher intersection crossings and curb-cuts
Multimodal interface (bike and pedestrian)	Connection to multiuse path	Sidewalk connections	No accommodations
Capital cost	Lower capital cost	Moderate capital cost	Higher capital cost
Transit travel time improvements	Best transit travel time improvements	Moderate transit travel time improvements	Limited transit travel time improvements
Future network transfer opportunities	Greater future network transfer connections	Moderate future network transfer connections	Limited future network transfer connections
Auto travel time impacts	Lower auto travel time impacts	Moderate auto travel time impacts	Higher auto travel time impacts
Property (ROW) impacts	Less property impact	Moderate property impact	Greater property impact
Business and residential access impacts	Less impacts to access	Moderate impacts to access	Greater impacts to access
Parking/loading zones	Less impacts to parking and loading zones	Moderate impacts to parking and loading zones	Greater impacts to parking and loading zones

B.5 Evaluation Results

As discussed, a high level qualitative review of each planning segment was conducted based on the criteria shown in Table B.5 and Table B.6, above. The results of the high level comparative evaluation for the design concepts using the evaluation criteria described above are summarized by planning area. Provided below are summarized recommendations for each alignment, organized by the respective planning area previously defined.

B.5.1 North Area – Summerville/Nexton Alignments Review

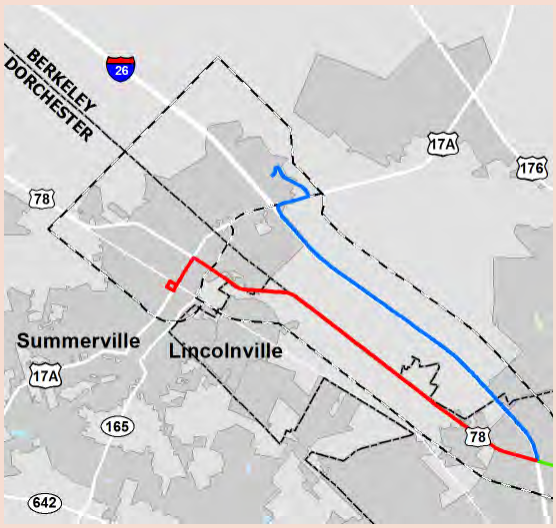
Table B.7 Guideway Effectiveness Assessment–North Area

Guideways	Alignment	
	Summerville (US 78)	Nexton (I-26)
Dedicated or exclusive guideway	Low	N/A
Freeway guideway	N/A	Moderate
Semi exclusive	Low	N/A
Mixed traffic	High	High
Peak-hour Lanes	N/A	N/A
Bi-directional	N/A	N/A
Reversible lanes	Partial - Moderate	N/A

Table B.8 Guideway Effectiveness Assessment–North Area Options

Criteria	1A: Option 1 Mixed traffic – Summerville to I-26	1B: Option 2 Reversible – Fairgrounds to I-26	Nexton: Option 1 Mixed Traffic	Nexton: Option 2 Freeway BRT
Corridor safety treatments	None	Intersection Improvement, median addition	None	Some upgrades to freeway standards
BRT and automobile interaction	Low traffic volumes Unchanged	With displacement of connections with median	Unchanged	Separated
Multimodal interface (bike and pedestrian)	N/A	N/A	N/A	N/A
Capital cost	Low capital cost	Medium capital cost	Low capital cost	High capital cost
Transit travel time improvements	Minimal improvement with TSP	Increase speeds and reliability, avoids southern traffic congestion	No improvement	Significant savings in the peak hours
Auto travel time impacts	Minimal improvement TSP only	Safety improvements	Minimal improvement TSP only	Minimal improvement TSP only
Property (ROW) impacts	No property impact	Limited property impact	No property impact	No property impact
Business and residential access impacts	No impacts to access	Limited impacts to access	No impacts to access	No impacts to access
Parking/loading zones	No parking zone impact	No parking zone impact	No parking zone impact	No parking zone impact
Applicability	High	Moderate	High	Low

Table B.9 Guideway Effectiveness Assessment–North Area Recommendation

North Area Alignments	Recommendations
	Summerville Alignment (US 78): From Summerville to Ingleside Drive, a mixed-traffic configuration is suggested for the start of BRT operations along this alignment for most of the route. Building an exclusive or semi-exclusive guideway would constitute an unnecessary expenditure given current roadway volumes and congestion. Future opportunities exist to expand capacity and exclusivity for BRT when the roadway is widened under other projects. It may be prudent to consider purchasing ROW for future roadway expansion; however, this would likely need to be purchased using local area funds not associated with the current FTA transit project. The area from Ingleside Blvd to I-26 does warrant implementation of a reversible center lane. From Ingleside Drive to Medical Plaza Drive (I-26), a reversible lane is recommended to bypass several congested signalized intersections that exist along this segment of the alignment.
	Nexton (I-26) Alignment: Operating predominantly on a congested freeway, space is available for a freeway guideway in the median; however, this would come at a significant capital cost. A second option considered was shoulder lane operation. Currently, surrounding land use densities suggest that operations on this alignment will struggle to attract and retain ridership, resulting in greater project costs and costs per rider. It is recommended to operate in mixed-traffic due to the cost per rider.

B.5.2 Center Area – Rivers Avenue Alignment Review

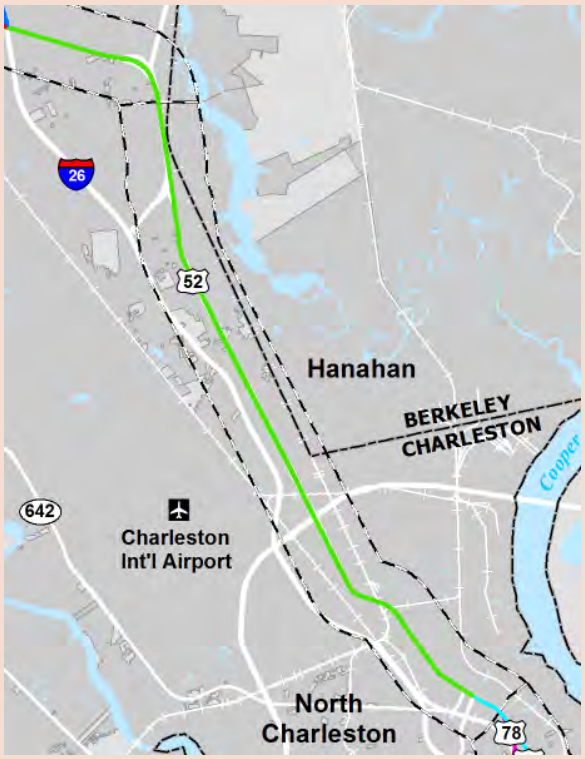
Table B.10 Guideway Effectiveness Assessment–Center Area

Guideways	Alignment
	Rivers Avenue/US 78/US 52
Dedicated or exclusive guideway	High
Freeway guideway	N/A
Semi-exclusive	Moderate
Mixed traffic	Low
Peak hour lanes	Low
Bi-directional	N/A
Reversible lanes	N/A

Table B.11 Guideway Effectiveness Assessment–Center Area Options

Criteria	No Change/Mixed traffic	BAT Lane Semi Exclusive	Center-running Guideway
Corridor safety treatments	None	Minor	Best safety improvements for all modes
BRT and automobile interaction	Low traffic volumes Unchanged	Improved but still BRT blocking traffic	Less intersection crossings and curb-cuts
Multimodal interface (bike and pedestrian)	N/A	Connection to multiuse path, significant pedestrian infrastructure proposed	Connection to multiuse path, significant pedestrian infrastructure proposed
Capital cost	Low capital cost	Moderate capital cost	High capital cost
Transit travel time improvements	Minimal improvement with TSP	Moderate improved travel time	Best transit travel time improvements
Exclusivity and guideway enforcement	Minimal improvement TSP only	Greater number of semi-exclusive lane miles	Greater number of exclusive lane miles
Auto travel time impacts	Minimal improvement TSP only	Significant impacts with a thru lane removed	Lower auto travel time impacts, improved cross connections with U-turns
Property (ROW) impacts	No property impact	Minimal property impact	Acceptable property impact
Business and residential access impacts	No impacts to access	Minimal impacts to access	Minimal impacts to access, U-turns and median added in sections
Parking/loading zones	No parking zone impact	No impacts to parking and loading zones	No impacts to parking and loading zones
Applicability	Low	Medium	High

Table B.12 Guideway Effectiveness Assessment–Center Area Recommendation

Center Area Alignment	Recommendation
	Predominantly a suburban commercial corridor, Rivers Avenue is classified by South Carolina Department of Transportation as a principal arterial. A landscaped median separates the bi-directional travel lanes. Currently, there are a number of safety concerns within the corridor. One area in particular is the Rivers Avenue portion of the project because of the large roadway footprint, high travel speeds, minimal safe pedestrian crossings, un-signalized lefts and U-turns, and the number of business access points. Rivers Avenue is a safety corridor of concern in the state of South Carolina. From 2015 through 2018, Rivers Avenue saw 7,334 total auto-related crashes. Appendix A provides a high level summary of the issues within the corridor (source: South Carolina Department of Transportation crash data). Given the number of curb cuts for property access, and the high rate of both vehicular and pedestrian crashes in the corridor, a median-running dedicated guideway is recommended. The center running dedicated BRT treatment would provide needed features to address the corridor's safety issues. As the corridor continues to grow and redevelop, this portion of the corridor will become very important to future operations and reliability of the BRT service. It is therefore important to maximize the use of existing ROW for transit as part of any FTA capital project.

B.5.3 Neck Area – Meeting Street and King Street Alignment Reviews

Table B.13 Guideway Effectiveness Assessment–Neck Area

Guideways	Alignment	
	Meeting Street	King Street Extension
Dedicated or exclusive guideway	Moderate	Low
Freeway guideway	N/A	N/A
Semi-exclusive	Low	N/A
Mixed traffic	Moderate	Moderate
Peak hour lanes	Low	N/A
Bi-directional	Low	Moderate
Reversible lanes	N/A	N/A

Table B.14 Guideway Effectiveness Assessment–Neck Area Meeting Street Options

Criteria	Option 1: Meeting Street Mixed Traffic	Option 2: Exclusive Guideway
Corridor safety treatments	Moderate safety improvements for bike/pedestrian	Improve safety improvements for all modes
BRT and automobile interaction	Mixed flow	Separation for BRT
Multimodal interface (bike and pedestrian)	Construction to multiuse path	Intersection Improvements, no ROW for multiuse path
Capital cost	Low capital cost	High capital cost, bridge grade separation required to remove reliability transit
Transit travel time improvements	Minimal improvement in travel time	Highest transit travel time improvement, but existing traffic is not congested
Exclusivity and guideway enforcement	No exclusive	Greater number of exclusive lane miles
Auto travel time impacts	Moderate improvement	Moderate improvement
Property (ROW) impacts	Less property impact	Significant property impact, including railroad
Business and residential access impacts	Less impacts to access	Low impacts to access
Parking/loading zones	No impacts to parking and loading zones	Minor impacts to parking and loading zones
Applicability	Medium	Low

Table B.15 Guideway Effectiveness Assessment–Neck Area King Street Extension Options

Criteria	Option 1: Mixed Traffic Intersection Improvements	Option 2: Bi-directional Lane
Corridor safety treatments	Improve safety improvements for all modes	Improve safety improvements for all modes
BRT and automobile interaction	Mixed flow	Separation for BRT
Multimodal interface (bike and pedestrian)	Construction to multiuse path	Construction to multiuse path
Capital cost	Low capital cost	Moderate capital cost
Transit travel time improvements	Minimal improvement in travel time	Minimal improvement in travel time due to waiting for other direction, roadway congestion is low
Exclusivity and guideway enforcement	No exclusive	Greater number of exclusive lane miles
Auto travel time impacts	Moderate improvement, turn lanes added	Moderate improvement, turn lanes added
Property (ROW) impacts	Less property impact	Significant property impact, including railroad
Business and Residential access impacts	Less impacts to access	Low impacts to access
Parking/loading zones	No impacts to parking and loading zones	Minor impacts to parking and loading zones
Applicability	Medium	Low

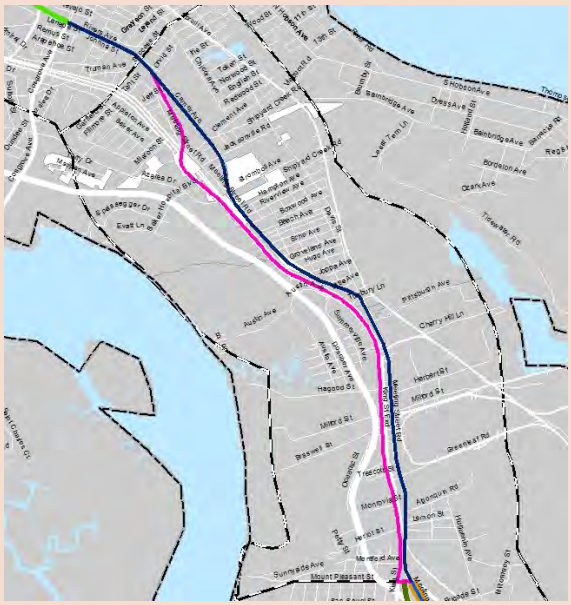
Additional Analysis

For the King Street Extension, a bi-directional lane and a mixed traffic options have little difference in the ranking/analysis. Additional analysis was performed to assist in the final recommendation. A small section of VISSIM model was completed along King Street Extension to review traffic operation as there are not any signalized intersections along this segment to provide insights into the roadway traffic congestion. From this analysis, the LCRT vehicle is projected to have minimal delays or reliability issues along King Street Extension. Projections do not show the existing and future traffic having a significant impact to transit operations. For this reason, it is recommended that King Street Extension be implemented with a mixed-traffic guideway and several crossing improvements to reduce delays from queued vehicles near rail crossings.

To make Meeting Street operate competitively to the King Street Extension and reduce delays, a set of bridges would be required across multiple rail crossings along Meeting Street. The length of Meeting Street would also be recommended to be center-running exclusive lanes.

See Appendix C for the additional analysis of traffic, railroad considerations, and structure costs.

Table B.16 Guideway Effectiveness Assessment–Neck Area Recommendation

Neck Area Alignments	Recommendations
	Meeting Street Alignment (dark blue/alignment on the east): The cross section of Meeting Street is similar to the northern and southern portions of Rivers Avenue. Portions of Meeting Street narrow, eliminating the two-way left turn lane common in other locations along the corridor. The street has significant redevelopment and urban intensification opportunities with several environmental justice neighborhoods. Building footprints are often set back from the roadway and fronted by parking. If this alignment is considered, a curb-side Exclusive running alignment with grade crossings is recommended. With three at-grade railroad crossings along this alignment, delays are expected to be an impact to the reliability of BRT vehicles. Currently, CARTA reports the interactions of buses and train crossing events, which show significant delays to operations. It is noted that grade separation would have significant costs and environmental impact access to adjacent parcels.
	King Street Extension Alignment (magenta/alignment on the west): Similar to US 78 near Summerville, King Street is a two-lane local roadway. If this alignment is considered, mixed traffic operations is most appropriate and recommended. While only one railroad crossing occurs along King Street Extenson (limited activity), the relative population and employment densities suggest an investment in BRT on the King Street Extension would yield limited ridership productivity but greater travel time reliability. The presence of an elevated I-26 and adjacent railway lines limit the constructability of neighboring lands.

B.5.4 Peninsula Area – Meeting/Calhoun, Lowline, Crosstown Alignment Reviews

Table B.17 Guideway Effectiveness Assessment–Peninsula Area

Guideways	Alignment		
	Meeting/Calhoun	Lowline	Crosstown
Dedicated or exclusive guideway	Low	High	Low
Freeway guideway	N/A	N/A	N/A
Semi-exclusive	Low	Moderate	Low
Mixed traffic	Moderate	Moderate	Moderate
Peak hour lanes	Moderate	Moderate	Low
Bi-directional	Low	Moderate	Low
Reversible lanes	Moderate	Low	Low

Table B.18 Guideway Effectiveness Assessment–Peninsula Area Meeting/Calhoun Options

Criteria	Option 1: Mixed Traffic Intersection Improvements	Option 2: Reversible Travel and BRT Lane
Corridor safety treatments	No change	Neutral impacts
BRT and automobile interaction	Mixed flow	Bus priority with shared right turns in peak direction - mixed flow in opposite
Multimodal interface (bike and pedestrian)	ADA improvements	ADA improvements
Capital cost	Lower capital cost	Low capital costs
Transit travel time improvements	TSP only	Moderate improvement and improve reliability
Exclusivity and guideway enforcement	No exclusive	Peak direction exclusive
Auto travel time impacts	No change	Moderate improvement
Property (ROW) impacts	No property impact	Minor property impact
Business and residential access impacts	No impacts to access	No impacts to access
Parking/loading zones	No impacts to parking and loading zones	Moderate parking removed
Applicability	Medium	High

Table B.19 Guideway Effectiveness Assessment–Peninsula Area Lowline Options

Criteria	Option 1: Dual Exclusive BRT Lanes	Option 2: Bi-directional BRT Lane
Corridor safety treatments	No change	Neutral impacts
BRT and automobile interaction	Mixed flow	Bus priority with shared right turns in peak direction - mixed flow in opposite
Multimodal interface (bike and pedestrian)	Integrated bike/pedestrian shared use path, space for path is impacted	Integrated bike/pedestrian shared use path, balanced approach
Capital cost	Higher capital cost	Low capital costs
Transit travel time improvements	Bypass area traffic congestion on Meeting Street	Bypass area traffic congestion on Meeting Street
Exclusivity and guideway enforcement	Exclusive	Exclusive, with layover points
Auto travel time impacts	N/A	N/A
Property (ROW) impacts	No property impact	No property impact
Business and residential access impacts	No impacts to access	No impacts to access
Parking/loading zones	No impacts to parking and loading zones	No impacts to parking and loading zones
Applicability	Low	High

Table B.20 Guideway Effectiveness Assessment–Peninsula Area Crosstown Options

Criteria	Option 1: Mixed Traffic
Corridor safety treatments	No change
BRT and automobile interaction	Mixed flow
Multimodal interface (bike and pedestrian)	ADA improvements
Capital cost	Lower capital cost
Transit travel time improvements	TSP only
Exclusivity and guideway enforcement	No change
Auto travel time impacts	No property impact
Property (ROW) impacts	No impacts to access
Business and residential access impacts	No impacts to parking and loading zones
Parking/loading zones	No change
Applicability	Medium

Note: Other roadway options were analyzed for the Crosstown alignments, please see Appendix H. Mixed traffic is the viable option for this section.

Table B.21 Guideway Effectiveness Assessment–Peninsula Area Recommendation

Peninsula Area Alignments	Recommendations
	Meeting/Calhoun Alignment (Orange): This alignment would be the most accessible of the downtown alignments, but also the alignment most susceptible to traffic conditions, particularly during the peak periods. The densities and access to adjacent properties create a transit-supportive environment already; however, it also restricts the ability to add ROW. To make transit competitive and successful with this alignment, a combination of curb-side Mixed-Traffic and Reversible Peak Hour Lane configurations is recommended, making full use of available technology to provide transit advantages during peak and off-peak periods to improve transit reliability in the peak direction.
	Lowline Alignment (Green): This alignment configuration utilizes a city-owned abandoned rail line, which creates a unique opportunity to integrate transit and a bike/pedestrian connection through a new corridor. It offers a combination of exclusive ROW via an abandoned railroad corridor that could act as an exclusive busway, along with access opportunities to neighborhoods disconnected by the construction of I-26. A combination of Bi-directional is recommended to balance bike and pedestrian usage. See above for Meeting/Calhoun for the lane recommendation.
	Crosstown Alignment (Blue): The primary advantage of the Crosstown alignment is the ability to bypass downtown traffic using an elevated connection to the I-26 freeway network. While this alignment helps bypass downtown traffic, there are few (if any) opportunities for stops along this alignment other than at the Medical University of South Carolina. If this alignment is selected, a curb-lane running mixed-traffic alignment may be most practical along the at-grade portions of the street due to high traffic demands.

B.6 Conclusions

Charleston's historical character and unique development patterns, coupled with the length of the desired LCRT corridor present a wide range of urban, suburban, and rural landscapes, all of which a BRT alignment can operate in and serve. The challenge is to find the right combinations of treatments that best balance costs, maximize ridership potential, and minimize impacts, while still keeping the project competitive.

The LCRT project needs to be competitive to score well against other projects across the nation vying for FTA CIG funding. Thus, the project needs to demonstrate ridership that justifies the costs, which is typically done by having at least 50 percent or more of its operation in a dedicated guideway. Having a majority of the project in that dedicated ROW will allow it to have improved transit vehicle speeds, reduced transit travel times, and improved reliability; especially when compared to existing transit services in the region and to other modal choices. Given that the areas within the project study area vary in character and ROW availability, different BRT guideway treatments will need to be applied to each area as appropriate.

Finding an optimal running way treatment is a balance among project attractiveness, cost control, and negative impact reduction. Therefore, in addition to being in its own ROW, the LCRT may need to operate in mixed traffic at times. Operations in mixed traffic makes the vehicles susceptible to traffic delays during peak hours and roadway crashes or other traffic incidents. This may impact on-time performance, service reliability, speed, and customer satisfaction, but may be the best choice given existing conditions. Likewise, side running/mixed-traffic configurations require a station and ROW on both curb sides of the alignment, in turn increasing the cost of the project, compared to a single shared median station.

Along a significant portion of the corridor, the BRT can operate in dedicated ROW along Rivers Avenue from the US 78/I-26 interchange to Carner Avenue as described earlier. Operating in a dedicated guideway offers the following benefits:

- Provides faster vehicle speeds that yield greater ridership
- Qualifies for more FTA streetscape improvements
- Reduces pedestrian crossing distances with center-running stations
- Provides infrastructure permanence, which in turn attracts development
- Reduces conflict with traffic and other transit vehicles, and retains both right- and left-turn movements for automobiles.

Table B.22 depicts the current recommended running way treatment by segments based on current information and analyses.

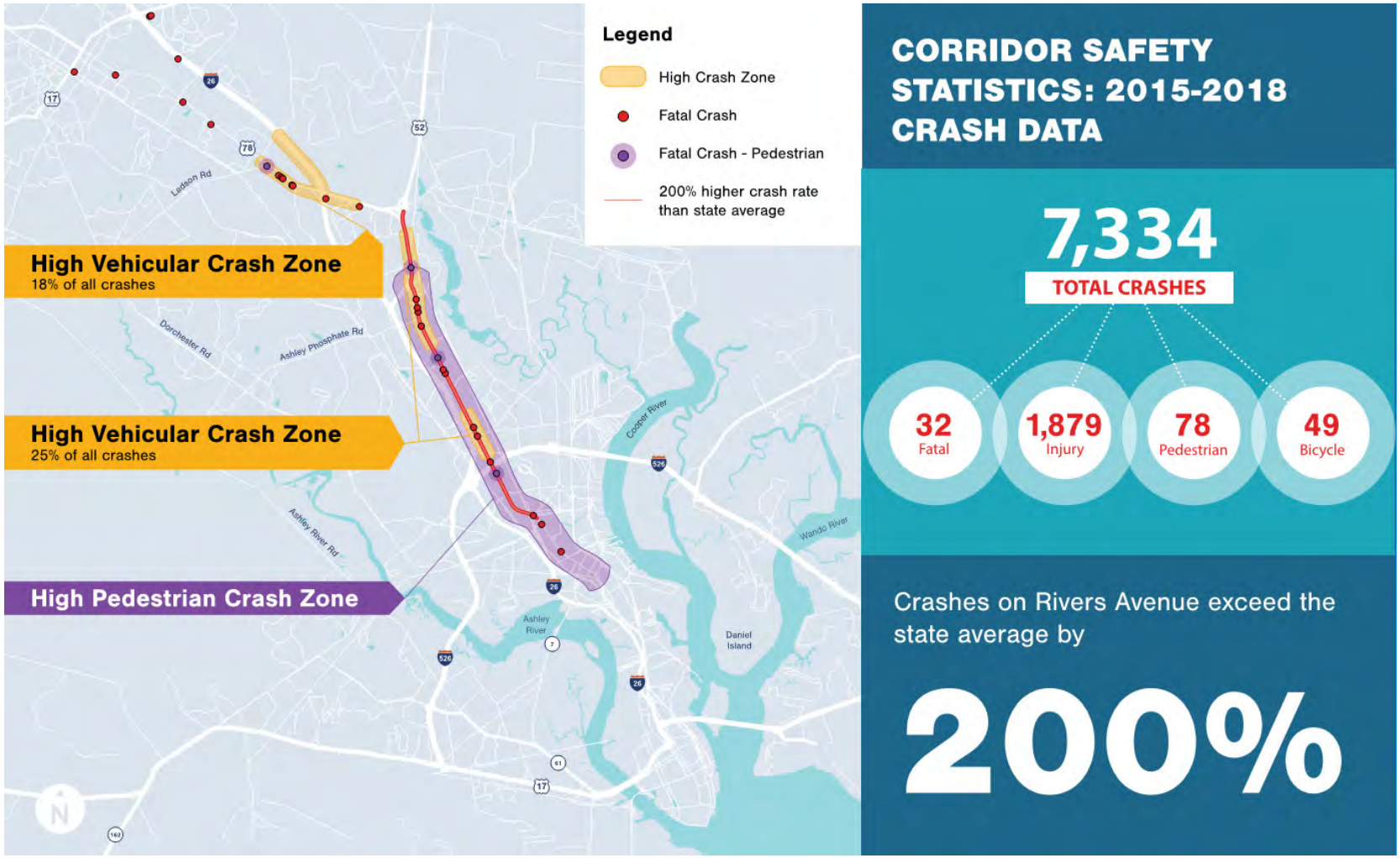
Running way treatments and enhancements will continue to be refined for the final preferred project alignment in subsequent phases of the project as more detailed information about field conditions are known and designs are finalized. However, to advance the project forward, these conclusions are more than sufficient to make project decisions and to advance this stage.

Table B.22 Recommended Guideway Treatment per Area

BRT Treatment				Alignments Studied in LCRT Project												
		ROW	Exclusivity	North Area			Center Area				Neck Area		Peninsula Area			
				Nexton	Summerville to Fairgrounds	Fairgrounds to US 78/I-26	US 78/I-26 to US 52	US 78 to Ashley Phosphate	Ashley Phosphate to Piggly W.	Piggly W. to Carner Ave.	King St. Ext.	Upper Meeting	Crosstown	Lowline	Meeting St.	Calhoun St.
Busway		Dedicated	Exclusive	Eliminated in i-26*ALT* Study												
Freeway BRT		Dedicated	Exclusive	√												
Arterial/ Collector/Local	Exclusive Center Running Lanes	Dedicated	Exclusive		√	√	√	√	√	√	√	√	√	√	√	√
	Side (Curb) Running Lanes	Dedicated	Exclusive		√	√	√	√	√	√		√	√		√	√
	Side (Curb) Running Lanes - BAT	Dedicated	Semi-exclusive		√	√	√	√	√	√		√	√		√	√
	Bi-directional Lane	Dedicated	Exclusive			√					√	√	√	√	√	√
	Median Reversible BRT Lane	Dedicated	Exclusive			√							√		√	√
	Side (Curb) Reversible Lanes	Dedicated	Exclusive												√	√
	Side (Curb) Reversible Lanes	Dedicated	Semi-exclusive												√	√
	Business Access & Transit (BAT)/Peak Hour Lanes	Dedicated	Semi-exclusive				√	√	√	√		√	√		√	√
	Mixed Traffic	Mixed	Mixed	√	√	√	√	√	√	√	√	√	√		√	√

Eliminated Previously	
Reviewed	√
Selected	√

Attachment A – Rivers Avenue Safety Summary



WHAT TRAFFIC MOVEMENTS CONTRIBUTE TO HIGH CRASH RATES?

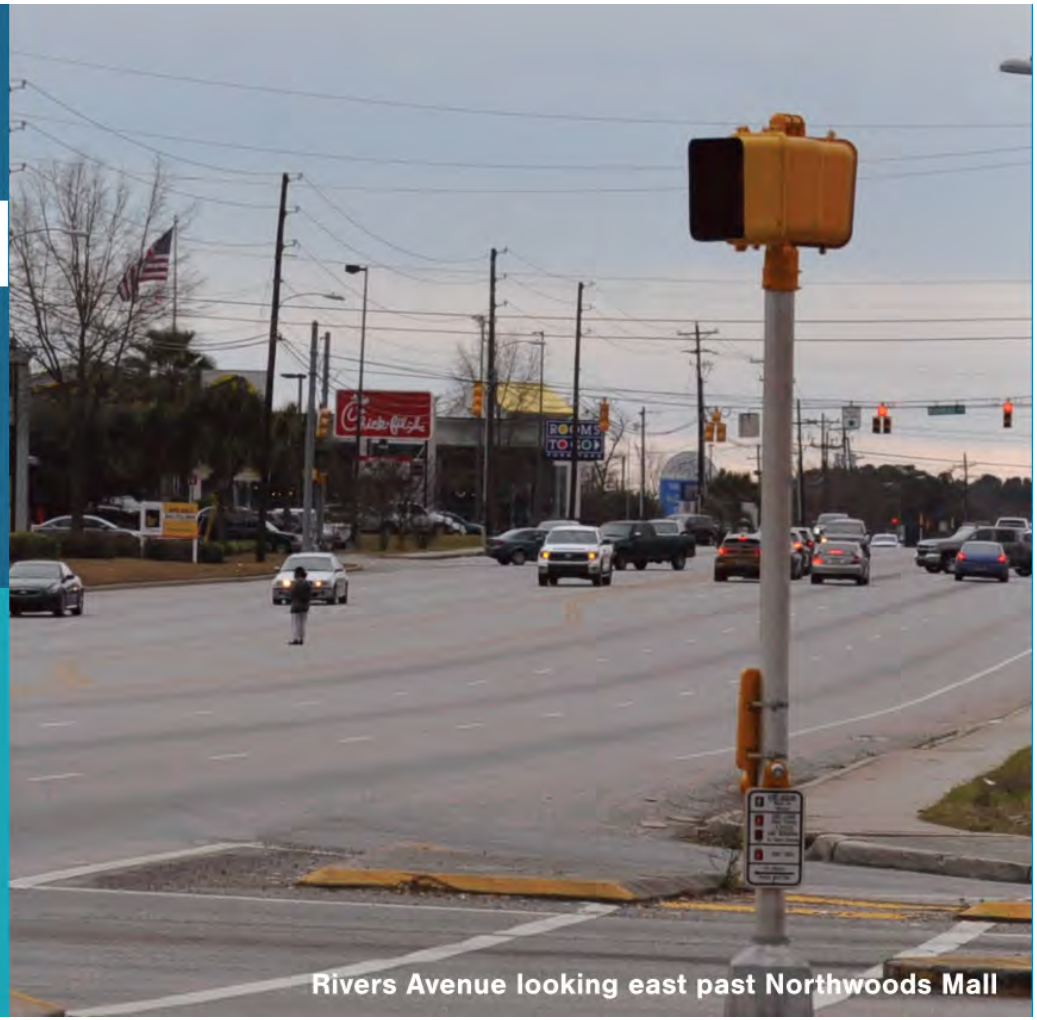
Lack of Pedestrian Facilities

There are only **11** signalized crosswalks on 9 miles of the Rivers Avenue corridor, from Otranto Rd to Reynolds Ave.

.82 miles
average distance between crosswalks

4.9 miles
longest gap between crosswalks

There is a lack of contiguous sidewalks along the entire corridor.



Rivers Avenue looking east past Northwoods Mall

WHAT TRAFFIC MOVEMENTS CONTRIBUTE TO HIGH CRASH RATES ON RIVERS AVE?

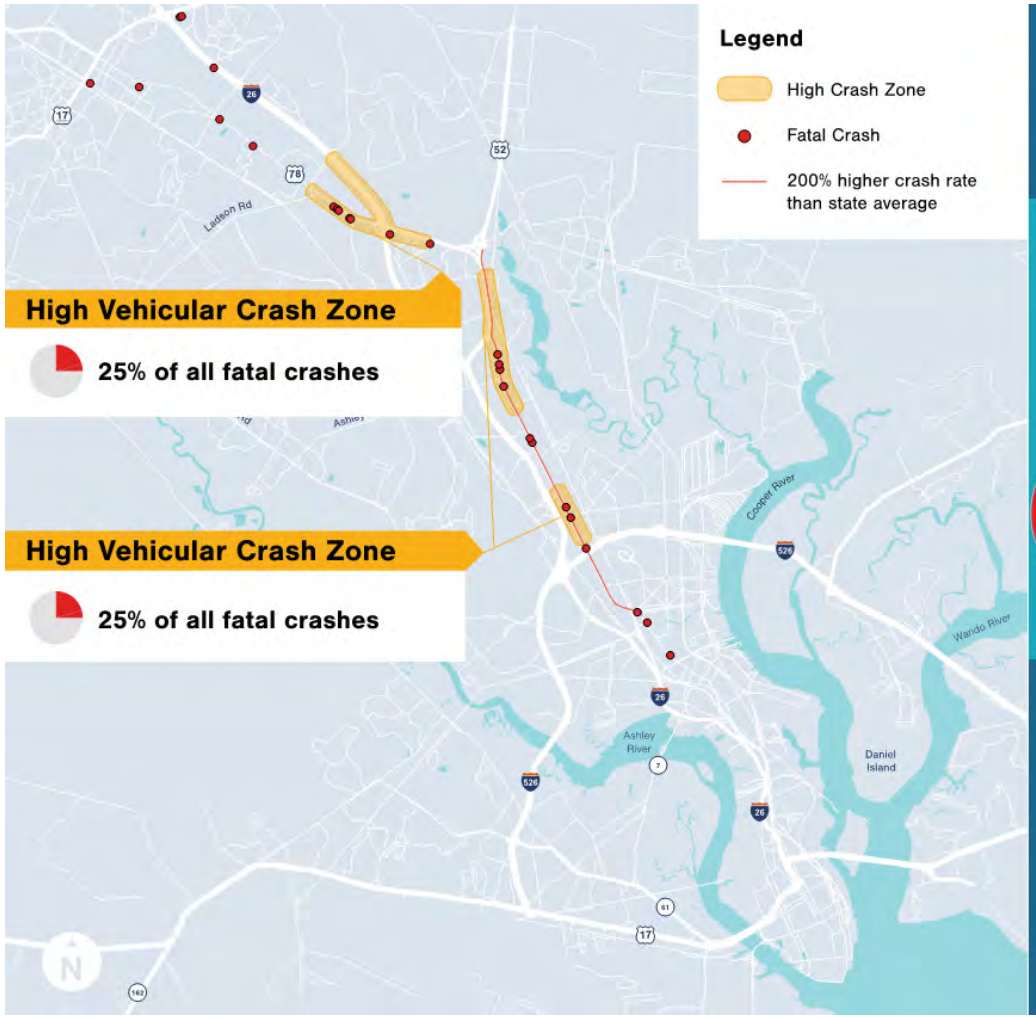
	Unsignalized Median Cross-Over	Median U-Turn Acceleration/Merge Lanes	Scissor Intersection/Median U-Turn Conflicts
Crashes (Angle and Sideswipes)	116	39	54
Injuries	88	10	12
Fatalities	2	0	0

WHAT TRAFFIC MOVEMENTS CONTRIBUTE TO HIGH CRASH RATES?

Interchange Off-Ramp Weaving Movements

EXAMPLE:

Traffic from I-26 must cross up to **two** lanes on Remount Rd over a distance of just **500 ft** in order to access a turn lane onto Rivers Ave.



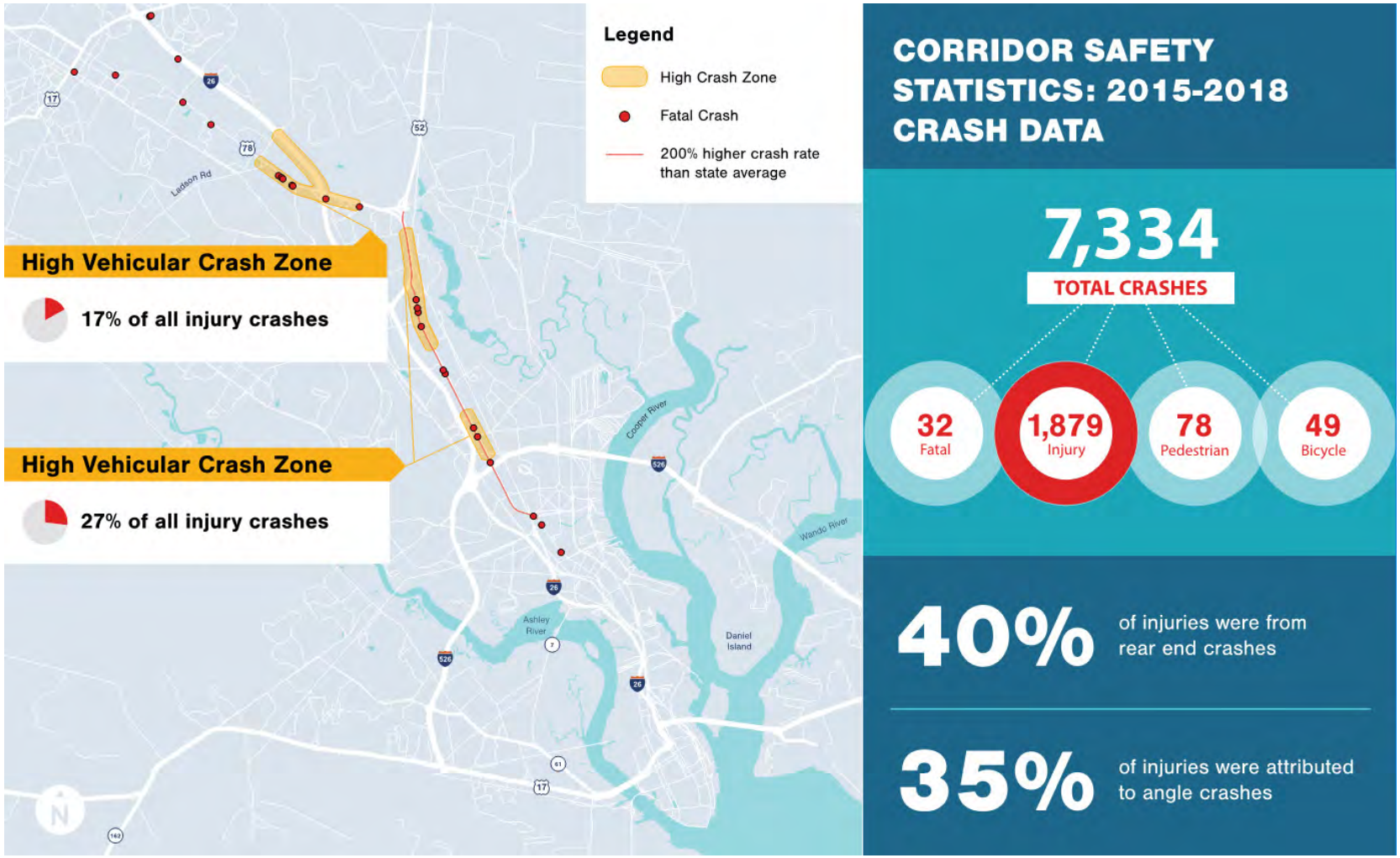
CORRIDOR SAFETY STATISTICS: 2015-2018 CRASH DATA

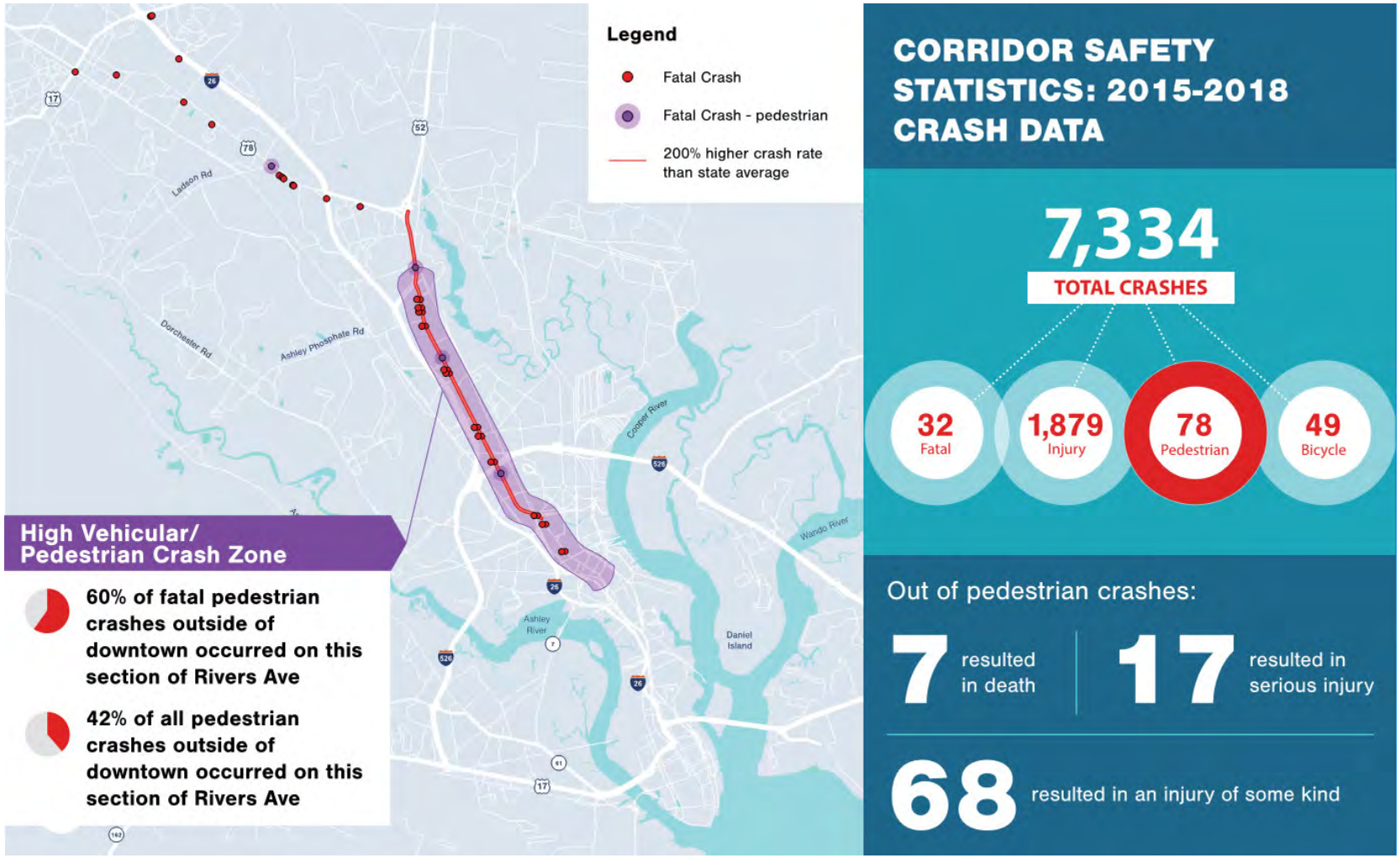
7,334
TOTAL CRASHES

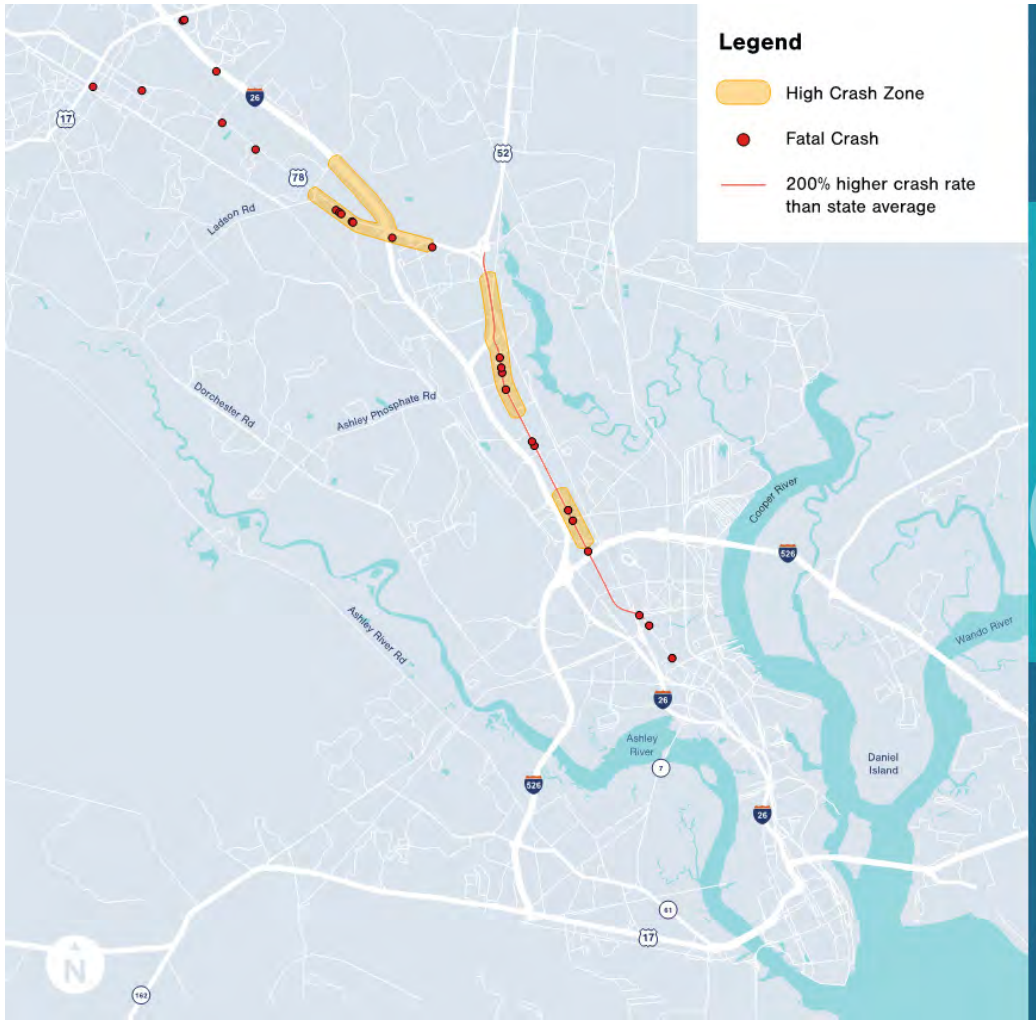
32	1,879	78	49
Fatal	Injury	Pedestrian	Bicycle

22%
of fatal crashes involved pedestrian deaths - single greatest cause of fatal crashes in the study area

66%
of fatal crashes occurred in dark conditions or dark conditions with streetlights


Legend
High Crash Zone
Fatal Crash
200% higher crash rate than state average
High Vehicular Crash Zone
17% of all injury crashes
High Vehicular Crash Zone
27% of all injury crashes
Ladson Rd
Cooper River
Wando River
Ashley River
Daniel Island
CORRIDOR SAFETY STATISTICS: 2015-2018 CRASH DATA
7,334
TOTAL CRASHES
32
Fatal
1,879
Injury
78
Pedestrian
49
Bicycle
40%
of injuries were from rear end crashes
35%
of injuries were attributed to angle crashes


Legend
Fatal Crash
Fatal Crash - pedestrian
200% higher crash rate than state average
High Vehicular/ Pedestrian Crash Zone
60% of fatal pedestrian crashes outside of downtown occurred on this section of Rivers Ave
42% of all pedestrian crashes outside of downtown occurred on this section of Rivers Ave
Ladson Rd
Dorchester Rd
Ashley Phosphate Rd
Cooper River
Wando River
Ashley River
Daniel Island
CORRIDOR SAFETY STATISTICS: 2015-2018 CRASH DATA
7,334
TOTAL CRASHES
32
Fatal
1,879
Injury
78
Pedestrian
49
Bicycle
Out of pedestrian crashes:
7
resulted in death
17
resulted in serious injury
68
resulted in an injury of some kind



CORRIDOR SAFETY STATISTICS: 2015-2018 CRASH DATA

7,334 TOTAL CRASHES

32	1,879	78	49
Fatal	Injury	Pedestrian	Bicycle

8% of bicycle crashes resulted in a fatality or severe injury

78% of bicycle crashes resulted in a fatality or injury of some kind

WHAT TRAFFIC MOVEMENTS CONTRIBUTE TO HIGH CRASH RATES?

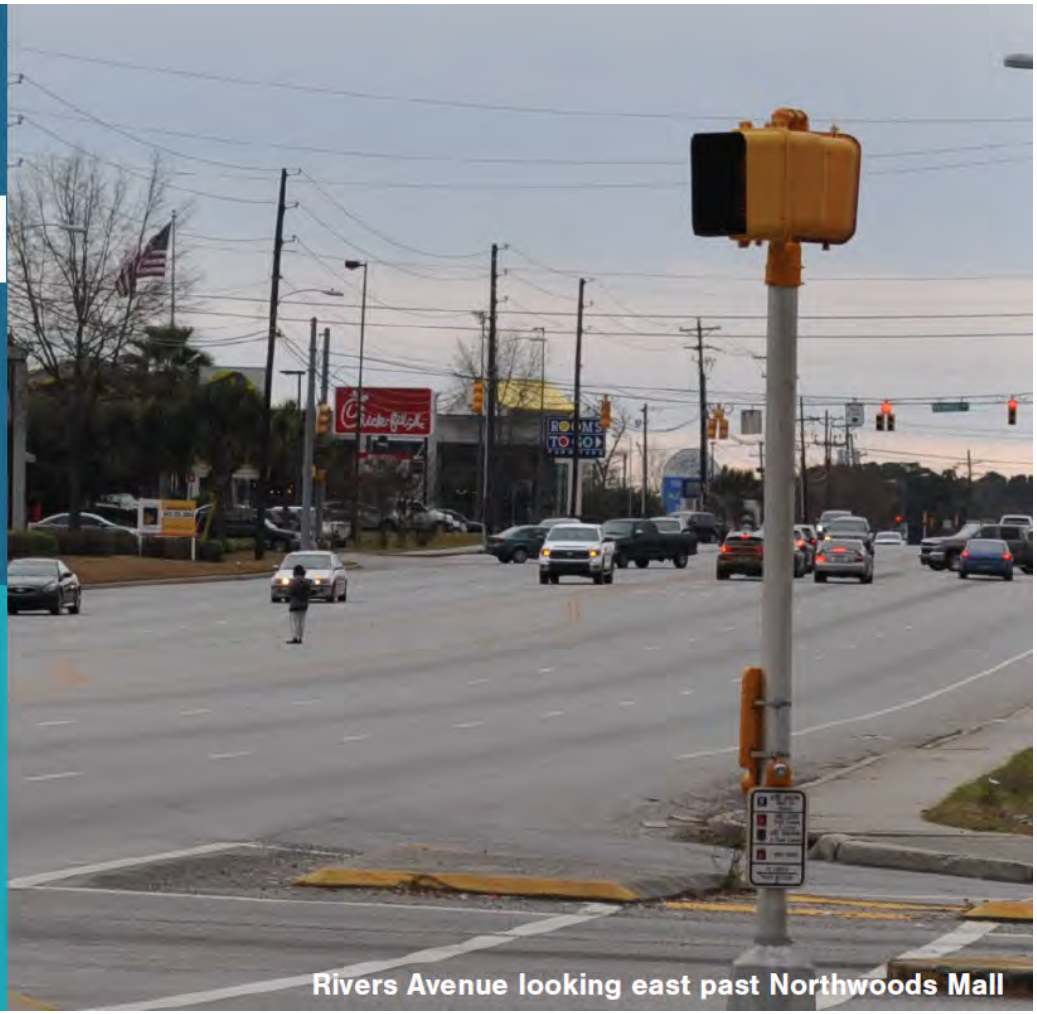
Lack of Pedestrian Facilities

There are only **11** signalized crosswalks on 9 miles of the Rivers Avenue corridor, from Otranto Rd to Reynolds Ave.

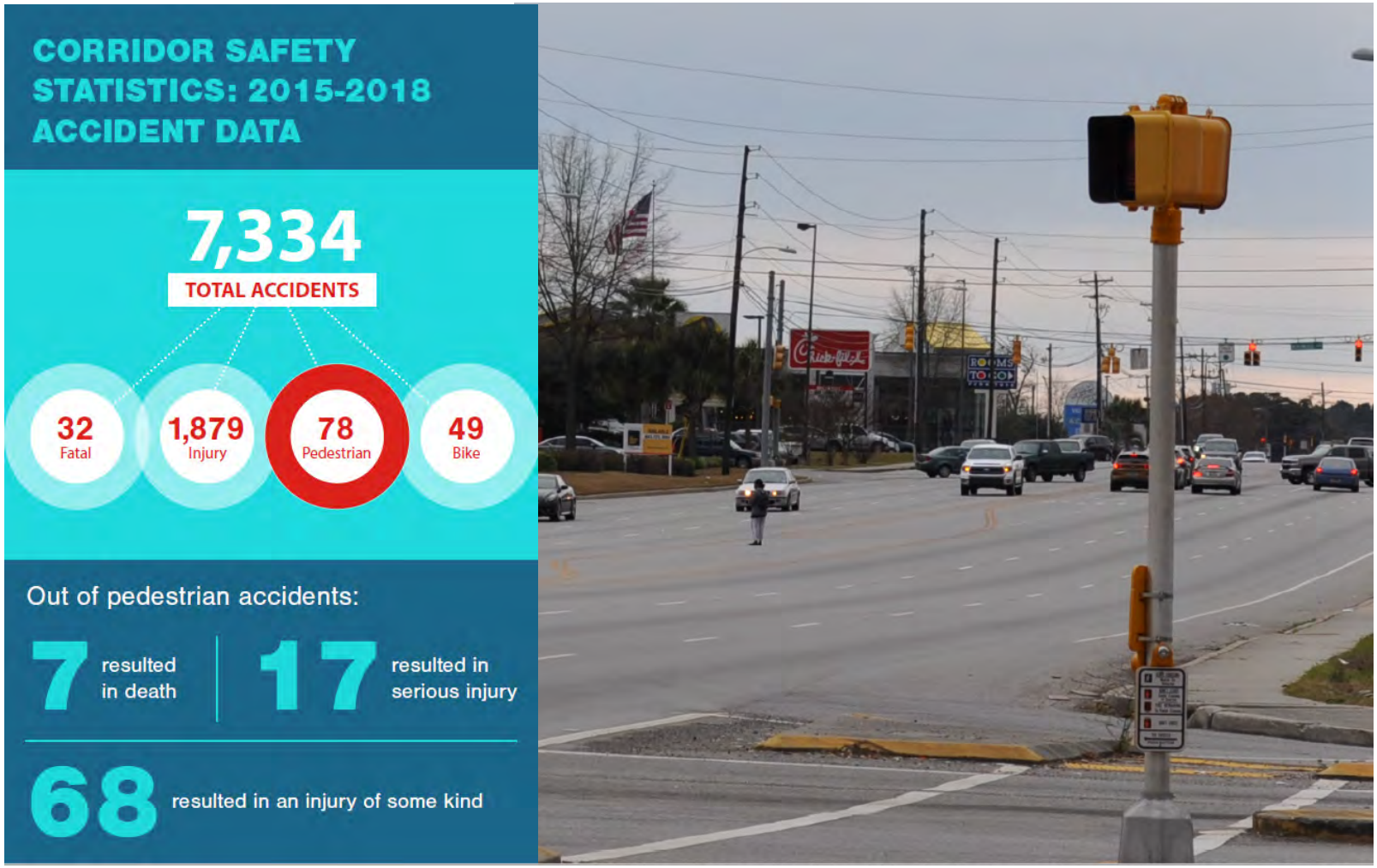
.82 miles
average distance between crosswalks

4.9 miles
longest gap between crosswalks

There is a lack of contiguous sidewalks along the entire corridor.



Rivers Avenue looking east past Northwoods Mall


CORRIDOR SAFETY STATISTICS: 2015-2018 ACCIDENT DATA
7,334
TOTAL ACCIDENTS
32
Fatal
1,879
Injury
78
Pedestrian
49
Bike
Out of pedestrian accidents:
7
resulted in death
17
resulted in serious injury
68
resulted in an injury of some kind

CROSS SECTIONS AND DESIGN CONSIDERATIONS

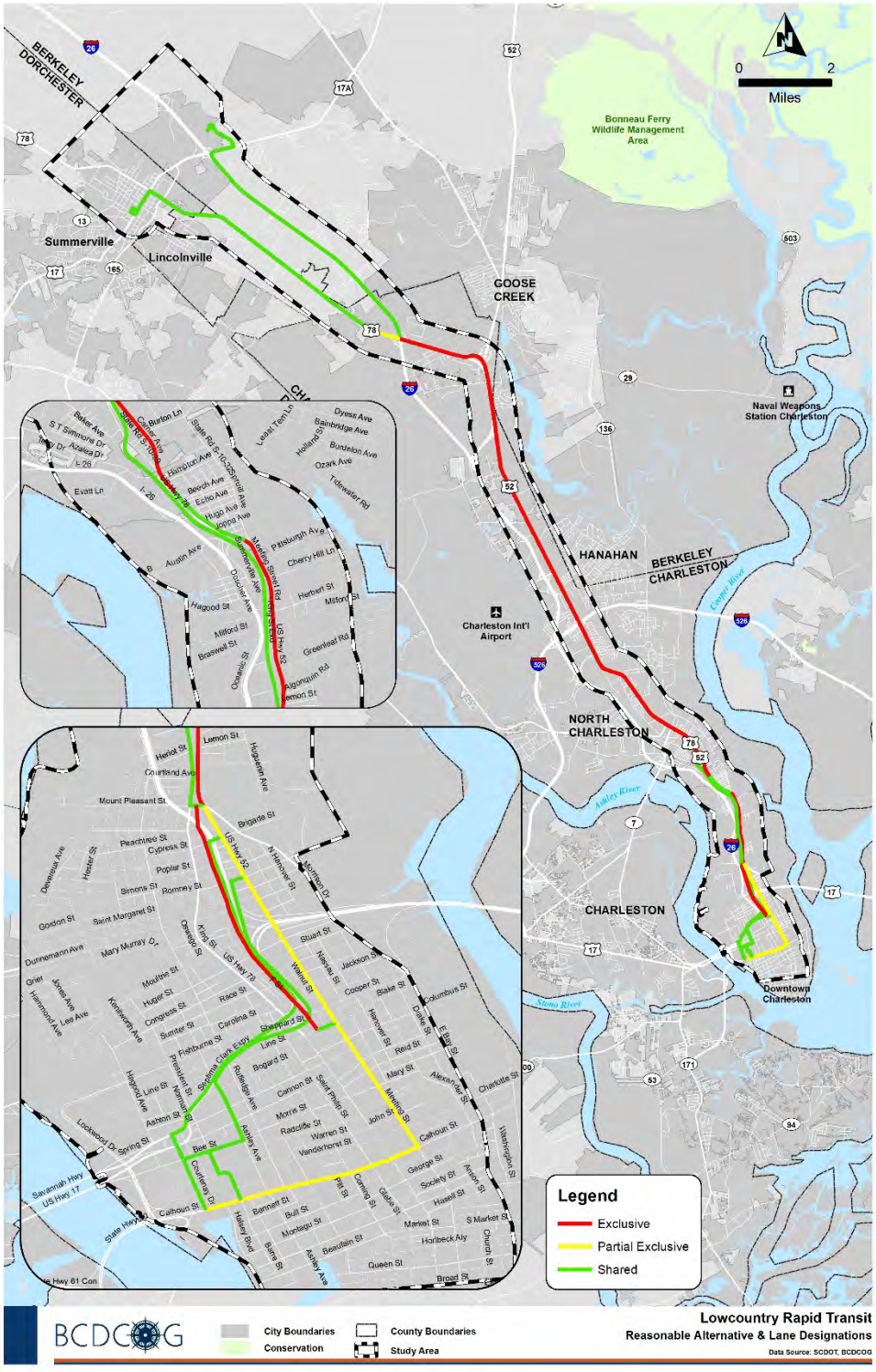
Conceptual Cross Sections

Lowcountry Rapid Transit design will focus on moving people in cars, on the bus, on bikes and by foot. Here are two conceptual examples of how the roadway could be designed.

CENTER RUNNING

SIDE RUNNING

Attachment B – LCRT Lane Designations



Attachment B Figure 1 LCRT Reasonable Alternatives and Lane Designations

Attachment C – Neck Area Additional Analysis

Neck Area Alignments Analysis

Through the Neck Area, alignments with King Street Extension and Meeting Street were studied as alternatives. It is recommended the LCRT operate on King Street Extension in mixed traffic due to several factors:

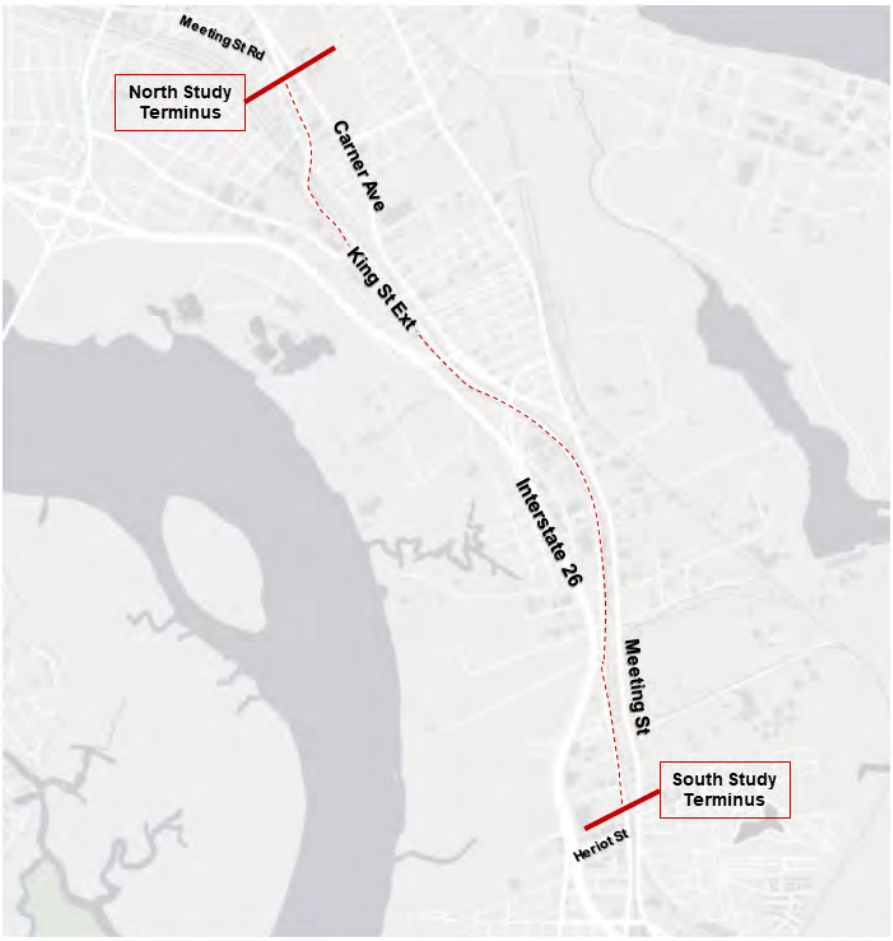
- Travel time along King Street Extension demonstrates minimal impacts in mixed traffic.
- Growth along King Street is expected to increase due to Magnolia and several smaller developments, but traffic through the corridor is not over-capacity.
- The intersection at Mt. Pleasant Street and King Street, the railroad crossing at Hackemann Avenue, and the railroad crossing at Discher Street show traffic congestion due to increased traffic and rail events. Spot queue jump lanes and queue bypasses would need to be implemented in these locations.
- Station accessibility for both alignments would require construction of a pedestrian bridge to provide safe access to environmental justice populations.
- Meeting Street would require grade separation of three railroad crossings to maintain travel times. These grade separations have projected costs in excess of $80 million, and would involve significant coordination with the railroad owners for ROW access, design review, and construction scheduling – impacting the overall LCRT BRT project schedule. Additionally, the crossing adjacent to Cunnington Avenue is constrained by the location of the Bethany Cemetery, a potentially eligible Section 4(f) resource.

Although not a factor in the selection criteria in this subsection, it is important to note that both the King Street Extension and Meeting Street operate at an acceptable level of service, with 9,700 and 15,800 (2019) average daily traffic, respectively.

Travel Time Analysis

King Street Extension Existing Travel Time Analysis

A travel time analysis was conducted using VISSIM microsimulation software to evaluate the existing peak hour travel times on King Street Extension. The travel time was measured in each direction for a segment of King Street Extension between Meeting Street and Heriot Street. The segment is shown in Attachment C Figure 1, below. The overall model was calibrated across the network with Streetlight data and field travel times.



Attachment C Figure 1 King St Extension Travel Time Study Corridor

The simulation was run six times each for the AM and PM peak hours. The average results of these simulation runs were calculated, and are shown in Attachment C Table 1.

Attachment C Table 1 Average VISSIM Travel Time Analysis Results

King St Extension	Distance (ft)	Observed vehicles		Travel Time (min)	
		AM	PM	AM	PM
Meeting Street Rd to Heriot St (southbound)	12,848	337	144	4.43	4.19
Heriot St to Meeting Street Rd (northbound)	12,853	29	338	4.96	5.11

These results show that travel times were longer in the southbound direction during the morning peak, and shorter during the afternoon peak. The opposite was true for the reverse direction, with northbound afternoon travel times exceeding morning travel times. This corresponds with the directionality of the peak hour volumes predicted on the corridor. The average simulation observed vehicles traveling the analysis segment above demonstrate that the simulation

modeled a 90/10 directional split in favor of the southbound direction in the morning, and a 70/30 split in favor of the northbound direction in the afternoon.

The average speeds along the segment were also calculated using the average travel times, as shown in Attachment C Table 2 below.

Attachment C Table 2 Average Speed Calculations for King St Extension

King St Extension	Distance (ft)	Average Speed (mph)	
		AM	PM
Meeting Street to Heriot St (southbound)	12848	32.9	34.8
Heriot St to Meeting Street (northbound)	12853	29.5	28.6

Results

The VISSIM analyses show that there is little delay observed outside of locations where vehicles are making left turns. Northbound is slower because there are more vehicles attempting to turn left across larger southbound traffic volumes.

Future traffic is expected to grow 2.4 percent per year with several larger planned developments that would connect to King Street Extension. Future traffic is expected to be near 15,500 vehicles per day. This segment is anticipated to be Level of Service D (threshold 17,700) based on the Florida Department of Transportation level of service tables. Future VISSIM modeling is underway and will be validated as NEPA continues to advance.

Build Concept for King Street Extension

There are two advanced concepts: a mixed-traffic concept and a bi-directional lane concept.

Mixed-Traffic Concept allows the BRT vehicle to travel the length of the segment with little delay. The intersections and rail crossings require additional turn lanes and queue storage to minimize stopped vehicles from delaying the BRT vehicles. The Mt. Pleasant and King Street Extension signalized intersection does experience delay through the close spacing. It is proposed to modify the BCDCOG Hospitality on Peninsula lot to allow traversing between Meeting Street and King Street Extension. LCRT is planned to travel down Meeting Street south of Mt. Pleasant Street.

Bi-directional Concept creates a single lane for the BRT vehicle to travel a portion of the southern King Street Extension. The exclusive lane would be placed on the east side of King Street Extension next to the rail corridor. The reason the lane does not continue north is due to the bridge structures for the Port Access Interchange. The speed increase does not provide a significant increase in travel time in a segment where travel time is not delayed and minimal traffic signals are in the area. Construction along the railroad is difficult due to the requirement to have flaggers present at all times when construction work could foul the tracks. Work would need to be stopped 15 minutes before and after a train passes, which would impact the

construction schedule. This concept would require the acquisition of some ROW from CSX Railroad, which could prove difficult, costly, and result in significant schedule delay.

Recommendation

For lane configuration, the Mixed Traffic configuration is recommended, with several intersection improvements along King Street, and traversing the Hospitality on Peninsula lot.

- Traffic congestion is not anticipated to be severe.
- This would reduce risks associated with the bi-directional concept for increased budget and schedule impacts due to construction near active rail lines, and probable acquisition.
- The value and benefit to the project is better spent in other areas. Note: improvements to the intersections of King Street Extension with Hackemann Avenue and Discher Street as well as King Street Extension at Meeting Street are anticipated to make this segment fast and reliable.

Meeting Street Rail Impacts

There are three existing at-grade railroad crossings along Meeting Street with an additional future connection scheduled for construction. The heavily utilized rail connections would require grade separation to maintain LCRT travel times. These grade separations have projected costs in excess of $80 million, and would involve significant coordination with multiple railroad owners for ROW access, design review, and construction scheduling – impacting the overall LCRT BRT project schedule. Additionally, any potential redesign for the crossing adjacent to Cunnington Avenue is constrained by the location of the Bethany Cemetery, a potentially eligible Section 4(f) resource. Below is a summary of the rail crossing data from the Existing Conditions Report.

Meeting Street/US 52 SC ID 6258 is a single track, public at-grade crossing located in Charleston SC Charleston County. The primary operating railroad is CSX Transportation DOT Inventory number 632177M, railroad milepost 419.05. The estimated number of trains per day is two switching moves with a maximum time table railroad speed of 10 miles per hour (mph) and highway posted vehicle speed of 45 mph. The crossing's cantilevered flasher gates are controlled by motion detection circuits. Nearby intersections are not signalized and are not interconnected.

Meeting Street/US 52 SC ID 5245 is a single track, public at-grade crossing located in Charleston SC Charleston County. The primary operating railroad is Norfork Southern Railway Company DOT Inventory number 721394H, railroad milepost 2.8. The estimated number of trains per day is five with a maximum time table railroad speed of 10 mph and highway posted vehicle speed of 45 mph. The crossing's cantilevered flashers are controlled by motion detection circuits with no gates installed. Nearby intersections are not signalized and are not interconnected.

Meeting Street/US 52 SC ID 6659 is a single track, public at-grade crossing located in Charleston SC Charleston County. The primary operating railroad is CSX Transportation DOT Inventory number 631997G, railroad milepost 392.97. The estimated number of trains per day is one (during PM peak) with five switching moves, a maximum time table railroad speed of 10

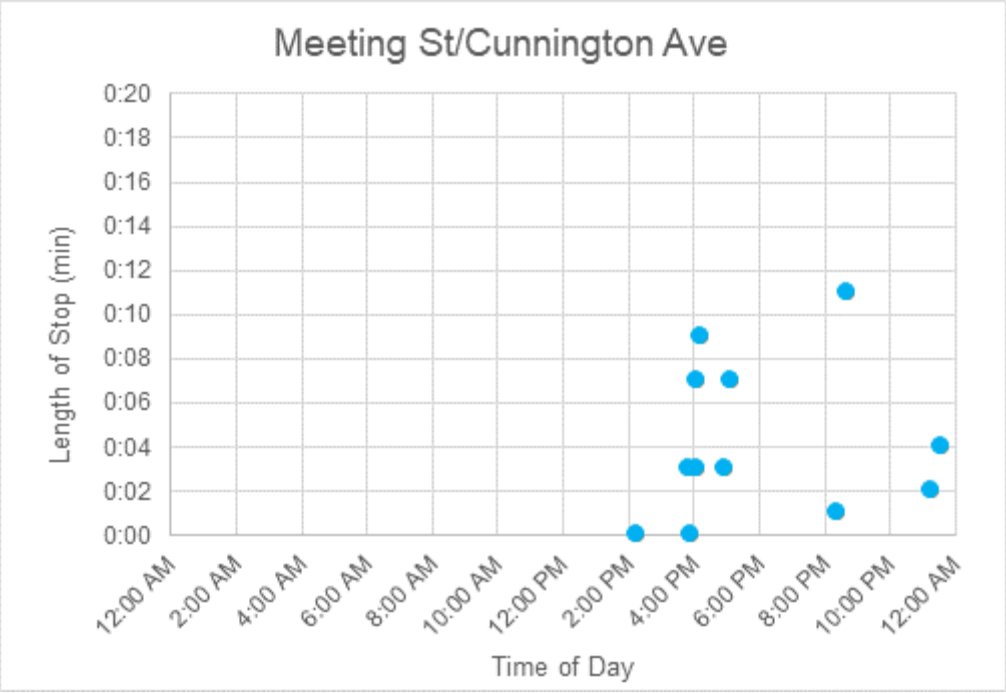
mph, and highway posted vehicle speed of 35 mph. The crossing's cantilevered flashers are controlled by direct current circuits with no gates installed. Nearby intersections are not signalized and are not interconnected.

Rail Crossing Delay

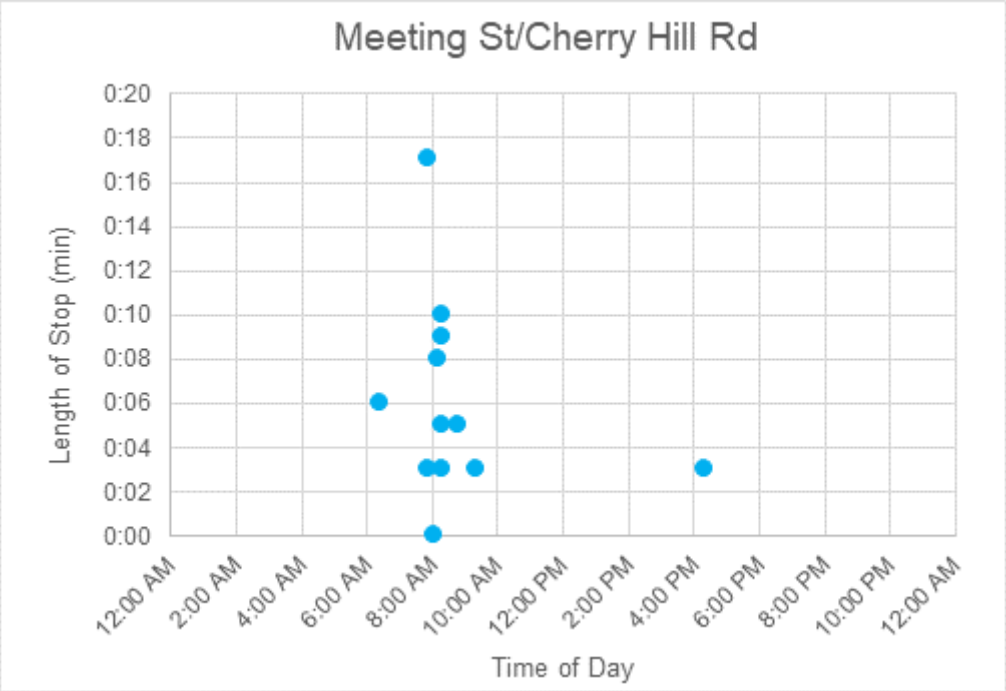
CARTA tracks the delays due to train crossing events. Delay events for the crossings along the LCRT project were reviewed for October 2019. Four railroad crossings are located on the LCRT alignments on Meeting Street and King Street Extension. The results of the review of the crossing delay events are shown in the charts below. Delay events that are recorded as zero minutes of delay indicate that a detour was taken around the rail crossing.

From the analysis it is shown that the rail crossings on Meeting Street at Cunnington Avenue and Meeting Street at Cherry Hill Road caused the most delays in October 2019. These locations also had the longest maximum delays, with the Cherry Hill Road crossing recording the longest delay of 17 minutes. Most of the delays at the Cherry Hill Road crossing occurred in the morning between 8:00-10:00 AM. All of the delays at the Cunnington Avenue crossing occurred in the afternoon and night, with most occurring between 4:00-6:00 PM.

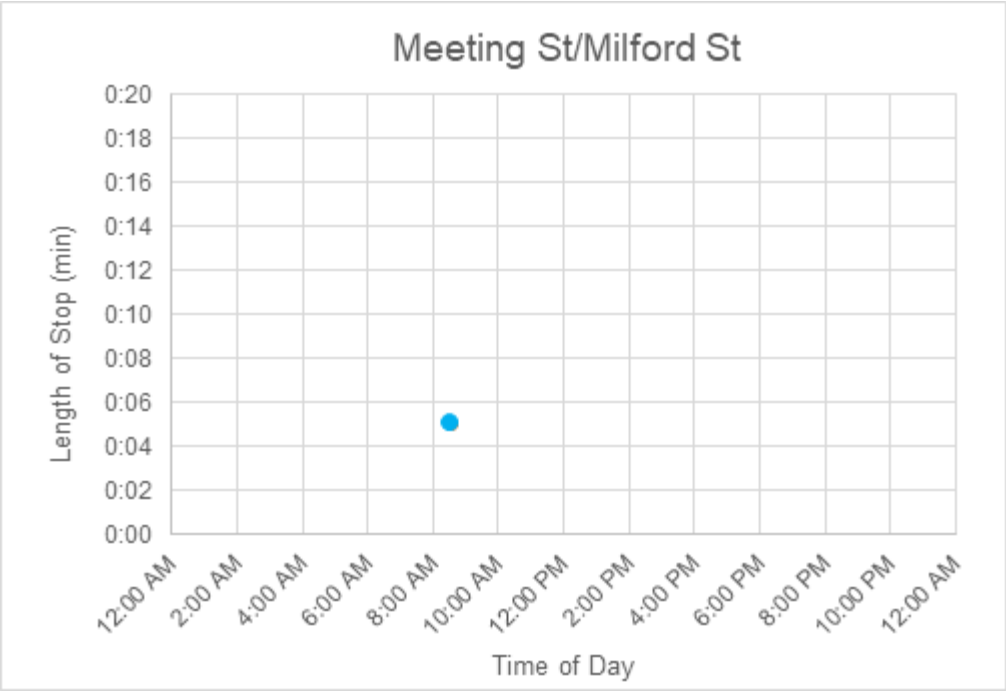
Meeting Street at Milford Street only recorded one delay event in the month of October 2019, and the same was true of the crossing of King Street at Discher Street. The duration of the delay at the crossing at King Street and Discher Street was not recorded, so the duration shown is an estimate based on the other delays in the area. The delay at Meeting Street and Milford Street occurred during the morning at 8:35 AM, and the delay at King Street and Discher Street occurred during the afternoon at 4:11 PM.



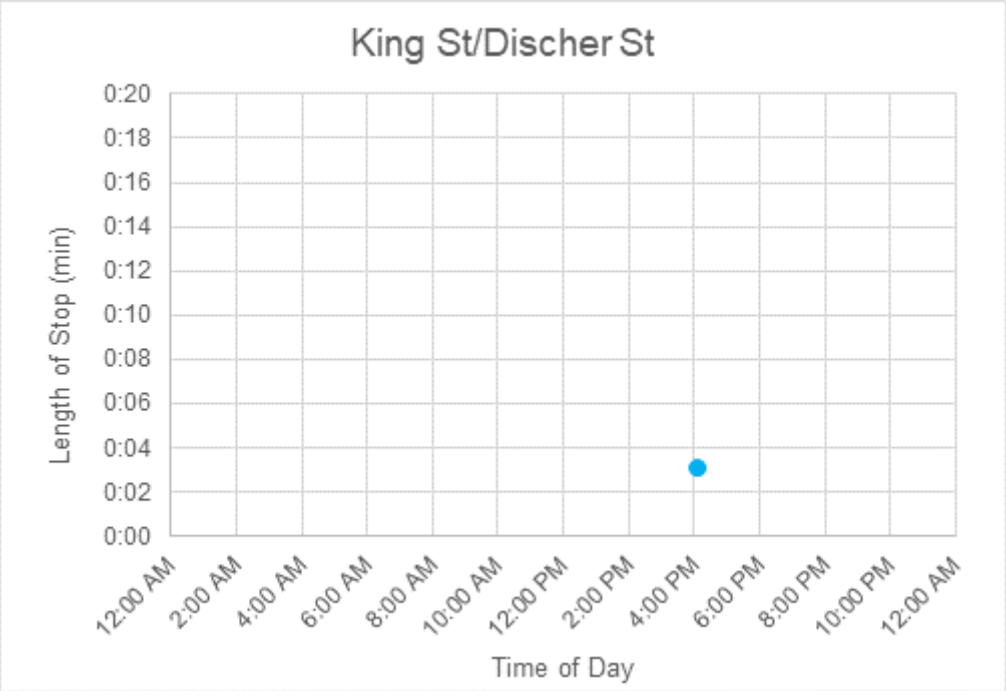
Attachment C Figure 2 Rail Crossing Delay: Meeting St. and Cunnington Ave



Attachment C Figure 3 Rail Crossing Delay: Meeting St. and Cherry Hill Rd



Attachment C Figure 4 Rail Crossing Delay: Meeting St. and Milford St



Attachment C Figure 5 Rail Crossing Delay: King St. and Discher St.

Meeting Street Concept

Meeting Street has a viable cross section where exclusive lanes could be implemented with little impact to the businesses and other land uses. There are three existing and a proposed fourth (Palmetto Railway Southern Loop) at-grade rail crossing on the south end of the Meeting Street alignment. To continue the exclusive lanes, two bridge structures are required. As there is insufficient distance between the crossings to return to a roadway section, one bridge structure would be required to span over both the two existing and one proposed at-grade rail crossings near Cherry Hill Lane and Milford Street. A second bridge structure would be required at the crossing near Cunnington Avenue. The concept developed for this is a BRT-only bridge structure. The structures would be two lanes over the rail crossings. The cost estimate is $80M with construction and other cost items associated with project development. These potential bridge structures would also have some impacts to parcel access.

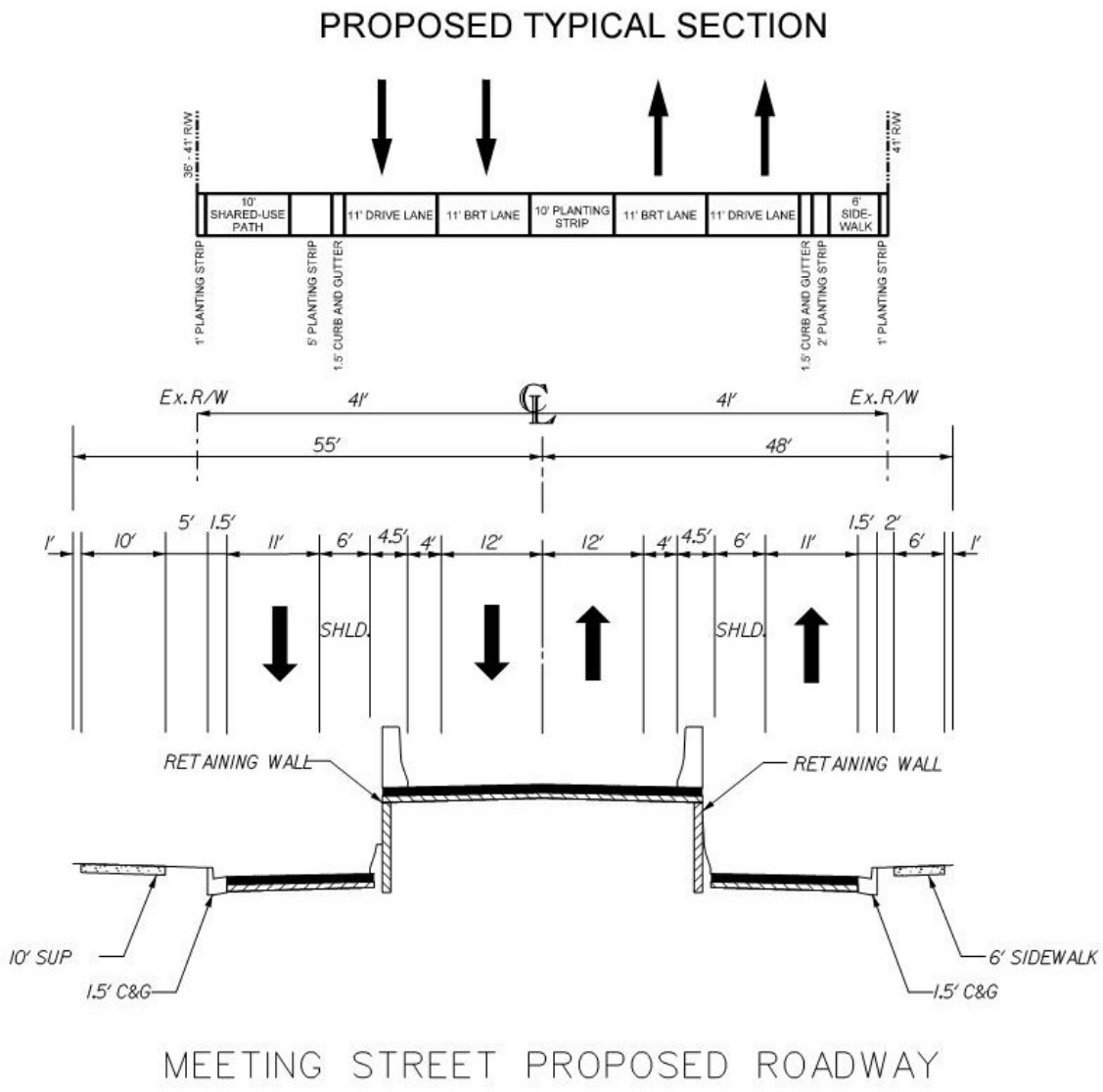
The concept would provide a 2-lane BRT bridge in the center of the Meeting Street ROW, allowing businesses to have right-in/right-out access. Additional ROW (21 total feet) will be required to construct the grade-separated BRT guideways, at-grade general purpose lanes, 6-foot sidewalk, and 10-foot shared use path. Even with the removal of buffers and the use of only 5-foot-wide sidewalks, an additional 9 feet of ROW will be required. Attachment C Figure 6 shows the proposed typical section for this segment of Meeting Street with the BRT lanes at-grade and with the BRT lanes grade separated on the required bridge approaches.

Attachment C Figures 7, 8, and 9 show the plan view of the BRT bridge concepts with the new ROW required and the extents of the grade separation for the bridge approaches shown by the proposed linework. Attachment C Figure 7 shows the grade separation for the approaches to bridge 1 would begin at the intersection with Morrison Drive/Mount Pleasant Street and would extend until approximately Algonquin Road. The new ROW required for the proposed typical section would impact the Bethany Cemetery. ROW impacts also include one residential displacement, and a commercial displacement of the Munkle Brewing Company. Additional damages and a possible relocation of the Meeting Green Nursery could also be required.

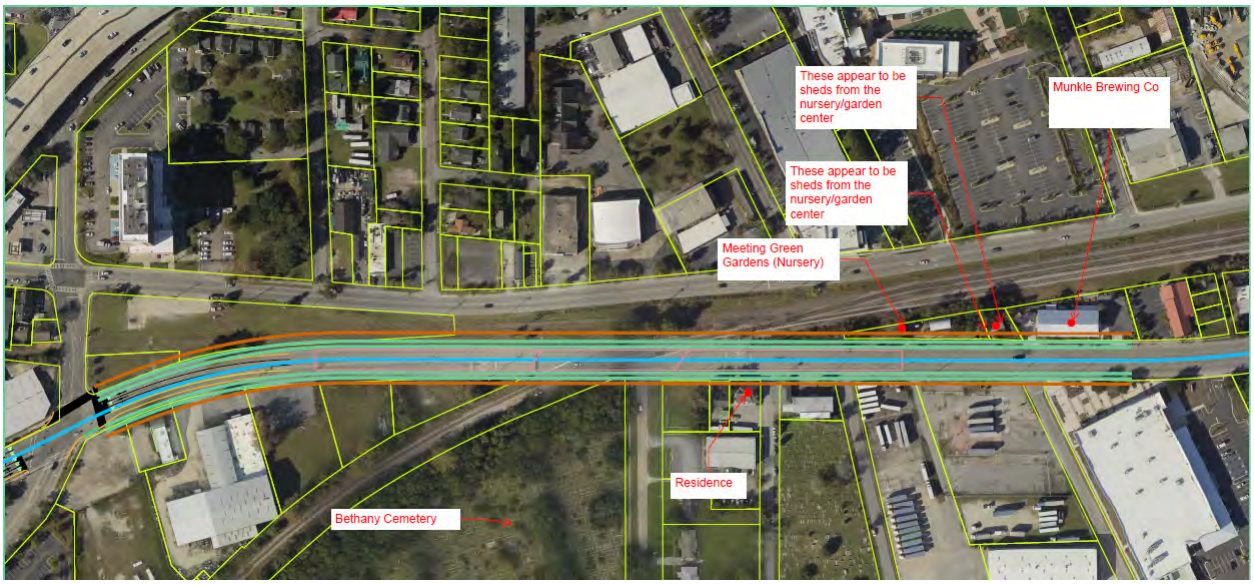
Attachment C Figures 8 and 9 show the Meeting Street bridge 2 required for the grade separated BRT lanes. The bridge 2 approach would begin grade separating approximately 900’ south of Milford Street and tie back to the existing grade near Pittsburgh Avenue. ROW impacts include commercial relocations for eHouse Studio, three multi-tenant commercial buildings, Rosemont Missionary Baptist Church and two residences. Additional ROW damages would also be expected at Mike’s Alignment and Green Spirit Hydrogardens.

In order to grade separate the BRT lanes, bridge 1 would need to be approximately 1200’ in length in order to provide the necessary vertical clearance over the skewed railroad crossing. Approximately 500’ of retaining walls would also be required for each approach in order to tie down the grade to Meeting Street. Attachment C Figure 10 shows the proposed profile needed for bridge 2. In order to provide adequate vertical clearance for the three railroad crossings, the bridge would need to be approximately 2700 feet long due to the spacing of the crossings. Additional retaining walls would be required of approximately 500 feet on both approaches to

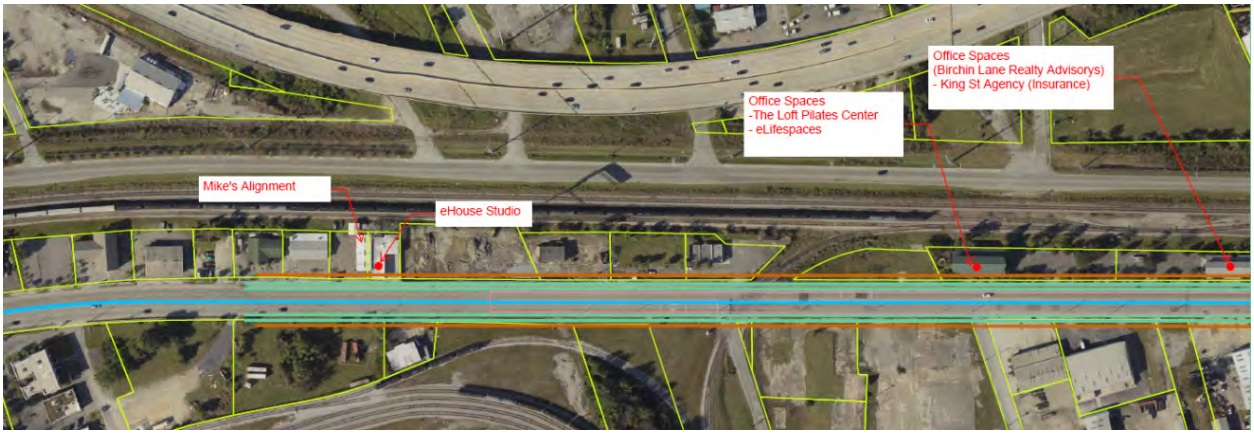
allow for the grade separation to tie down. The Meeting Street intersections that would be affected by the bridge concept are also shown in Attachment C Figure 10.



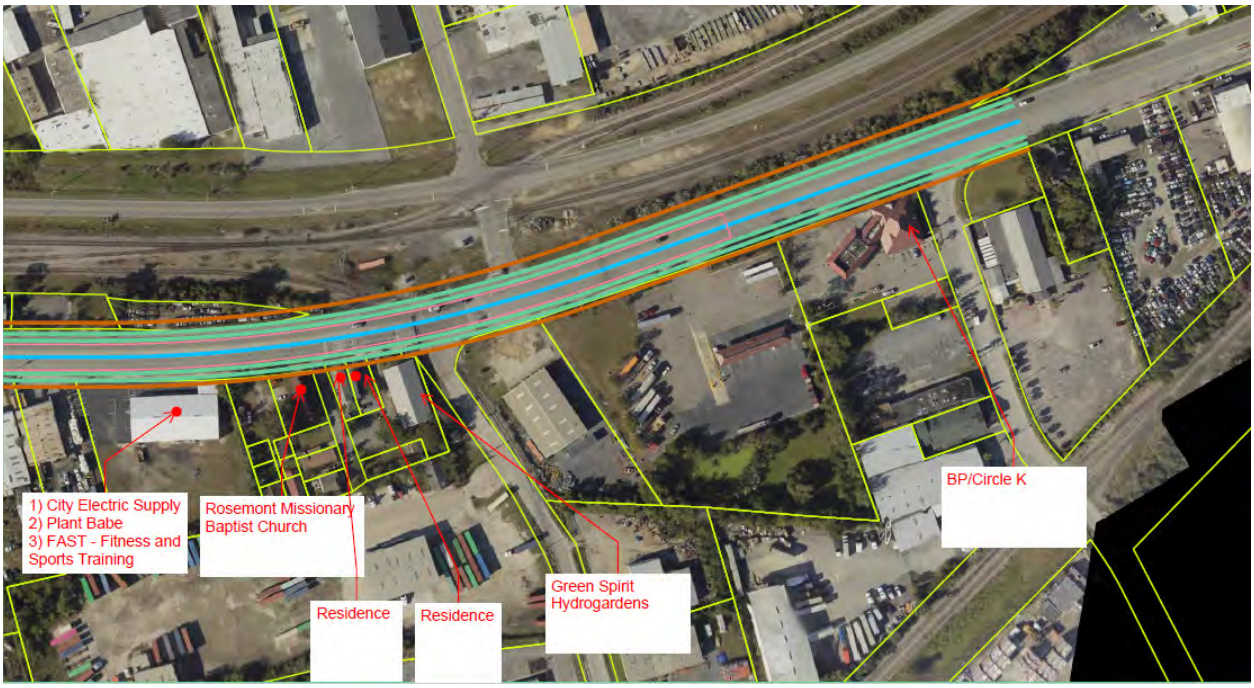
Attachment C Figure 6 Typical Section of Meeting Street



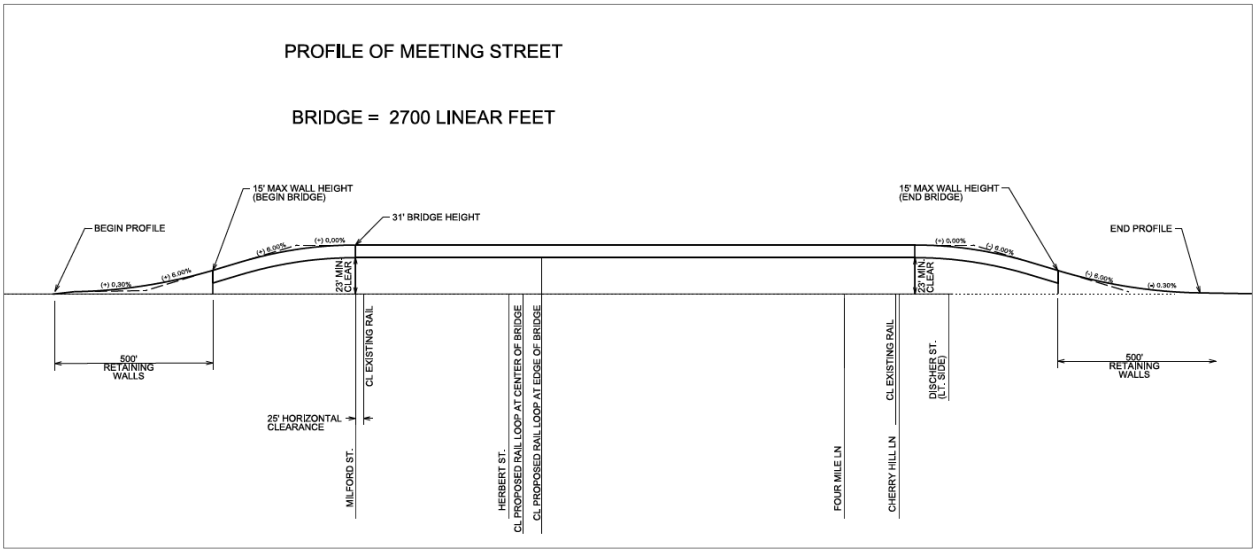
Attachment C Figure 7 Plan View of Meeting Street Bridge 1



Attachment C Figure 8 Plan View of Meeting Street Bridge 2



Attachment C Figure 9 Plan View of Meeting Street Bridge 2



Attachment C Figure 10 Profile of Meeting Street Bridge 2

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Appendix C: Travel Time and On-Time Performance Review

Lowcountry Rapid Transit

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August 10, 2020

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C Travel Time and On-Time Performance Review

C.1 Travel Time

The LCRT project corridor is served by CARTA and TriCounty Link (TCL). TCL operates in rural areas using deviated local and deviated local and commuter routes on a flag stop basis, allowing for passenger boarding and alighting outside of fixed bus stop locations. TCL routes often connect with CARTA service at bus stops and park-and-ride facilities, enabling seamless transfer opportunities for passengers. TCL bus route CS2 primarily runs in the study area from Summerville to Rivers Avenue and Otranto Road in North Charleston. TCL runs five morning peak / six evening peak inbound trips and five morning peak/six evening peak outbound trips.

CARTA is the primary transit service provider for the urbanized areas in the BCDCOG region, offering a variety of transit services including fixed local bus, commuter express bus, shuttles, and Tel-A-Ride paratransit services. Route 10 (Rivers Avenue) operates between Trident Medical Center and the Charleston Visitor Center in downtown Charleston, primarily via Rivers Avenue, it is the highest ridership route of the CARTA system. Route 10's weekday span of service is from about 6:00 AM to 12:45 AM with a peak frequency of 20 minutes and off peak frequency of 30-60 minutes. On Saturday the route operates from about 6:45 AM to about 12:15AM with frequencies ranging between 20 and 40 minutes. Sunday service is provided from about 8:30 AM to 9:30 PM at 30-60 minute frequencies.

A trip comparison was also done for this analysis, including end to end travel time review for the alignments. The travel time was then compared to the travel time for a single occupancy vehicle (SOV). The analysis used Google Maps, for automobile travel, and Google Transit, for transit travel, routing and travel time suggestions. The analysis took into consideration the most congested time of day, i.e., 5PM, and direction of travel, i.e. northbound from MUSC to Summerville and from MUSC to Nexton, for Wednesday March11, based on previously recorded travel data in Google maps, i.e., data from previous years. The analysis showed that travel time reliability, mirroring the LCRT alignment, varies greatly from MUSC to the Town of Summerville. On the low end, the approximate 26 mile trip could be made in 55 minutes and on the high end, it may take 120 minutes. The LCRT in dedicated ROW and with traffic signal priority treatments can ensure more reliable travel times throughout the day. Table E.1 summarizes the comparison.

Table C.1 Alignment Travel Time Comparison

		Summerville Alignments						Nexton Alignments					
		1	2	3	4	5	6	7	8	9	10	11	12
LCRT Length (mi)	-	26.0	24.9	26.1	25.9	24.9	25.9	25.6	25.6	26.7	26.6	25.6	26.7
LCRT No. of Stations	-	26	22	26	26	22	26	21	17	21	21	17	21
LCRT End to End Travel Time		86 min.	75 min.	86 min.	85 min.	75 min.	85 min.	77 min.	67 min.	77 min.	77 min.	67 min.	76 min.
Travel time - Single Occupancy Vehicle (SOV) on fastest route [1,2]	Low	35 min.						35 min.					
	High	75 min.						65 min.					
Travel time - Single Occupancy Vehicle (SOV) on LCRT route[3,4]	Low	55 min.						45 min.					
	High	120 min.						100 min.					
Existing Bus - Option 1[5]: CARTA XP1[6] TCL CS2[7]	-	103 min.						Due to current TCL transit schedules the trip would approximately thirteen (13) hours to allow for transfers from XP1 to CS2 and from CS2 to TCL D305 Summerville Connector[8].					
Existing Bus - Option 2[9]: CARTA Route 31[10]	-	127 min.						Due to transit schedule, trip departure would need to occur on Thursday and take approximately 253 min connecting from XP1 to Route 10, to D305[11].					

C.2 On-Time Performance Review

CARTA uses the Swiftly software to analyze its routes on-time performance (OTP). The OTP for a transit vehicle ranges from one minute early to five or 10 minutes late. The OTP for Route 10 for weekday service during the month of October 2019 was analyzed. October was chosen since it represents a typical high ridership month as schools are in session, the weather is comfortable for users to access transit, and there are no major national holidays. Figure E.1 shows the OTP parameters as one minute early and 10 minutes late; using these parameters, the OTP for Route 10 was 1.7% early, 74.0% on-time, and 24.3% late. Figure E.2 shows the OTP parameters with one minute early to 5 minutes late as another metric. Using this parameter, the OTP for Route 10 was 1.6% early, 49.4% on-time, and 48.9% late.

[1] Source: https://tinyurl.com/u3y8jdk
[2] Source: https://tinyurl.com/r774y4c
[3] Source: https://tinyurl.com/twufklb
[4] Source: https://tinyurl.com/v4socj8
[5] Source: https://goo.gl/maps/1uqtoRG1MXMetf3RA
[6] CARTA XP1: James Island - North Charleston Express route
[7] TriCounty Link CS2: Commute Solutions 2 Summerville/North Charleston route
[8] Source: https://goo.gl/maps/ZnE2L8FRuHHQKmKf7
[9] Source: https://goo.gl/maps/3MYNjHe2muhppXN89
[10] CARTA 31: Folly Road route
[11] Source: https://goo.gl/maps/Ud2QxApWWwyJ2rh59

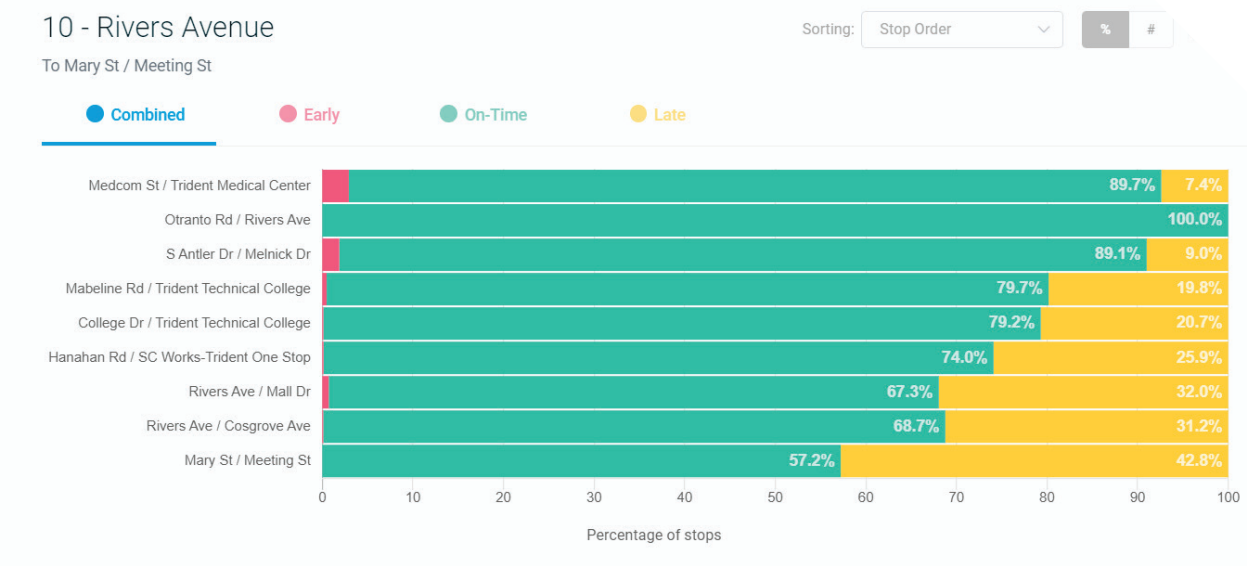

Figure C.1 Route 10 OTP 1-Minute Early and 5 Minutes Late

Figure C.2 Route 10 OTP 1-Minute Early and 10 Minutes Late

Once the single LCRT alignment is defined, work will need to be done to optimize the underlying transit network operations to maximize mobility for the region. In essence, optimizing the local bus service to make it attractive for current and new users to access the LCRT. Some improvements could include, new routes, modified routes, changes to span of service and headway improvements.

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Appendix D: Safety Impact Evaluation

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August 10, 2020

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D Safety Impact Evaluation

D.1 Assumptions on Opportunity to Impact Safety Evaluation Measures

The opportunity to impact safety evaluation was based on best available alignment concepts at the time of the assessment. The following SCDOT data sources were used in this evaluation:

- Crash data for the years 2015-2019
- Average daily traffic (ADT) data from the department's count program stations for the years 2015-2019.

Because this assessment represents a comparison of alternatives, any segments which are expected to show no differences between alternatives were not evaluated. Therefore, since the concept for much of Rivers Avenue is the same across all alternatives, it was excluded from the evaluation of each alternative. Further analysis could be performed on the Rivers Avenue sections. However, detailed conceptual plans and traffic model data that is presently not available would be needed to include Rivers Avenue in this evaluation.

The local streets in the hospital district in downtown Charleston were not included in this analysis, because minimal differences were expected between alternatives and because crash and ADT data is limited on these streets.

D.2 Safety Impact Potential Scoring

The scoring criteria are explained below and summarized in Table D.1

- A score of 1 indicates no potential for safety improvements or requires the use of ITS infrastructure to supplement dynamic lanes to maintain safe operations. For example, segments on the freeway have no opportunity to impact pedestrian safety since no pedestrian facilities are present on freeways. Regarding motorist safety, sections receiving a score of 1 have the potential to have a net no-change to crash risk but additional ITS infrastructure may be required to achieve this. For example, the use of dynamic lanes may require the ability to monitor and respond to incidents or to perform an all-clear assessment before time-of-day change take place.
- A score of 2 indicates minimal net direct impact to safety based on current concepts, but allows for the potential for safety improvements if needed. For example, while no major improvements are proposed on US 17A, the pedestrian facilities and/or the intersections could be improved if any safety concerns arose.
- A score of 3 indicates a moderate potential safety impact, such as the addition of traffic signals and some raised median sections, but may include some shared lane sections or other areas with less safety benefit. For example, the current concept for Carner Avenue includes new signals, but only small sections of raised median, with the rest of the bus lanes being separated by pavement buffers. It received a 3 in both motorist and pedestrian safety impact. Regarding pedestrian safety, a section receiving a score of 3 has safety-improving elements such as new signals, crosswalks, and sidewalk

rehabilitation, but has a low background demand for pedestrian crossings. This score is reserved for sections along King Street between Carner Avenue and Mount Pleasant Street where there is little reason to cross King Street due to a lack of origins or destinations.

- A score of 4 indicates a high potential safety impact, including additional signals and raised medians along the whole segment length. Sections receiving a pedestrian safety score of 4 are locations where background pedestrian crossing demand was expected to be higher than sections receiving a 3. For example, Meeting Street between Rivers Avenue and Mount Pleasant Street received a 4, because in addition to LCRT pedestrian crossing demand, there is the potential to improve conditions for background pedestrian traffic between neighborhoods and businesses on either side of Meeting Street.
- A score of 5 indicates significant potential for safety impact, especially in areas of high risk. For example, Rivers Avenue between Carner Avenue and Cosgrove Avenue received a 5 for motorist safety impact because this short segment has two new proposed signals and a raised median in an area with a high concentration of driveways and a large number of crashes associated with them. Regarding pedestrian safety, sections receiving a score of 5 include the potential to improve existing traffic signals, add new signals, and improve sidewalk conditions in areas where pedestrian traffic is high and where crash trends show that pedestrian-related crashes are occurring frequently.

Table D.1 Pedestrian and Motorist Safety Scoring Criteria

Score	Pedestrian Safety	Motorist Safety
1	No potential to improve pedestrian safety	Potential to result in no change to safety with ITS countermeasures
2	No conceptual improvements identified, but proposed route has pedestrian traffic and LCRT could help improve connectivity and conditions	No conceptual improvements identified, but LCRT could help improve motorist safety conditions if a need is determined through design phases
3	New signals could provide improved pedestrian crossings; background crossing demand may be minimal	New signals can improve intersection crash rates, raised median sections can reduce crash rates, partially consists of raised median sections, some mixed-traffic lanes
4	New signals could provide improved pedestrian crossings; background crossing demand is anticipated to be higher than Category 3	New signals can improve intersection crash rates, raised median sections can reduce crash rates, continuous raised median sections, some mixed-traffic lanes
5	New signals could provide improved pedestrian crossings; background crossing demand is anticipated to be very high; several pedestrian crashes have occurred during study period	New signals can improve intersection crash rates, raised median sections can reduce crash rates, continuous raised median sections, existing crash hotspots

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Appendix E: Hagood Avenue Extension Assessment

Lowcountry Rapid Transit

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August 10, 2020

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E Hagood Avenue Extension Assessment

For technical feasibility the proposed Hagood Avenue extension, Figure F.1, was reviewed. The Hagood Street Extension will be a new major north-south street connecting the Westside Neighborhood, Gadsden Green and West Edge to the Medical District[1].The Hagood Avenue extension appears to be a good connection for the Crosstown Alignment, but it does not make the Alignment any more feasible for LCRT. The roadway modification would not induce a significant change in ridership as the proposed station is in approximately the same location.

- The benefits of the Hagood connection for a Crosstown alternative are as follows:
  - Allows for better circulation in the Medical District, so the circulation can be for Hagood Avenue, Bee Street to Courtenay Drive.
  - Geometrics may improve Bus flow – although it is not fully exclusive.
  - Could allow for an easier connection from West Edge.
  - Enables a better DASH connection from the Medical District to West Edge.
- Cons:
  - ROW ownership is unknown. If the LCRT is expected to purchase the ROW this could impact the NEPA class of action.
  - Access along the roadway may slow BRT operations with vehicles trying to enter the parking structure.
  - SCDOT signal spacing on US 17 are too close for approval. A design variance would be required.
  - LCRT does not have costs for additional construction for this roadway connection.
  - Schedule impacts for selecting this action would impact both NEPA and design tasks. There are several design concerns due to lane configuration and vehicles stopping place that will need to be addressed in greater detail for safe traffic flow.

[1] Source: http://www.designdivision.org/hagood-street-extension

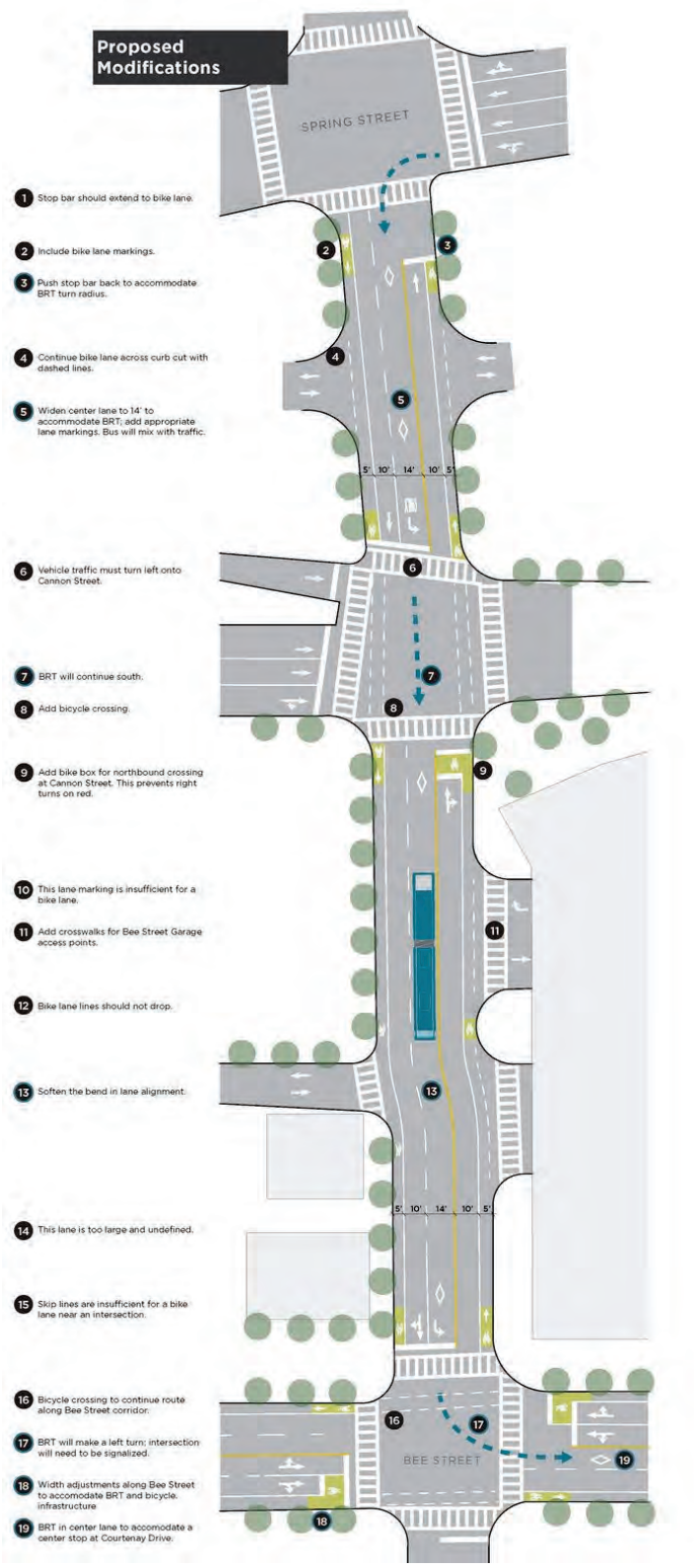

Figure E.1 Hagood Street Extension Concept

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Appendix F: Evaluation Matrix Detailed Results

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August 10, 2020

5790 Casper Padgett Way, North Charleston, SC 29406

Tel: 843.529.0400 **Fax:** 843.529.0305.

F Evaluation Matrix Detailed Results

					1		2		3		4		5		6		7		8		9		10		11		12	
					Summerville, Short Ave/Jay St. Meeting/Calhoun		Summerville, Short Ave/ Jay St. Crosstown		Summerville, Short Ave/ Jay St. Low Line		Summerville, Short Ave, Meeting St. Meeting/Calhoun		Summerville, Short Ave, Meeting St. Crosstown		Summerville, Short Ave, Meeting St. Low Line		Alexion, Short Ave, Jay St. Meeting/Calhoun		Alexion, Short Ave, Jay St. Crosstown		Alexion, Short Ave, Jay St. Low Line		Alexion, Short Ave, Meeting St. Meeting/Calhoun		Alexion, Short Ave, Meeting St. Crosstown		Alexion, Short Ave, Meeting St. Low Line	
LCRT Goals	Evaluation Category	Evaluation Criteria	Measurement	Max Rating	Rating Per Alignment																							Detail
Promote livable, transit-supportive development	Support existing and generate new development patterns	Land available for TOD development	Land available for TOD development within each station area for each alignment	20	19.4	3722.0	16.0	3434.0	20.0	3770.4	19.4	3722.0	16.0	3434.0	20.0	3770.4	9.6	2890.5	6.3	2602.5	10.2	2938.9	9.6	2890.5	6.3	2602.5	10.2	2938.9
Elastic multimodal system: travel choice	Bicycle, pedestrian, and persons with limited mobility connectivity	Station accessibility	Existing bike facilities within each station area for each alignment	10	10.0	3.6	3.8	2.5	6.5	3.0	10.0	3.6	3.8	2.5	6.5	3.0	10.0	3.6	3.8	2.5	6.5	3.0	10.0	3.6	3.8	2.5	6.5	3.0
			Existing pedestrian facilities within each station area for each alignment	10	9.0	168.4	3.7	101.9	9.2	170.5	9.0	168.4	3.7	101.9	9.2	170.5	8.0	155.3	2.7	88.8	8.2	157.4	8.0	155.3	2.7	88.8	8.2	157.4
			Planned bike facilities within each station area for each alignment	5	5.0	61.1	3.5	53.4	5.0	61.1	5.0	61.1	3.5	53.4	5.0	61.1	2.8	49.2	1.3	41.5	2.8	49.2	2.8	49.2	1.3	41.5	2.8	49.2
			Planned pedestrian facilities within each station area for each alignment	5	5.0	19.58	3.9	18.05	4.9	19.32	5.0	19.58	3.9	18.05	4.9	19.32	2.6	16.26	1.5	14.73	2.4	16	2.6	16.26	1.5	14.73	2.4	16
Minimize environmental impacts and promote a healthy human environment	Environmental impacts	Cultural resources (Section 106)	Historic resources (structures) adjacent to and facing the alignment	10	3.9	11	9.7	7	6.8	9	2.4	12	8.3	8	5.3	10	5.3	10	10.0	6	8.3	8	9.7	7	3.9	11	6.8	9
			Historic districts each alignment traverses	10	5.4	4	8.2	3	2.7	5	5.4	4	8.2	3	2.7	5	8.2	3	10.0	2	5.4	4	10.0	2	8.2	3	5.4	4
		Section 4(f) properties	Section 4(f) properties adjacent to and facing each alignment	10	4.2	8	9.4	5	4.2	8	4.2	8	9.4	5	4.2	8	5.9	7	10.0	4	5.9	7	10.0	4	5.9	7	5.9	7
		Transit dependent populations	Population under 18 served within each station area (1/2-mile) by alignment	10	9.9	8,965	6.7	7,800	10.0	8,995	9.9	8,965	6.7	7,800	10.0	8,995	5.8	7,486	2.5	6,321	5.9	7,516	5.8	7,486	2.5	6,321	5.9	7,516
			Population 65 + served within each station area (1/2-mile) by alignment	10	9.4	4,950	4.7	3,573	9.8	5,055	9.4	4,950	4.7	3,573	9.8	5,055	7.1	4,251	2.3	2,874	7.4	4,354	7.1	4,251	2.3	2,874	7.4	4,354
			Disabled population served within each station area (1/2-mile) by alignment	10	9.5	5,165	4.8	3,651	9.8	5,259	9.5	5,165	4.8	3,651	9.8	5,259	7.1	4,386	2.3	2,872	7.4	4,480	7.1	4,386	2.3	2,872	7.4	4,480
			Zero-auto households served within each station area (1/2-mile) by alignment	10	8.9	2,788	3.3	1,515	8.7	2,753	8.9	2,788	3.3	1,515	8.7	2,753	8.5	2,709	3.0	1,436	8.4	2,674	8.5	2,709	3.0	1,436	8.4	2,674
		Environmental justice populations	Minority population served within each station area (1/2-mile) by alignment	15	14.2	25,559	6.8	19,975	14.4	25,855	14.2	25,559	6.8	19,975	14.4	25,855	11.1	23,185	3.6	17,595	11.2	23,274	11.1	23,185	3.6	17,595	11.2	23,274
			Poverty population served within each station area (1/2-mile) by alignment	15	13.9	14,226	6.0	9,595	13.9	14,192	13.9	14,226	6.0	9,595	13.9	14,192	11.8	12,989	3.8	8,352	11.8	12,951	11.8	12,989	3.8	8,352	11.8	12,951
	Traffic Operations	Existing Roadway Crash Rate	Crash rate for each major road within an alignment, normalized by average daily traffic	5	2.1	8.37	2.8	7.16	2.3	8.01	1.6	9.05	2.4	7.88	1.9	8.69	4.5	4.35	5.0	2.87	4.7	4.01	4.1	5.05	4.9	3.61	4.3	4.70
		Potential to Impact Safety	Ability of BRT Project to enhance safety	5	5.0	16.50	3.4	15.83	4.6	16.17	5.0	16.33	2.8	15.67	4.0	16.00	4.0	16.00	1.7	15.33	2.8	15.67	3.4	15.83	1.1	15.17	2.3	15.50
Improve local, regional mobility, transit efficiency, and quality of service	Transit connections / integration	Integration with existing transit services	Total connections to existing transit routes	10	8.6	24	3.1	15	8.6	24	8.6	24	3.1	15	8.6	24	8.6	24	3.1	15	8.6	24	8.6	24	3.1	15	8.6	24
	Reliability	Dedicated right-of-way	Percent of alignment in Exclusive Lanes	5	4.4	60	1.4	54	4.3	59.9	4.2	59.6	1.5	54.1	4.1	59.5	4.5	60.4	1.8	54.8	4.4	60.2	4.4	60	1.6	54.4	4.3	59.8
		Dedicated right-of-way	Percent of alignment in Exclusive and Partial Lanes	10	8.7	66.7	3.0	54	8.6	66.5	8.5	66.3	3.0	54.1	8.4	66.1	8.9	67.1	3.3	54.8	8.8	66.9	8.7	66.7	3.2	54.4	8.6	66.5
		Railroad crossings and disruption to service during peak periods	Number of active at-grade railroad crossings	10	8.4	4	8.4	4	8.4	4	3.5	7	3.5	7	3.5	7	10.0	3	10.0	3	10.0	3	5.2	6	5.2	6	5.2	6
	Travel times	Travel times	Travel times during PM peak period	10	3.5	1:26:36	7.7	1:15:54	3.6	1:26:14	3.8	1:25:42	7.7	1:15:55	3.8	1:25:39	7.2	1:17:05	10.0	1:07:13	7.3	1:17:03	7.3	1:17:01	10.0	1:07:14	7.3	1:16:58
		Distance between stations	Average distance between stations per alignment	5	4.8	1.04	3.9	1.19	4.8	1.05	4.9	1.04	3.9	1.19	4.8	1.04	2.9	1.33	1.1	1.60	2.9	1.34	2.9	1.33	1.1	1.60	2.9	1.33
Support economic development plans along the corridor	Population and employment	Existing population	Population within ½-mile of each station area along the alignment	20	18.9	46,744	9.1	33,309	19.3	47,335	18.9	46,744	9.1	33,309	19.3	47,335	14.6	40,836	4.8	27,389	15.0	41,413	14.6	40,836	4.8	27,389	15.0	41,413
		Existing employment	Employment within ½-mile of each station area along the alignment	20	18.4	50,031	7.8	35,659	18.5	50,160	18.4	50,031	7.8	35,659	18.5	50,160	15.8	46,469	5.2	32,097	15.9	46,598	15.8	46,469	5.2	32,097	15.9	46,598
	Ridership potential	Ridership generators served	Ridership generators within ½-mile of each station along the alignment segment (activity nodes)	10	9.4	63	3.9	46	9.1	62	9.4	63	3.9	46	9.1	62	8.1	59	2.6	42	7.8	58	8.1	59	2.6	42	7.8	58
		Total Ridership from FTA STOPS model	Annual Ridership (305 days)	30	28.7	2,337,520	11.0	1,621,685	27.1	2,273,470	28.4	2,324,405	10.8	1,615,890	27.0	2,269,200	24.4	2,164,585	8.6	1,525,305	23.9	2,145,675	24.2	2,157,875	8.4	1,518,595	22.3	2,078,880
	On-street parking	On-street parking	Linear feet of potential impacted on-street parking	5	1.8	7,783	4.9	2,742	3.5	5,040	1.8	7,783	4.9	2,742	3.5	5,040	1.8	7,783	4.9	2,742	3.5	5,040	1.8	7,783	4.9	2,742	3.5	5,040
Project viability, costs, and implementation	Technical feasibility	Constructability issues	BRT constructability issues based on potential conflicts and technical challenges	15	8	Construction parallel to railroad along King St. Meeting/Calhoun construction includes	12	Construction parallel to railroad along King St. Improves over Alignment 1 due to less construction	6	Construction parallel to railroad along King St. In addition to Alignment 1 the Low Line has	6	Multiple at-grade railroad lines crossing Meeting St. alignment. Meeting/Calhoun construction include signal	10	Multiple at-grade railroad lines crossing Meeting St. alignment.	4	Multiple at-grade railroad lines crossing Meeting St. alignment	11	Availability to add enhancements to I-26 shoulder area. Construction parallel to	15	Availability to add enhancements to I-26 shoulder area. Construction parallel to	9	Availability to add enhancements to I-26 shoulder area. Construction parallel to	9	Availability to add enhancements to I-26 shoulder area. Multiple at-grade railroad lines	13	Availability to add enhancements to I-26 shoulder area. Multiple at-grade railroad lines	7	Availability to add enhancements to I-26 shoulder area. Multiple at-grade railroad lines	
	Financial sustainability	OPEX Cost Per Rider	OPEX (305 days) cost per rider (Operating Expense)	10	8.5	2.66	2.4	3.43	8.0	2.73	8.4	2.67	2.4	3.44	7.9	2.74	9.2	2.57	4.1	3.22	9.1	2.59	9.1	2.58	4.0	3.23	8.4	2.67	
		CAPEX Cost Per Rider	Cost per rider (Capital Cost)	30	25.8	171.0	8.1	226.8	25.6	171.9	28.4	162.9	10.2	220.0	27.1	166.8	23.6	177.9	8.8	224.3	25.8	171.0	24.4	175.5	11.0	217.3	25.9	170.7	
			Total	350	293		183		288		286		176		280		263		153		261		266		135		249	

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Appendix G: Supplemental Supportive Maps

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

August 10, 2020

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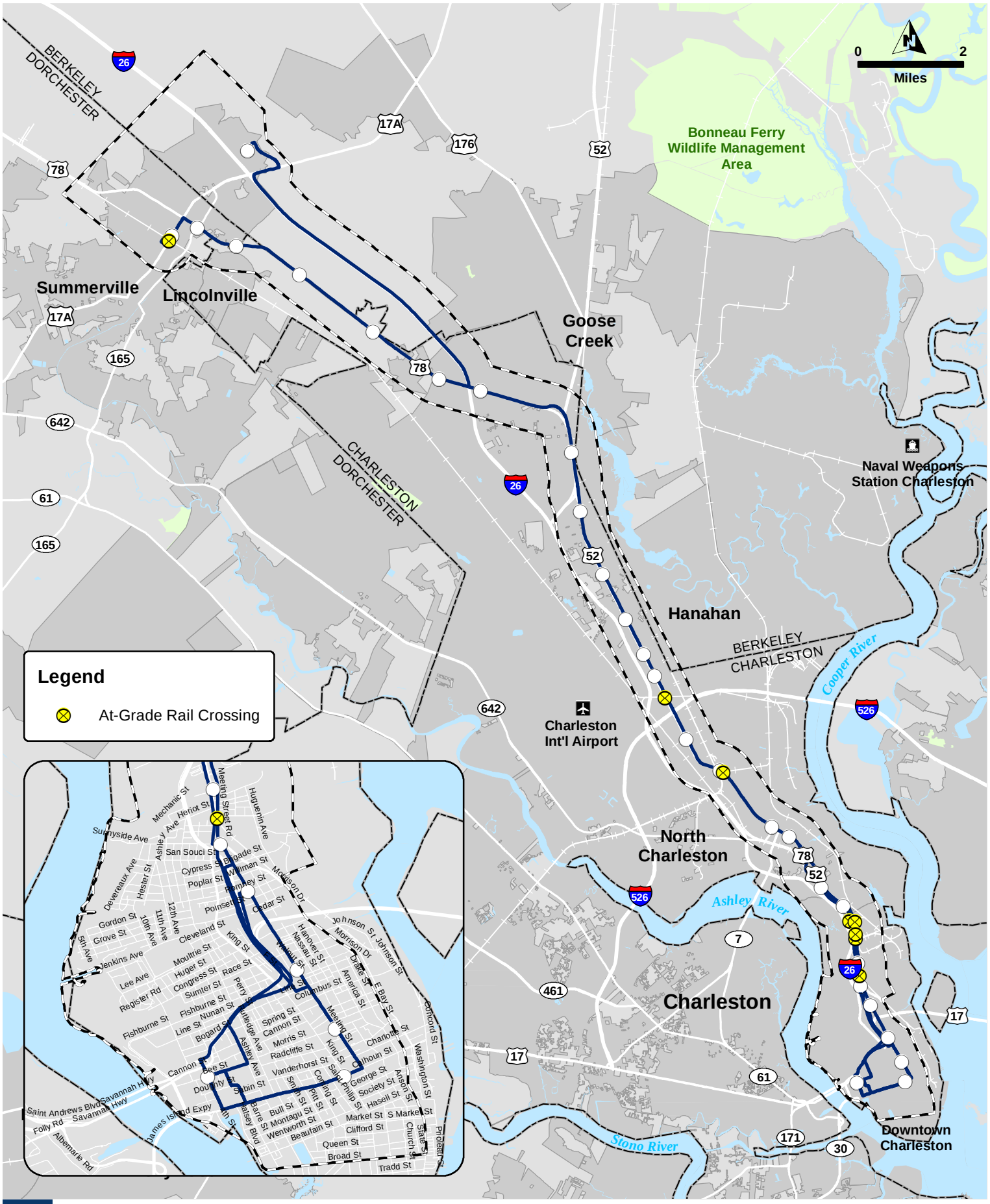

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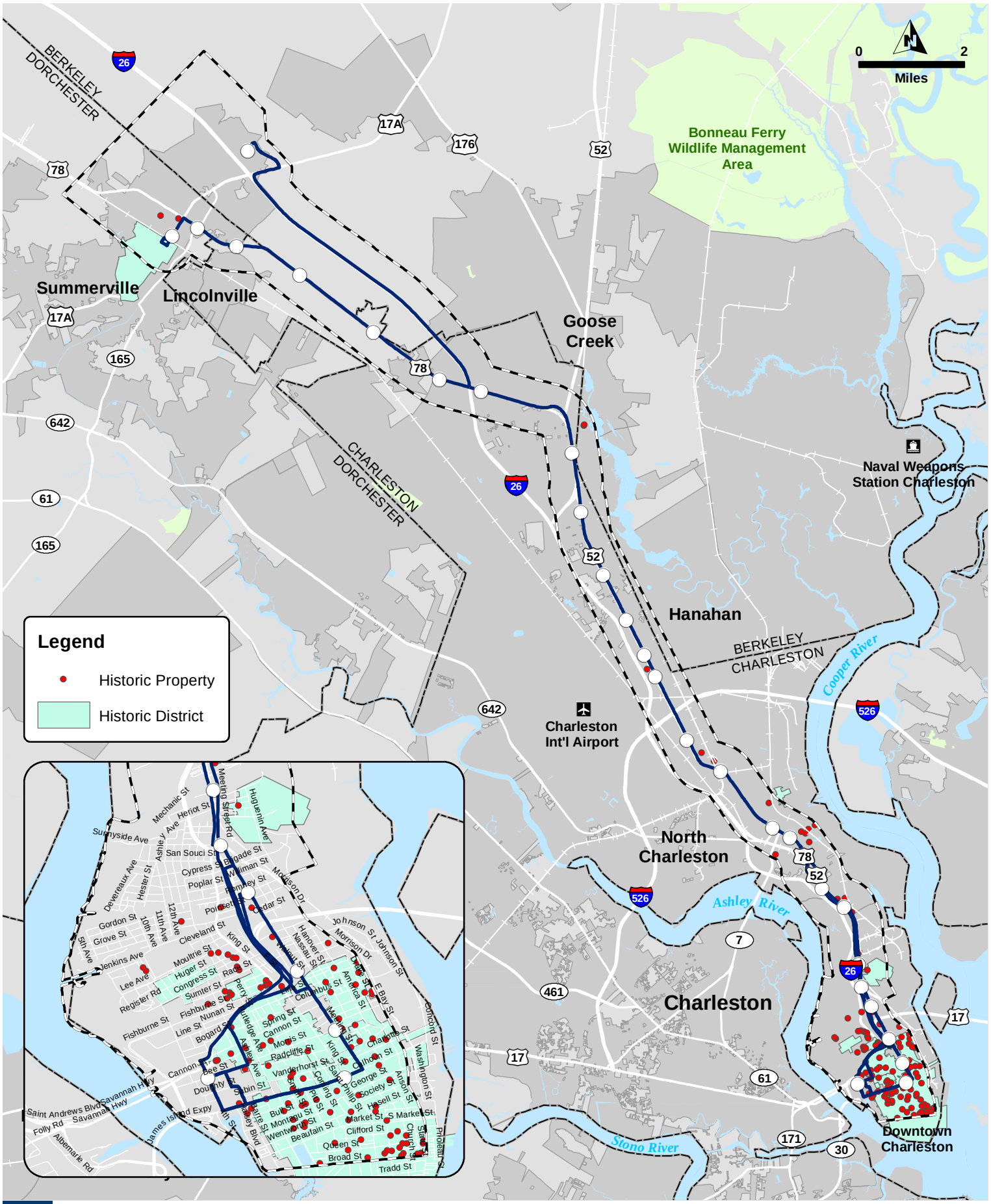

BCDCOG

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Lowcountry Rapid Transit

Cultural Resources

Data Sources: BCDCOG, SCDOT

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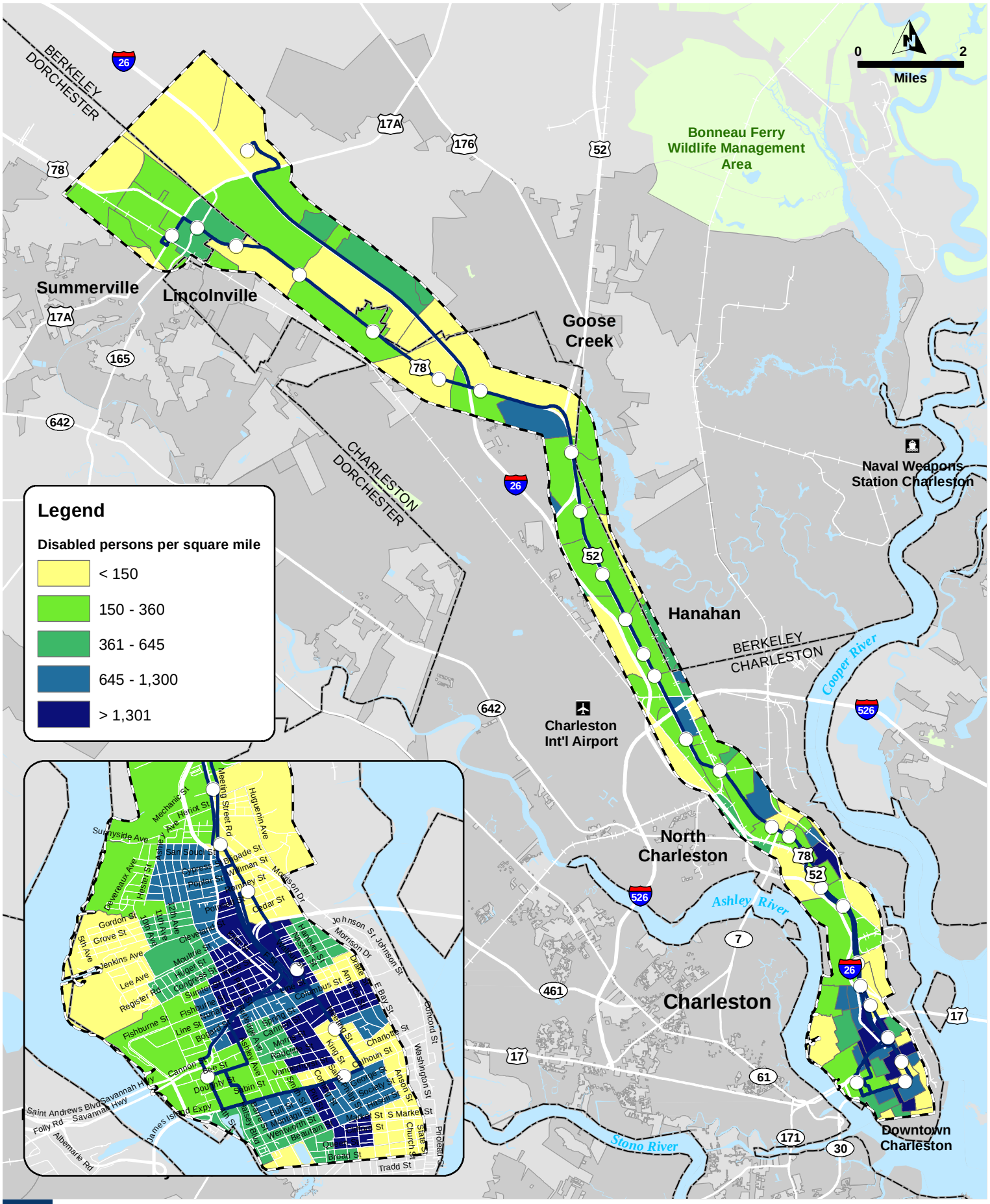
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Summerville
Lincolnville
Goose Creek
Hanahan
North Charleston
Charleston
Downtown Charleston
Naval Weapons Station Charleston
Charleston Int'l Airport
Cooper River
Ashley River
Stono River
Legend
Disabled persons per square mile
< 150
150 - 360
361 - 645
645 - 1,300
> 1,301
LCRT BRT Station Options
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Disabled Population Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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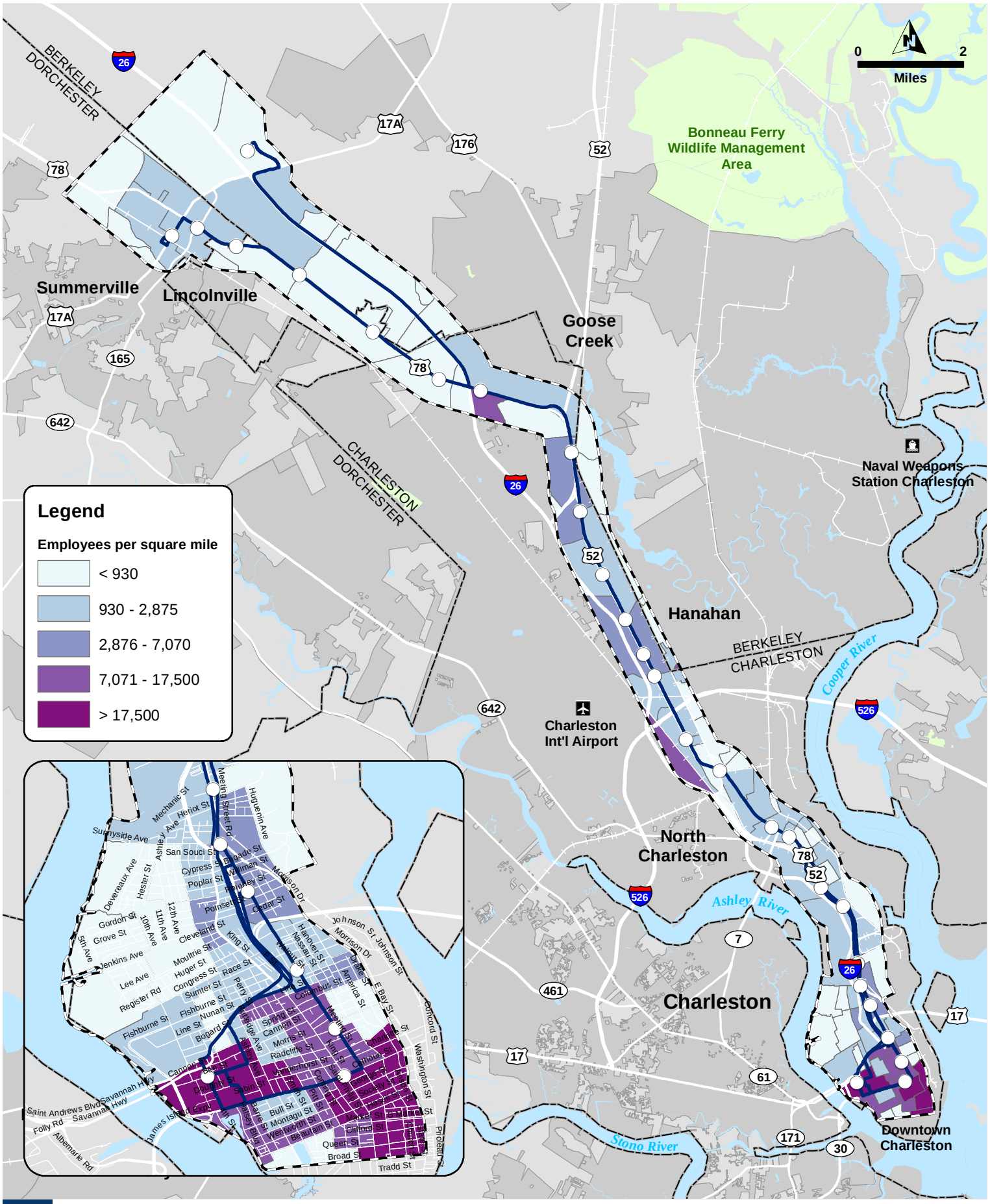

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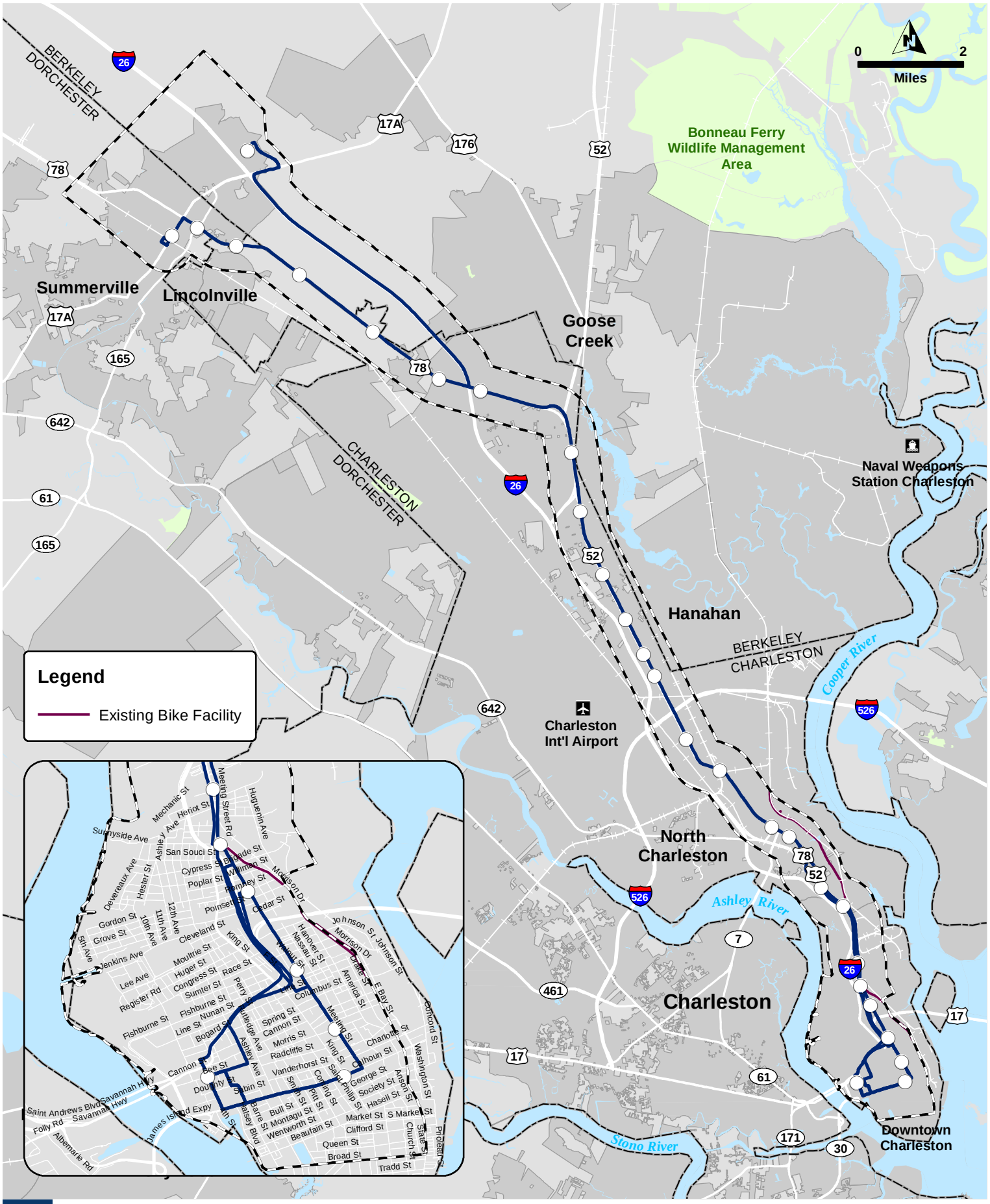

LCRT BRT Station Options
LCRT BRT Alignment Alternatives
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Lowcountry Rapid Transit
Existing Bike Facilities

Data Sources: BCDCOG, SCDOT

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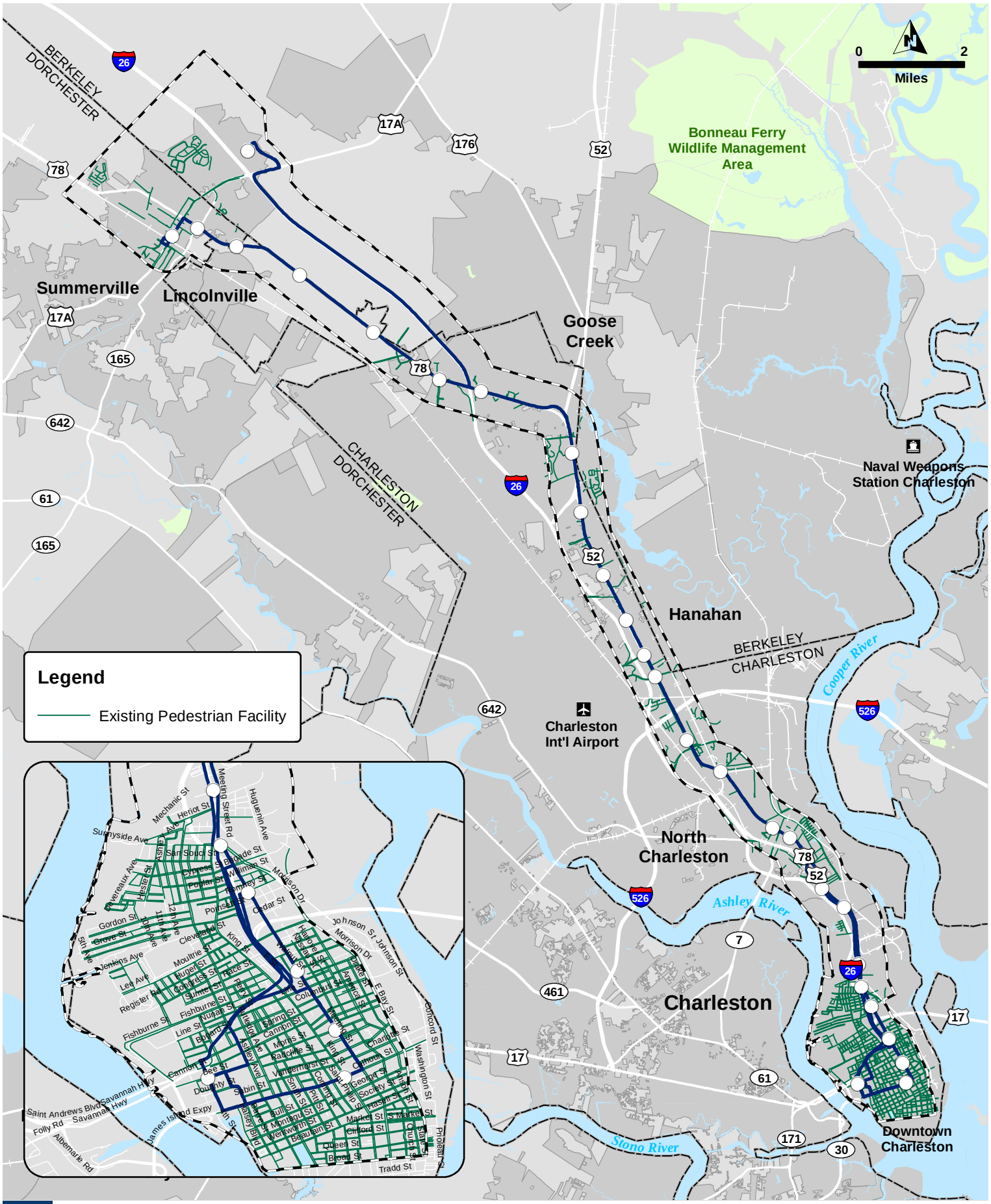

BCDCOG

LCRT BRT Station Options
LCRT BRT Alignment Alternatives
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Lowcountry Rapid Transit
Existing Pedestrian Facilities

Data Sources: BCDCOG, SCDOT

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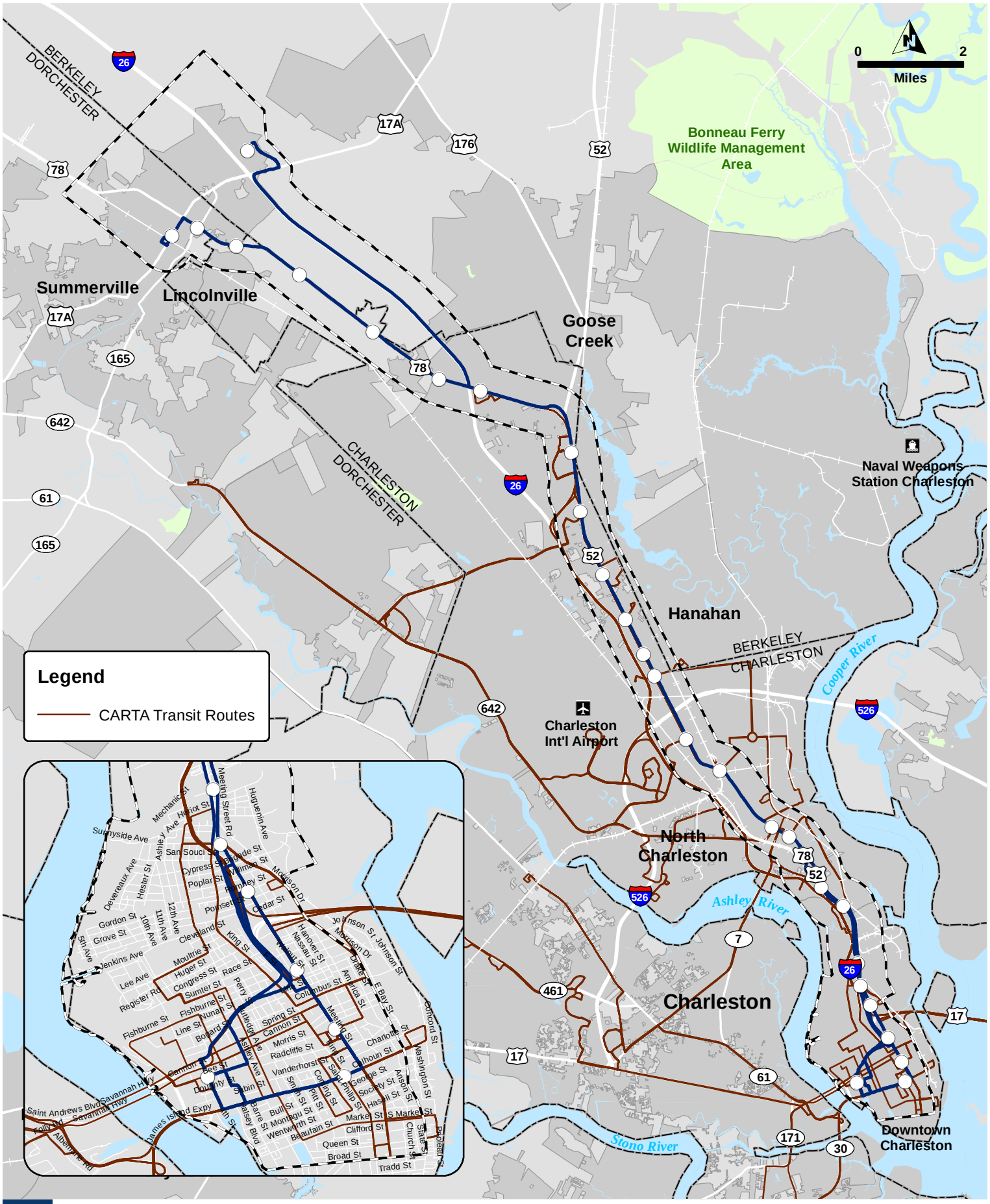

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Lowcountry Rapid Transit

Existing Transit Routes

Data Sources: BCDCOG, SCDOT

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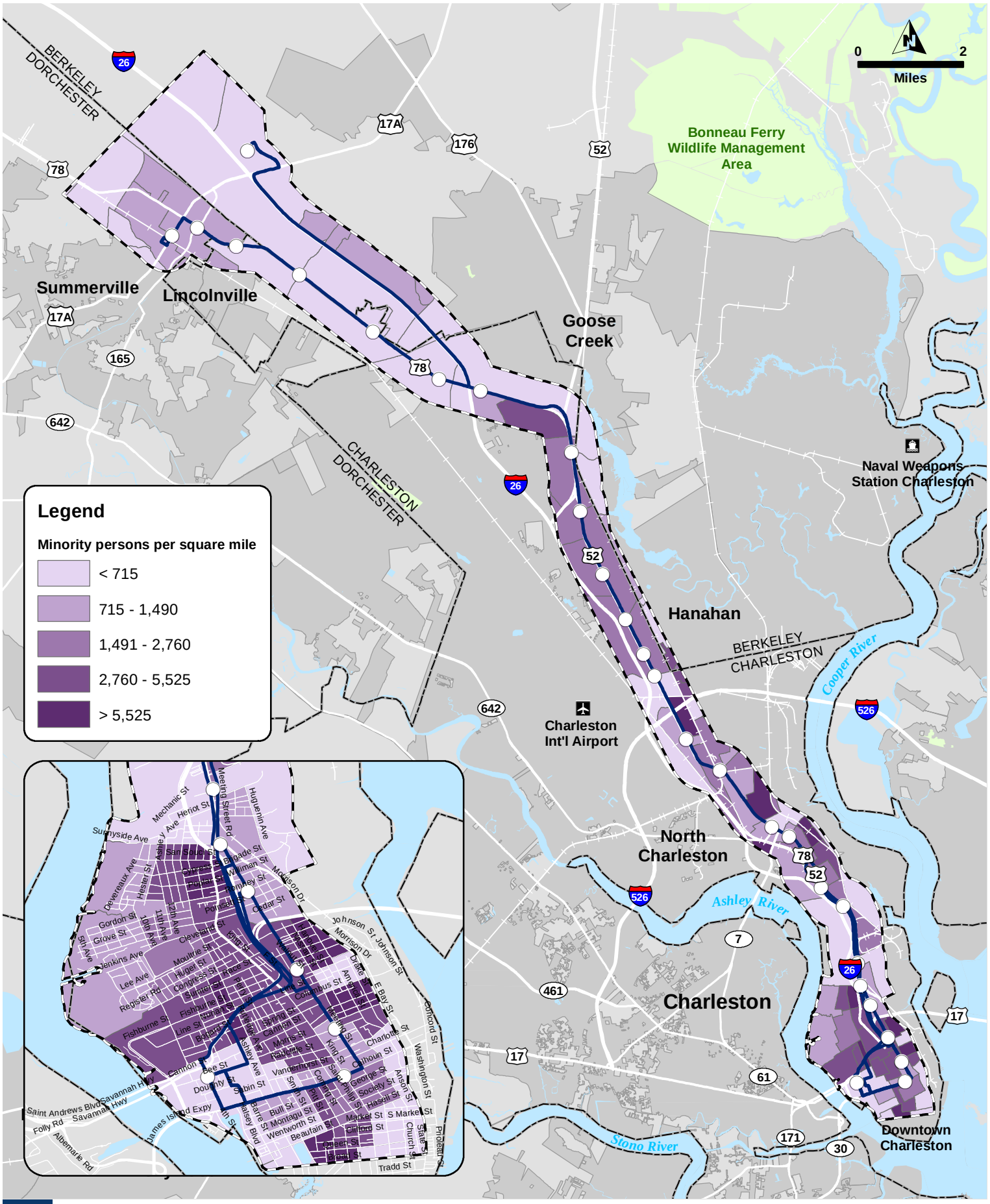
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Lincolnville
Goose Creek
Hanahan
North Charleston
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Downtown Charleston
Naval Weapons Station Charleston
Charleston Int'l Airport
Cooper River
Ashley River
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Minority persons per square mile
< 715
715 - 1,490
1,491 - 2,760
2,760 - 5,525
> 5,525
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Minority Population Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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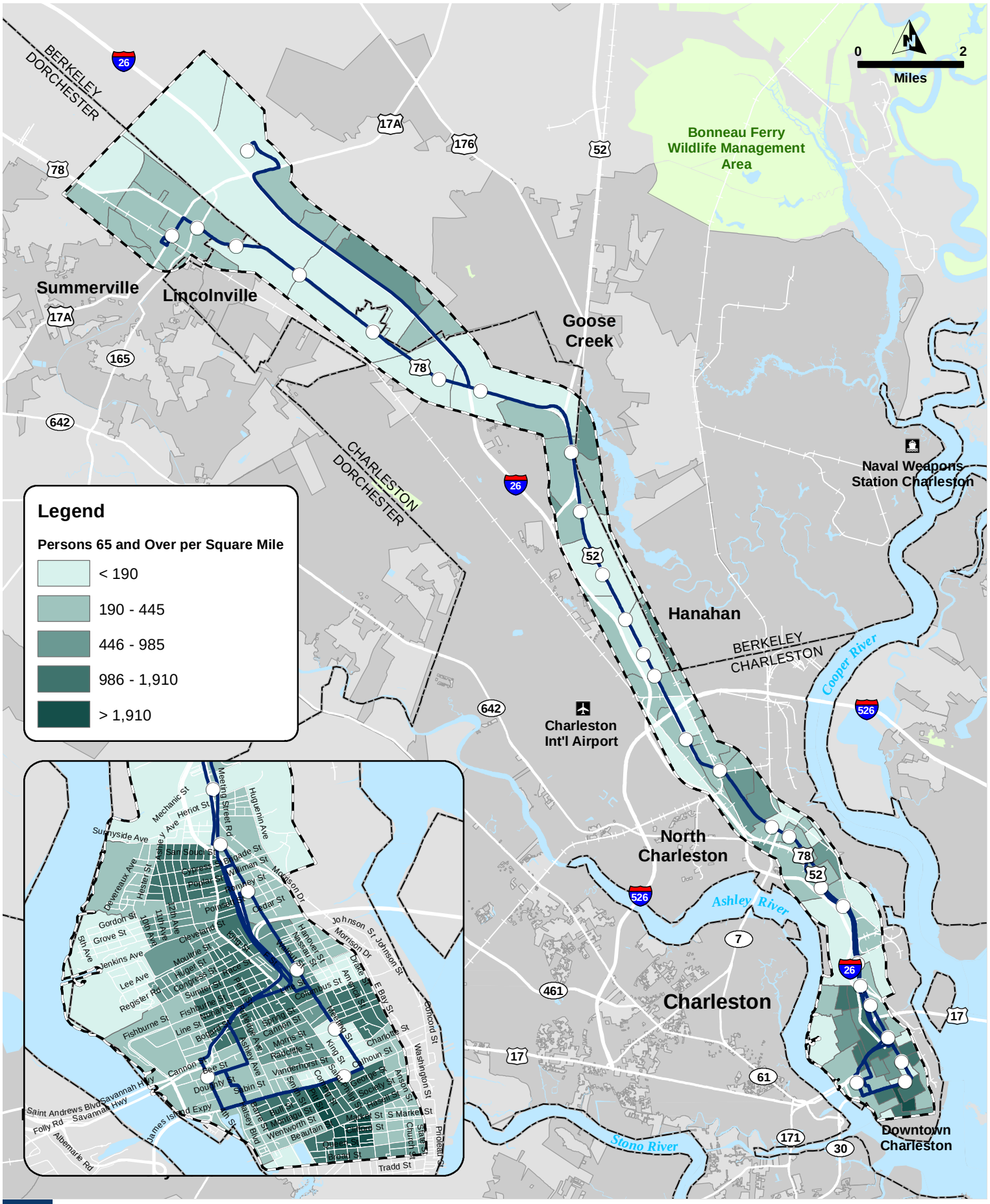
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Goose Creek
Hanahan
North Charleston
Charleston
Downtown Charleston
Naval Weapons Station Charleston
Charleston Int'l Airport
Cooper River
Ashley River
Stono River
Legend
Persons 65 and Over per Square Mile
< 190
190 - 445
446 - 985
986 - 1,910
> 1,910
LCRT BRT Station Options
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Population 65 and Over Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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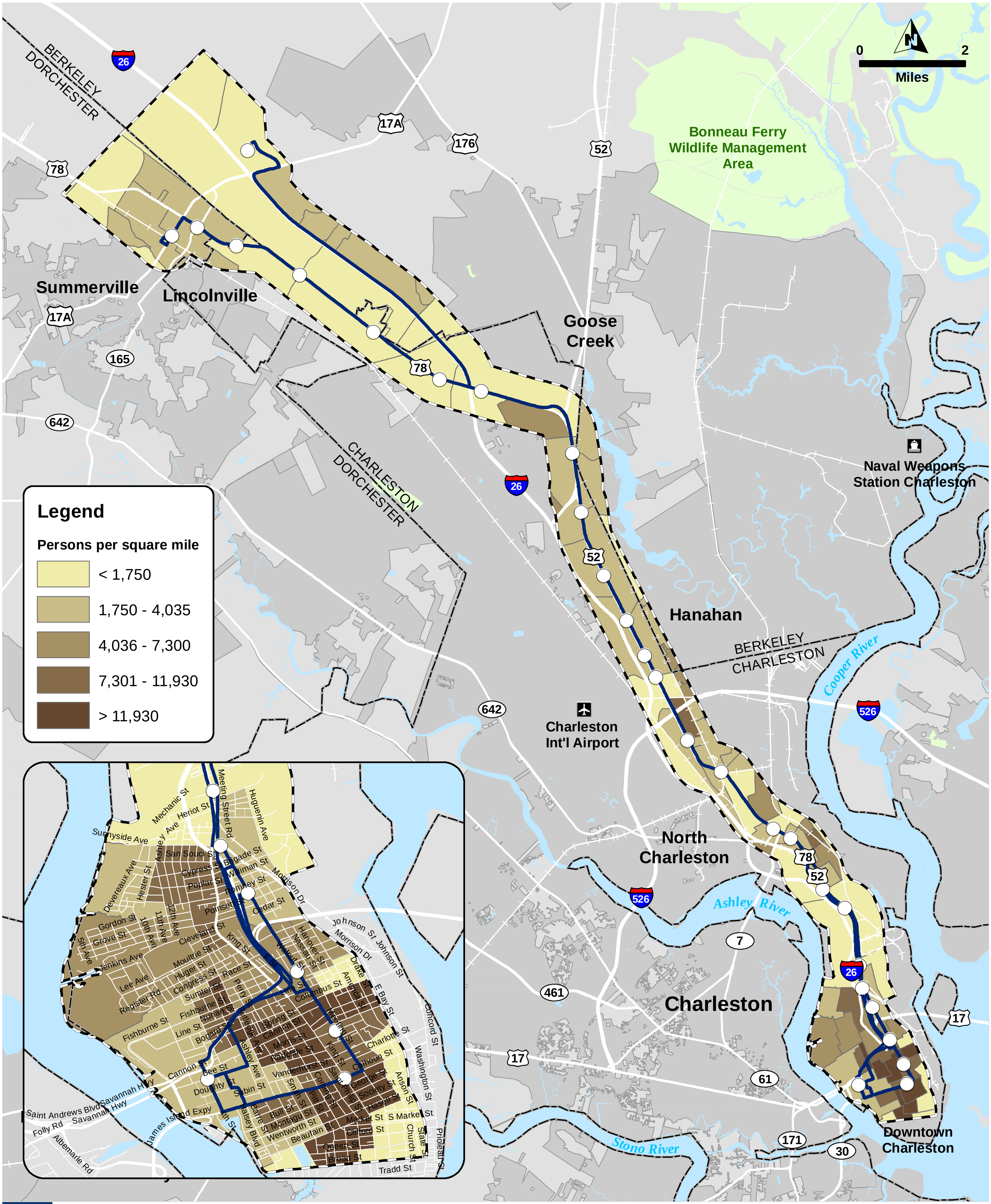

LCRT BRT Station Options

LCRT BRT Alignment Alternatives

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Population Density

Data Sources: BCDCOG, SCDOT, ACS 2018

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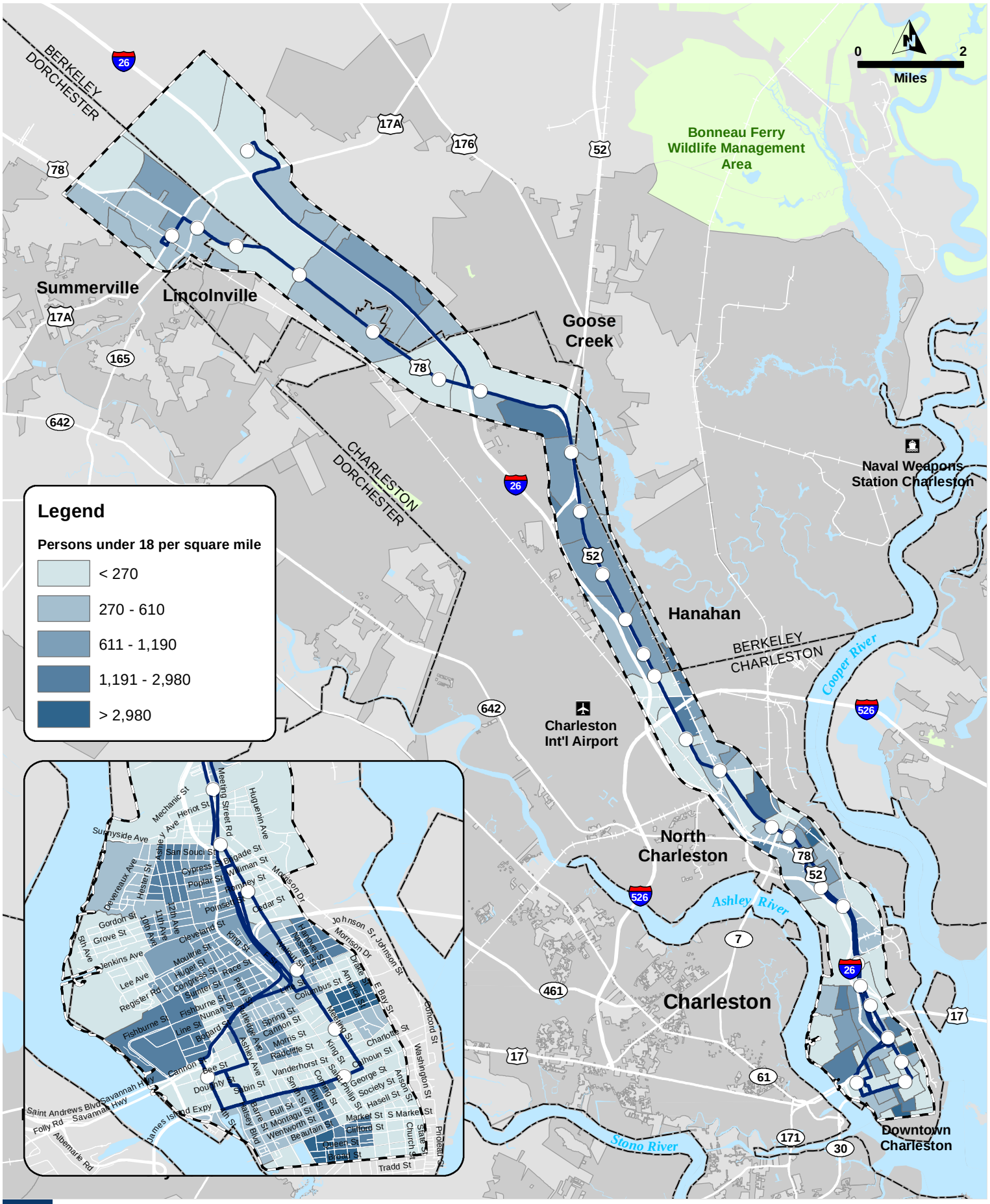
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Naval Weapons Station Charleston
Charleston Int'l Airport
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Persons under 18 per square mile
< 270
270 - 610
611 - 1,190
1,191 - 2,980
> 2,980
LCRT BRT Station Options
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Population Under 18 Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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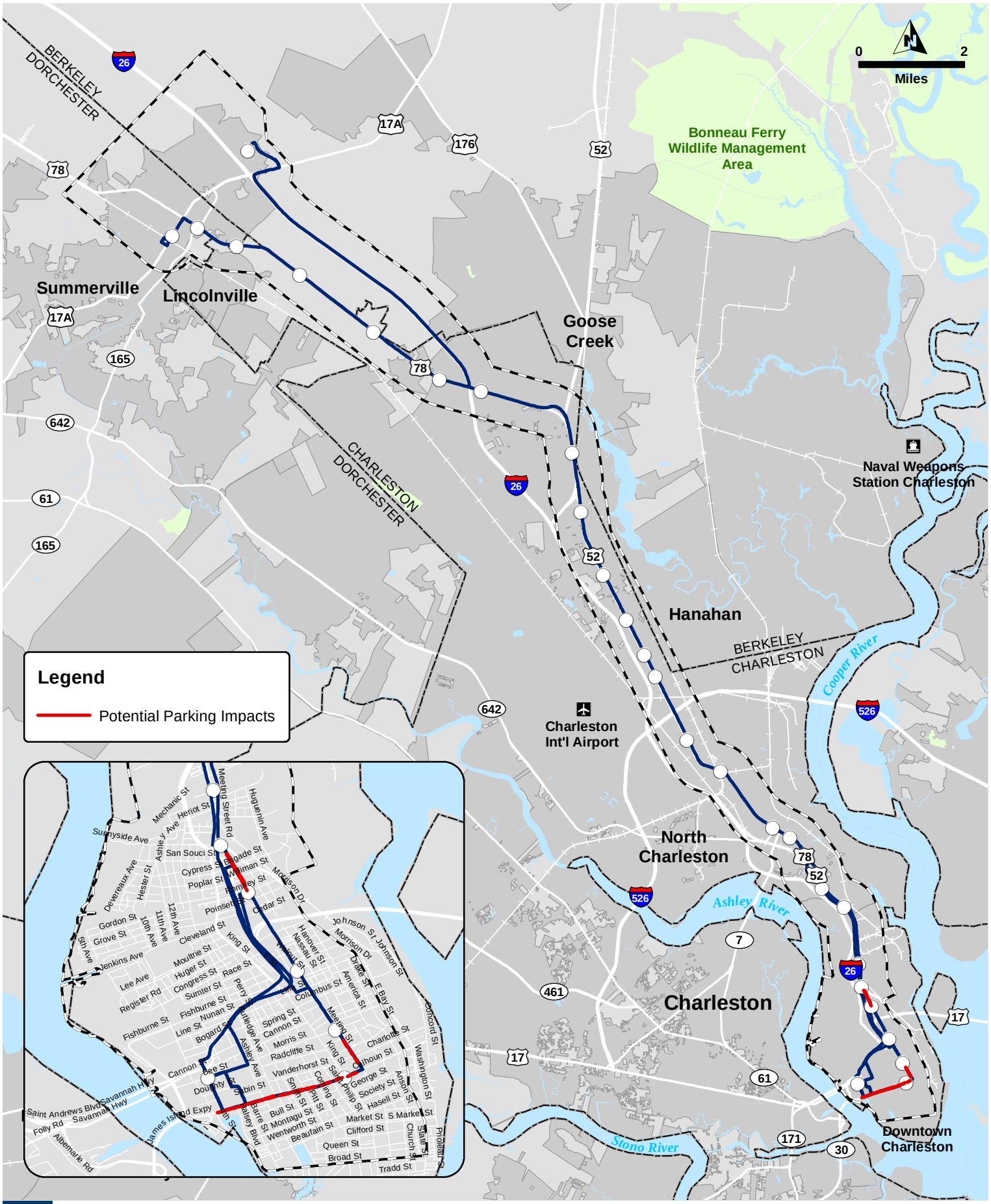

BCDCOG

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Potential Parking Impacts

Data Sources: BCDCOG, SCDOT

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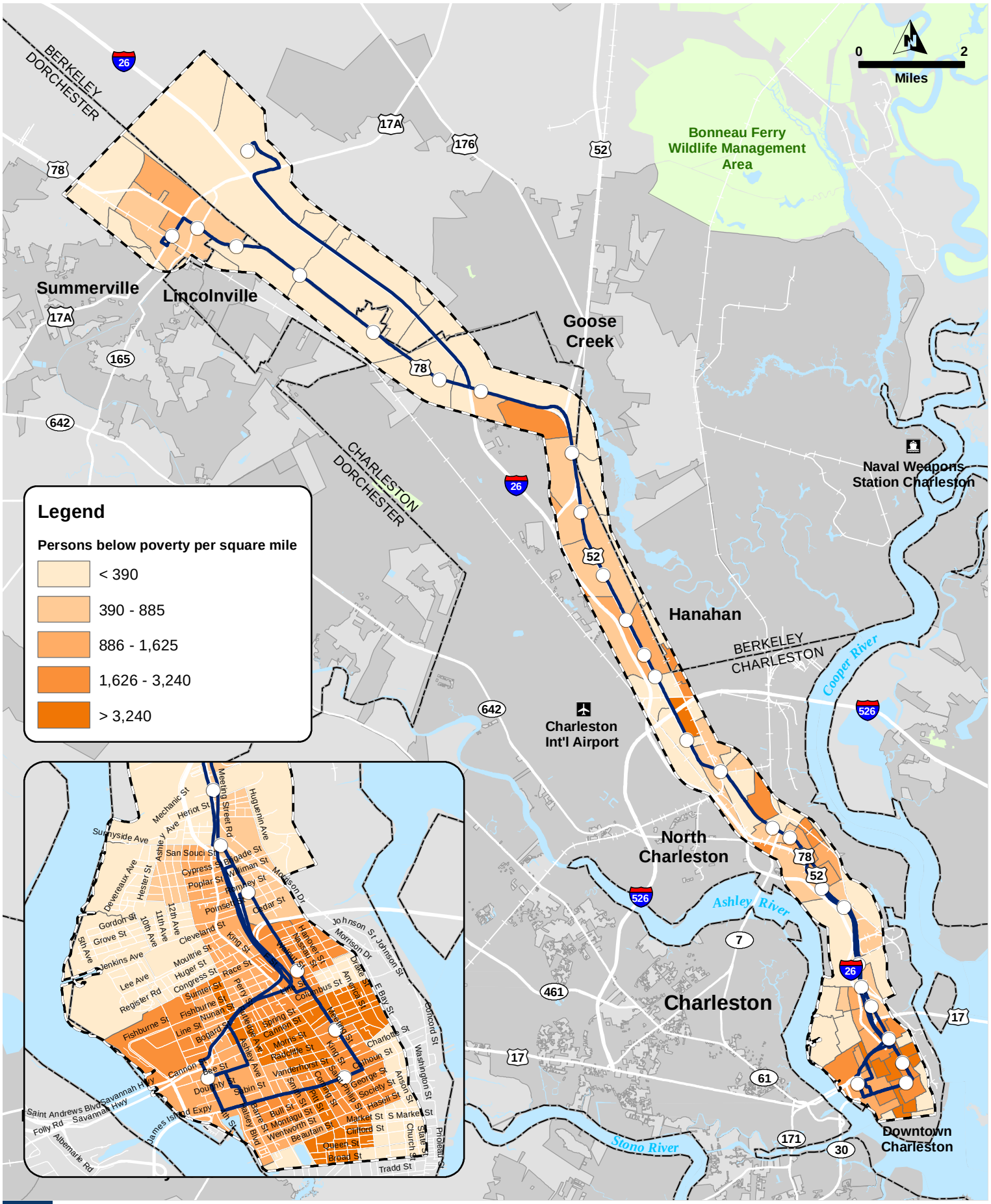
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Charleston Int'l Airport
Cooper River
Ashley River
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Legend
Persons below poverty per square mile
< 390
390 - 885
886 - 1,625
1,626 - 3,240
> 3,240
LCRT BRT Station Options
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Poverty Population Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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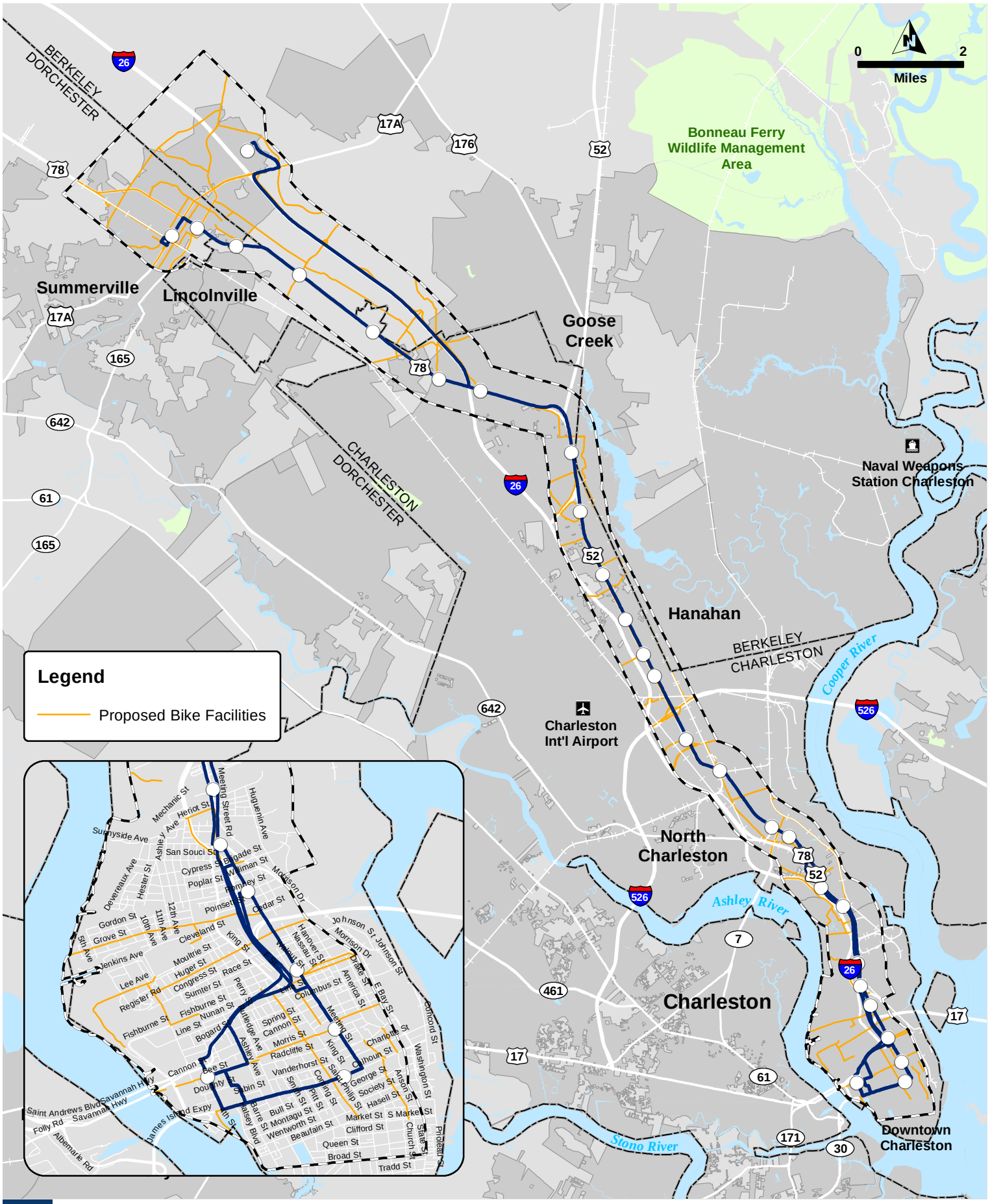
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Miles
Bonneau Ferry Wildlife Management Area
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Summerville
Lincolnville
Goose Creek
Hanahan
North Charleston
Charleston
Downtown Charleston
Naval Weapons Station Charleston
Charleston Int'l Airport
Cooper River
Ashley River
Stono River
Legend
Proposed Bike Facilities
LCRT BRT Station Options
LCRT BRT Alignment Alternatives
Study Area
City Boundaries
Conservation
Lowcountry Rapid Transit
Proposed Bike Facilities
Data Sources: BCDCOG, SCDOT
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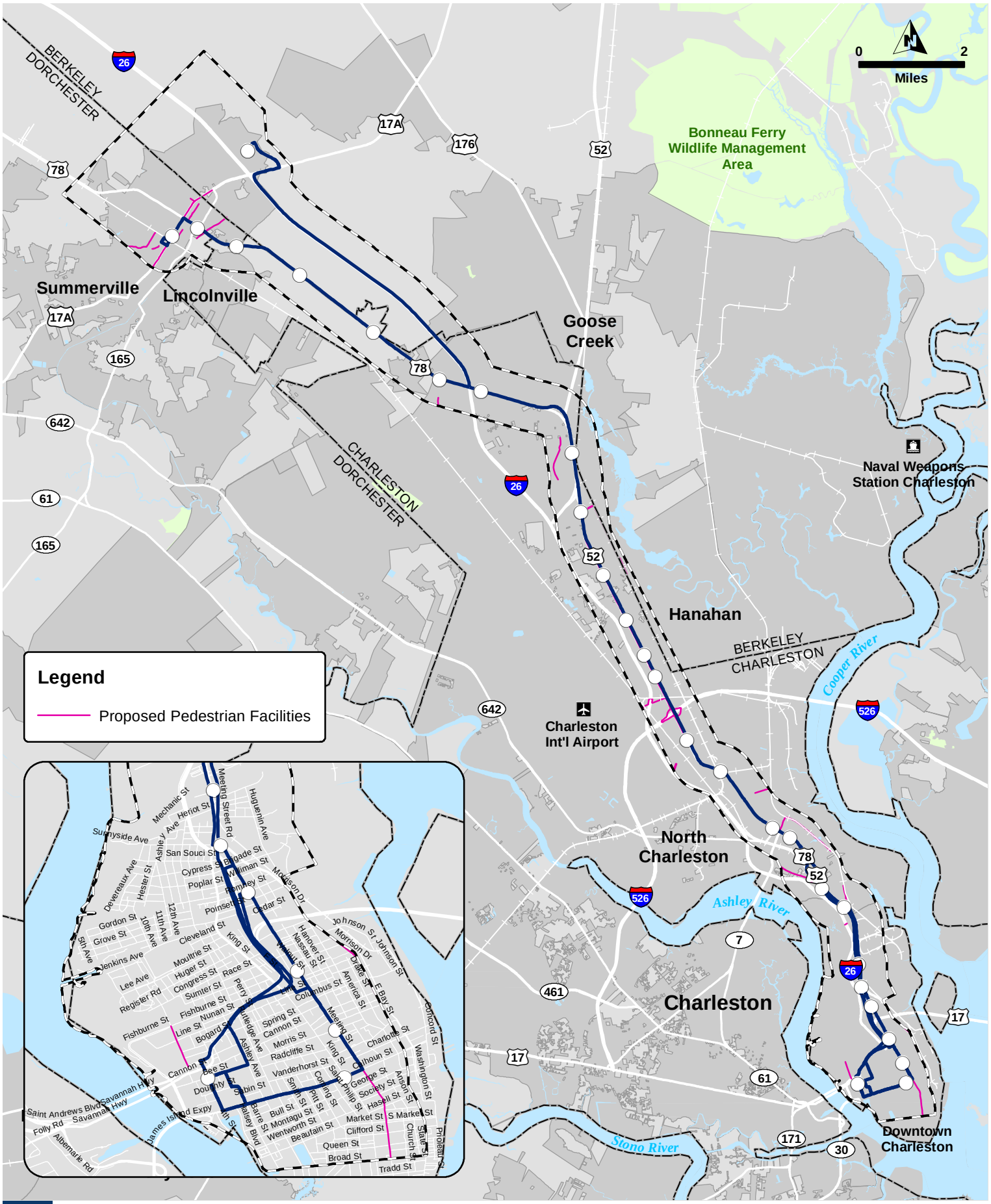

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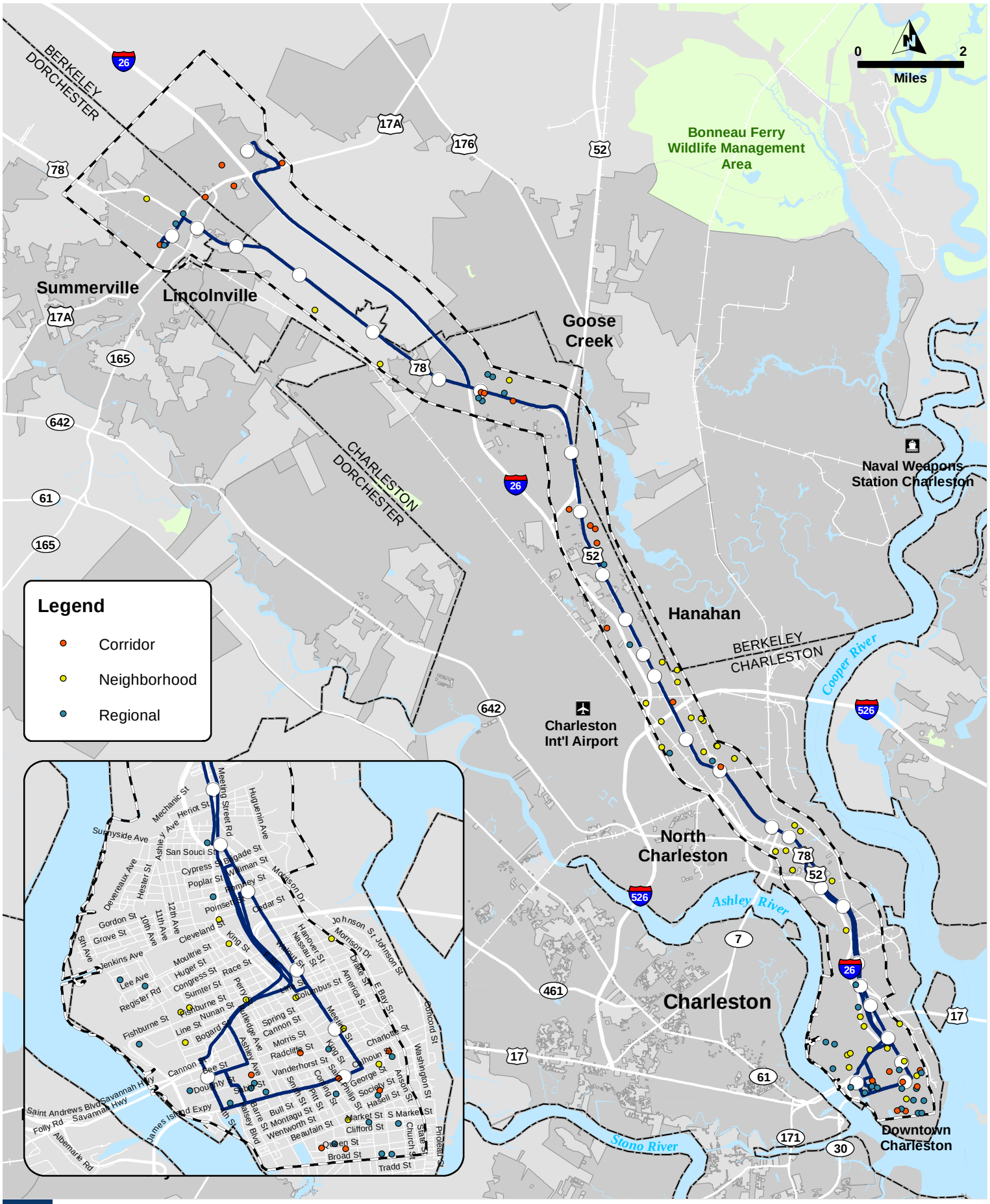

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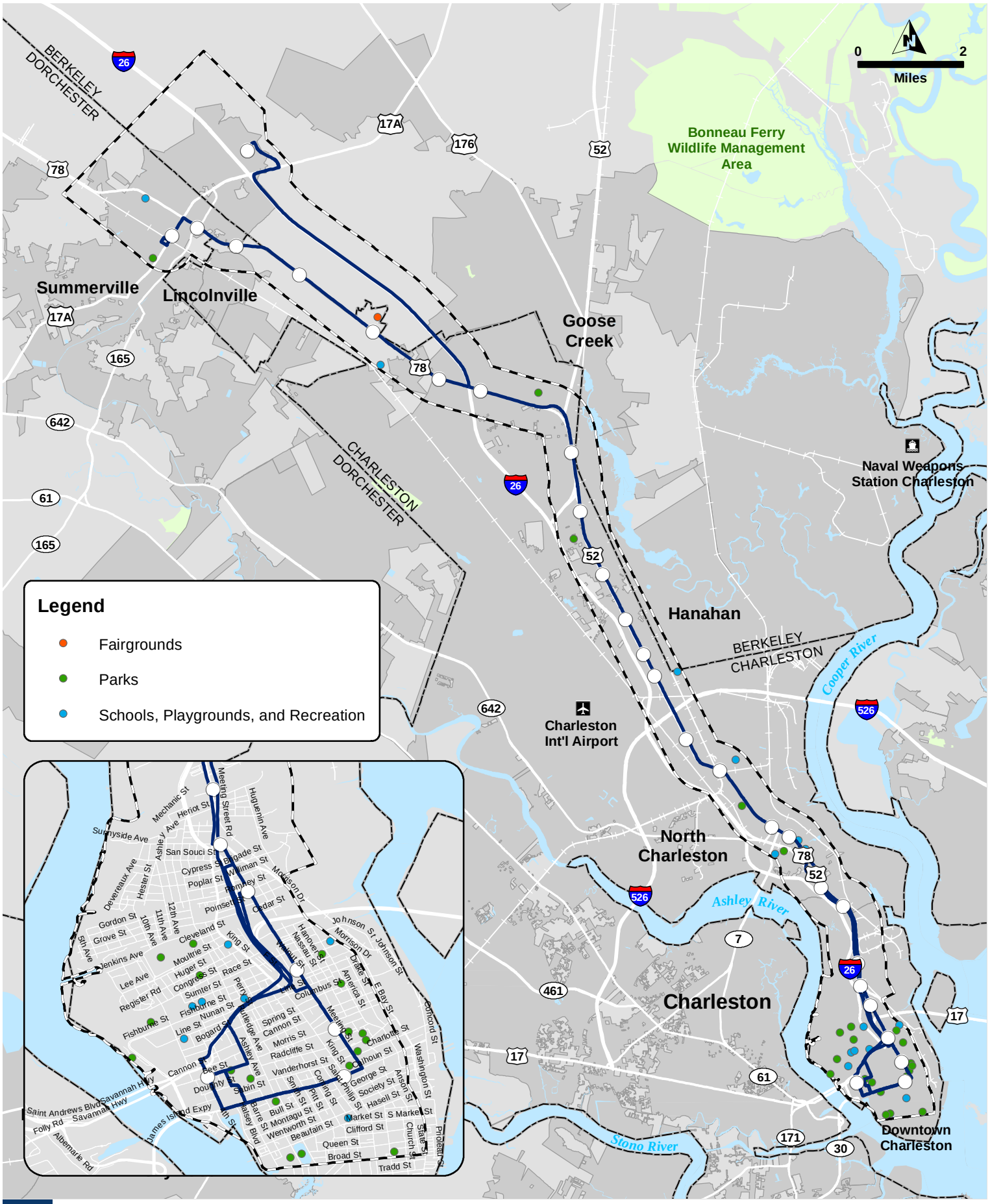

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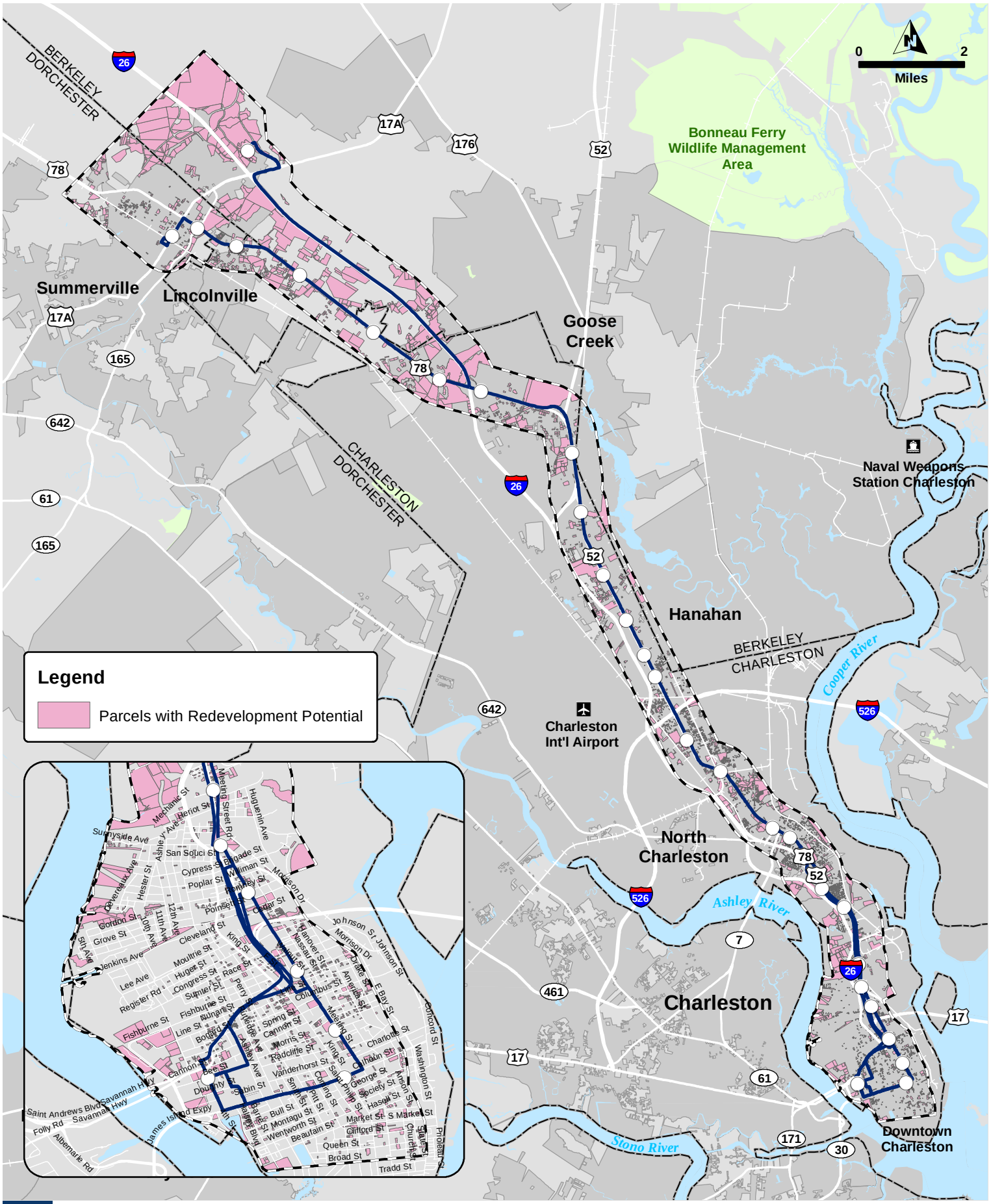

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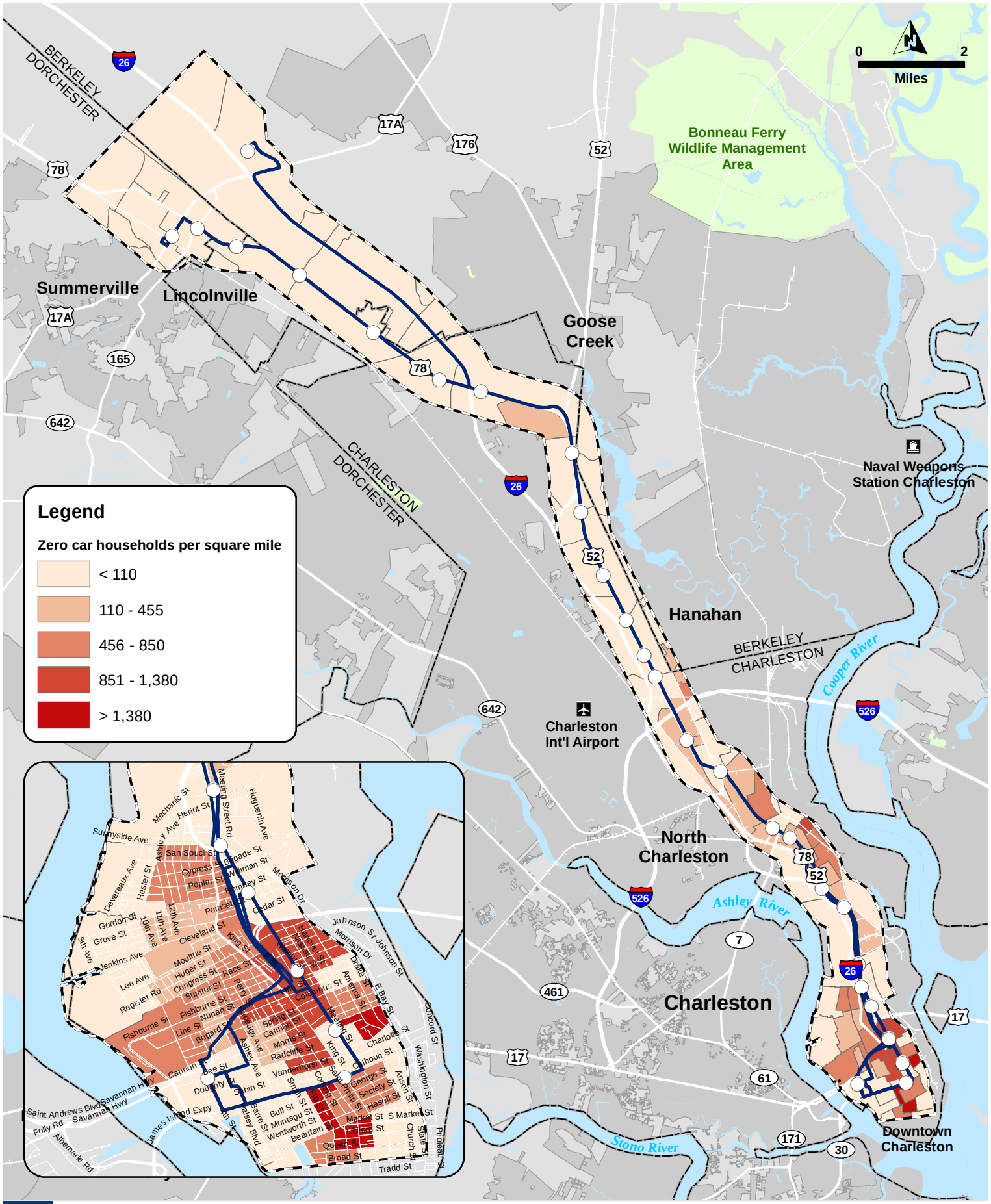
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Miles
Bonneau Ferry Wildlife Management Area
BERKELEY
DORCHESTER
CHARLESTON
DORCHESTER
BERKELEY
CHARLESTON
Summerville
Lincolnville
Goose Creek
Hanahan
North Charleston
Charleston
Naval Weapons Station Charleston
Charleston Int'l Airport
Cooper River
Ashley River
Stono River
Downtown Charleston
Legend
Zero car households per square mile
< 110
110 - 455
456 - 850
851 - 1,380
> 1,380
LCRT BRT Station Options
LCRT BRT Alignment Alternatives
Study Area
City Boundaries
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Lowcountry Rapid Transit
Zero Car Household Density
Data Sources: BCDCOG, SCDOT, ACS 2018
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Appendix H: Calhoun Street & US 17/Septima P Clark Parkway Concept Preliminary Analysis

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

August 10, 2020

5790 Casper Padgett Way, North Charleston, SC 29406

Tel: 843.529.0400 **Fax:** 843.529.0305.

Stantec

Memo

To:	Tom Hiles, PE	From:	Stuart Day, PE, PTOE
	HDR Inc.		Stantec Consulting Services Inc.
File:	171002134	Date:	May 14, 2019

Reference: LCRT – Calhoun Street and US 17/Septima P Clark Parkway - Concept Preliminary Analysis

Pursuant to a conversation between HDR and Stantec on March 28, 2019, Stantec performed a preliminary traffic analysis for a lane reconfiguration concept along Calhoun Street and US 17/Septima P Clark Parkway for the Lowcountry Rapid Transit project. The concept along Calhoun Street that was analyzed in *Synchro* involved a reversible lane concept that would allow for one-lane of dedicated general-purpose travel in each direction, a dedicated bus lane in the peak direction of travel that allows for right turning vehicles at intersections, and a dedicated left-turn lane at intersections. This is generally consistent with the four available travel lanes along Calhoun Street. The concept along US 17/Septima P Clark Parkway would reduce a lane in each direction of travel to be used as an exclusive bus only lane.

Existing Roadway Conditions

Calhoun Street is a four-lane principal arterial which primarily serves commercial, institutional, and residential land uses. The 2017 SCDOT AADT is 17,700 vpd and the posted speed limit is 25 mph. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along Calhoun Street ranges between 1% to 7%.

US 17/Septima P Clark Parkway is a six-lane principal arterial which primarily serves commercial and residential land uses. The 2017 SCDOT AADT is 62,100 vpd and the posted speed limit is 35 mph. Based upon the existing turning movement counts, the percentage of heavy vehicles in the study area along Septima Clark Parkway ranges between 1% to 3%.

Intersection Analysis

Intersection level of service (LOS) grades range from LOS A to LOS F, which are directly related to the level of control delay at the intersection and characterize the operational conditions of the intersection traffic flow. LOS A operations typically represent ideal, free-flow conditions where vehicles experience little to no delays, and LOS F operations typically represent poor, forced-flow (bumper-to-bumper) conditions with high vehicular delays, and are generally considered undesirable. Table 1 summarizes the *HCM 2010* control delay thresholds associated with each LOS grade for signalized intersections.

Table 1 – *HCM 2010* LOS Criteria for Signalized Intersections

Signalized Intersections	
LOS	**Control Delay Per Vehicle (seconds)**
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

Reference: **LCRT – Calhoun Street and US 17/Septima P Clark Parkway - Concept Preliminary Analysis**

Traffic Volumes

As part of the intersection analysis, SCDOT's default *Synchro* parameters were utilized, with the exception of lane utilization for approaches shared left-through lanes. These approaches were analyzed with a lane utilization factor of 0.80, as left-turning vehicles can restrict the through utilization of the lane. The 2018 traffic counts and peak hour factors (PHF) were utilized in the analysis of existing and modified conditions. Existing heavy vehicle percentages were utilized in the analysis.

Intersection Analysis

Using *Synchro* software, intersection analysis was conducted for 2018 Existing conditions and 2018 Modified conditions for the weekday AM peak hour and the weekday PM peak hour time periods. The results of the Calhoun Street intersection analysis for existing conditions for the weekday AM and PM peak hour time periods are summarized in Table 2. The results of the and US 17/Septima P Clark Parkway intersection analysis for existing conditions for the weekday AM and PM peak hour time periods are summarized in Table 3. For the study intersections, the overall intersection LOS and delay results are evaluated for acceptable operation, based upon *Synchro* methodologies for signalized intersections due to the fact *HCM 2010* methodologies were not available for some intersection geometries.

Table 2 – Calhoun Street Intersection Analysis Results

Intersection	Control	LOS/Delay (seconds)			
		2018 Existing Conditions		2018 Modified Conditions	
		AM	PM	AM	PM
Calhoun Street & Courtenay Drive	Signalized	C/23.0	B/17.6	B/19.1	B/18.0
Calhoun Street & Johnathan Lucas Street	Signalized	A/9.4	A/8.5	B/10.0	B/19.2
Calhoun Street & Ashley Avenue	Signalized	A/9.6	B/19.3	B/11.3	C/26.8
Calhoun Street & Rutledge Avenue	Signalized	A/6.6	A/9.3	A/8.2	B/11.0
Calhoun Street & Smith Street	Signalized	A/8.2	A/6.8	A/8.1	A/6.4
Calhoun Street & Coming Street	Signalized	B/12.6	B/16.4	B/12.8	B/15.6
Calhoun Street & St. Phillips Street	Signalized	A/6.6	A/4.4	A/8.0	A/5.0
Calhoun Street & US 78/King Street	Signalized	A/6.7	A/8.3	A/6.1	A/8.5
Calhoun Street & Meeting Street	Signalized	C/29.5	C/20.2	C/20.4	B/18.6

Reference: **LCRT – Calhoun Street and US 17/Septima P Clark Parkway - Concept Preliminary Analysis**

Table 3 – US 17/Septima P Clark Parkway Intersection Analysis Results

Intersection	Control	LOS/Delay (seconds)			
		2018 Existing Conditions		2018 Modified Conditions	
		AM	PM	AM	PM
US 17/Septima P Clark Parkway SB & Coming Street	Signalized	B/19.7	B/17.4	E/73.4	C/22.9
US 17/Septima P Clark Parkway NB & Coming Street	Signalized	A/5.1	B/11.8	D/35.1	F/142.3
US 17/Septima P Clark Parkway & Rutledge Avenue	Signalized	C/31.5	C/24.1	F/114.5	F/117.8
US 17/Septima P Clark Parkway & Ashley Avenue	Signalized	B/12.4	B/14.1	F/108.3	F/82.4
US 17/Septima P Clark Parkway & President Street	Signalized	A/3.1	A/8.5	E/56.5	D/37.1
US 17/Septima P Clark Parkway & Spring Street	Signalized	C/30.3	D/41.7	F/107.4	F/112.0
US 17/ Cannon Street & Courteney Drive	Signalized	D/36.0	C/30.7	D/35.8	C/30.7

The results of the Calhoun Street intersection analysis indicate that all the study intersections currently operate and are expected to operate at an acceptable LOS. Generally, there are some minor increases in delay at various intersections and some minor decreases in delay at various intersections, however the differences are not substantial and could be considered neutral.

The results of the US 17/Septima P Clark Parkway intersection analysis indicate that all the study intersections currently operate at an acceptable LOS, however replacing a travel lane with a transit only lane would have a significant negative impacts from a LOS perspective.

Conclusion

This memorandum reviewed the intersection operations of a reversible lane concept along Calhoun Street and a transit only lane concept along US 17/Septima P Clark Parkway as part of the Lowcountry Rapid Transit project. Generally, the traffic analysis shows that the delay at intersections along Calhoun Street would not increase substantially, however the concept along US 17/Septima P Clark Parkway would have substantial increases in delay. This review did not include a review of impacts of the reversible lane signage or parking along Calhoun Street.

Stantec Consulting Services Inc.

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