




L C
R T

Alignment Evaluation Technical Memo

Lowcountry Rapid Transit

Berkeley-Charleston-Dorchester Council of Governments

July 6, 2020



5790 Casper Padgett Way, North Charleston, SC 29406

Tel: 843.529.0400 Fax: 843.529.0305.

Contents

1	Introduction	1
1.1	Document Purpose	1
1.2	Introduction	1
1.3	Project Background	1
2	i-26ALT Study Alternative Analysis Process	2
2.1	Purpose and Goals	2
2.2	Alternatives Analysis	2
2.3	Recommended Alternative	9
3	Advanced Planning and NEPA Preparation	11
3.1	Advance Planning	11
3.2	Alignment Options for Three Key Areas	11
4	Development of End to End Alignments	24
4.1	Fatal Flaw Review	26
4.2	Fatal Flaw Results	36
5	Next Steps and Phase 2 Evaluation	38

Figures

Figure 1	i-26ALT Pre-Screen Alignments	5
Figure 2	i-26ALT Screen One Alignments	6
Figure 3	i-26ALT Screen Two Alignments	8
Figure 4	i-26ALT Study Recommended BRT Alternative	10
Figure 5	Northern Terminus - Option 1	12
Figure 6	Northern Terminus - Option 2	13
Figure 7	Neck Area - Option 1	14
Figure 8	Neck Area - Option 2	15
Figure 9	Neck Area - Option 3	16
Figure 10	Southern Terminus - Option 1	17
Figure 11	Southern Terminus - Option 2	18
Figure 12	Southern Terminus - Option 3	19
Figure 13	Southern Terminus - Option 4	20
Figure 14	Southern Terminus - Option 5	21
Figure 15	Southern Terminus - Option 6	22
Figure 16	Southern Terminus - Option 7	23
Figure 17	Alignment Options for Fatal Flaw Analysis	24

Figure 18 LCRT Project Timeline.....38
Figure 19 LCRT Reasonable Alternatives39

Tables

Table 1 Alignment Options and Options25
Table 2 Alignment Fatal Flaw Analysis35

1 Introduction

1.1 Document Purpose

This document provides an overview of the i-26*ALT* study process that concluded in 2016 and the steps taken in Phase 1 of the Lowcountry Rapid Transit (LCRT) to prepare the project for advancement into NEPA and 30 percent design. The memo is comprised of the following:

- 1) A summary of the i-26*ALT* study alignment evaluation process;
- 2) A description of the Recommended Alternative from the i-26*ALT* study;
- 3) A detailed description of alignment options developed in three key areas of the project study area;
- 4) An overview of the fatal flaw analysis for Phase 1; and
- 5) An outline of the next steps of the alignment refinement and evaluation process.

1.2 Introduction

The Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) is the designated Metropolitan Planning Organization (MPO) responsible for carrying out the federally mandated urban transportation planning process for the Charleston Area Transportation Study (CHATS). As discussed in the Overview section on page 2 of the i-26*ALT* study, CHATS initiated the study to improve transit service, enhance regional mobility along the I-26 corridor connecting the Town of Summerville, the City of North Charleston, and the City of Charleston.

CHATS embarked on an effort to aid regional mobility through the development of a bus rapid transit system (BRT) now known as the Lowcountry Rapid Transit (LCRT). The LCRT is envisioned to operate within the current right-of-way (ROW) in mostly a separate guideway dedicated for the BRT vehicles, using a combination of center-running semi-exclusive guideway and curbside priority lanes. The project will be designed to meet the Federal Transit Administration's (FTA) Capital Investment Grant (CIG) program eligibility requirements for New Starts which requires that over 50 percent of the route operate in a separated right-of-way (ROW) dedicated for public transportation use, and that the project include defined stations, traffic signal priority (TSP) for buses, and frequent, bi-directional service¹.

1.3 Project Background

The 15-month i-26*ALT* study was initiated in October 2014 and included a Comprehensive Operational Analysis (COA) of the Charleston Area Regional Transportation Authority (CARTA) transit system and a fixed guideway transit Alternatives Analysis of the I-26 corridor². An extensive public involvement campaign was completed with public meetings, community events and focused "Transit Talks" to solicit input throughout the process. Public engagement efforts undertaken for the i-26*ALT* study were focused on identifying the various audiences/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,

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

² https://lowcountryrapidtransit.com/docs/I26_Fixed_Guideway_Transit_Alternatives_Analysis.pdf

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 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 i-26ALT Study Alternative Analysis Process

2.1 Purpose and Goals

The project’s purpose and goals process was informed through an extensive public and stakeholder engagement process. The outreach conducted was focused on engaged participation by a variety of stakeholders and the public with the goal of selecting a preferred alternative for transit improvements along the study corridor. The outreach efforts also supported the ongoing advocacy and outreach activities set forth by the CHATS and the BCDCOG to promote coordinated regional transportation planning. A steering committee and a technical advisory committee were formed at the beginning of the process to provide guidance and inform the overall decision making process. The involvement and input of the public, key stakeholders, and the steering and technical advisory committees, resulted in the purpose and goals development. The project’s goals shown in the i-26ALT study on page 2 of the Overview section are to:

- 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; and
- Support a diverse regional economy.

2.2 Alternatives Analysis

The results of the alternatives analysis included extensive public and stakeholder engagement. The documentation of the engagement for the i-26ALT study is included in Chapter 7 of the i-26ALT study. The alternatives analysis process for the i-26ALT study included a three-tiered screening process to identify the best mode and alignment for a fixed guideway transit alternative connecting Summerville, North Charleston, and Charleston and 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)

2.2.1 Pre-Screening (Fatal Flaw Analysis)

Through extensive public and stakeholder outreach and engagement, the pre-screening analysis identified the universe of potential transit modes and an array of potential alignments including roadways, rail corridors, utility alignments, waterways, and other alignments. The fatal flaw analysis of premium transit modes and alignments was conducted to determine:

- 1) Has the alternative been eliminated previously for reasons that are still valid?
- 2) Is a mode or alignment (including alignment options) ill-suited to address the purpose and need and project goals?
- 3) Does the mode or alignment have a fatal flaw considering the market and environment in which it would operate or the amount of funding likely to be available?

2.2.1.1 Evaluation of Premium Transit Modes

The transit modes that were evaluated during the Pre-Screening analysis included; standard bus, bus rapid transit (BRT), commuter rail, hybrid rail, light rail, heavy rail, high speed rail, magnetic levitation, monorail, people mover, personal rapid transit, aerial tramway, and waterborne transit. A full description of each of these modes can be found in Chapter 2, Table 2-1 of the i-26ALT study. Alignments were considered along I-26, Dorchester Road, US 52 & US 78, US 52 & US 176, a utility corridor for the South Carolina Energy & Gas (SCE&G) and Santee Cooper, Norfolk Southern and CSX Railroads, Ashley and Cooper Rivers, Ashley River Road, and Glenn McConnell Extension (see Figure 1).

The pre-screening evaluation of premium transit modes identifies the technologies that best fit the project goals. The following criteria were used to pre-screen the transit modes.

- Does the mode provide the appropriate level of transit capacity?
- Can the mode utilize existing ROW?
- Is the mode consistent with local and regional plans?
- Will the alternative avoid significant impacts during its construction to either the environment or the affected neighborhoods?
- Is the mode compatible with community character?
- Will the alternative generate significant new permanent jobs associated with its operation and maintenance?

Based on the fatal flaw analysis and shown in Chapter 2, Table 2-2 and listed on page 6 of the i-26ALT study, the following transit modes were eliminated for future consideration; heavy rail, high speed rail, magnetic levitation, monorail, people mover, personal rapid transit, aerial tramway, and waterborne transit. Modes that advanced included BRT, Light Rail Transit (LRT), Hybrid Rail, and Commuter Rail.

2.2.1.2 Conceptual Alignments Pre-Screening

Through stakeholder meetings, community outreach, steering and technical committee meetings, field surveys, and planning study reviews, a high-level assessment of potential alignments that parallel the I-26 corridor was completed. Several potential alignments were prescreened to move forward based on the goals and objectives.

Goal 1: Improve Mobility, Accessibility, Safety, and Connectivity of the transit system.

- Does the proposed alignment have existing transit service, and would performance improve with fixed guideway?

Goal 2: Provide a cost effective and financially feasible transit alternative.

- Is there readily available ROW for the alignment?
- Does the alignment have sufficient capacity to add a transit alignment?

Goal 3: Support Local Land Use Objectives.

- Does the alignment have sufficient capacity to support Transit Oriented Development?

Goal 4: Plan for projected growth in an environmentally sustainable manner.

- Does the alignment avoid adverse impacts to environmentally sensitive areas (i.e. natural, cultural, and or historic)?

Goal 5: Respond to community needs and support.

- Does the alignment serve populations with no access to a vehicle?

Goal 6: Support a diverse regional economy.

- Does the alignment serve current and future employment centers?

The alignments shown on Figure 1 were evaluated based on these criteria and a ranking system of high (yes, it meets the criteria); medium (yes, it meets the criteria with restrictions), and low (does not meet the criteria). Those alignments with overall low rankings are eliminated from further screening. Table 2-3 from the *i-26ALT* study illustrates the results of the fatal flaw analysis. Alignments that were eliminated included those along the Ashley and Cooper Rivers, Ashley River Road and the Glenn McConnell Extension. The specific reasons why the transit modes were eliminated for future consideration are listed in Chapter 2 on page 6 of the *i-26ALT* study.

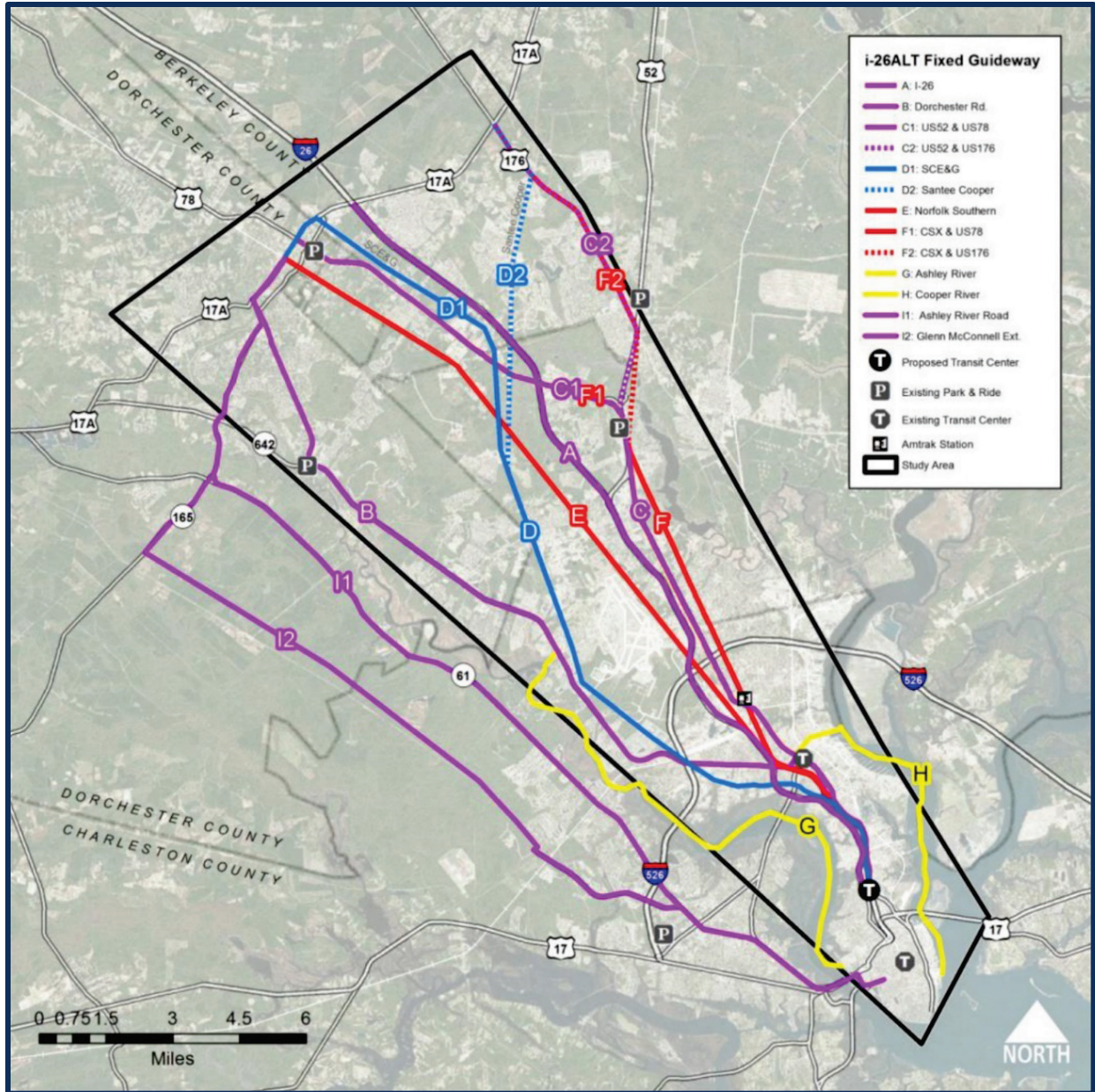


Figure 1 i-26ALT Pre-Screen Alignments

2.2.2 Screen One (Initial Screening)

A series of alternatives (see Figure 2) advanced through the pre-screening process and were further evaluated in Screen One. Screen One consisted of a qualitative and quantitative assessment of nine build corridors and their variants, with twenty alternatives in all. A No-Build alternative is discussed in Chapter 3 of the i-26ALT study, but was not factored into the analysis until Screen Two in Chapter 4. The no-build alternative assumed continuation of commuter bus service as operated by CARTA and TriCounty Link. CARTA’s Route 1- North Charleston and Route 3- Summerville provide peak hour service on US 52 (Route 1) and Dorchester Road (Route 3), and serve the i-26ALT study Area.

Nine corridors and their variants were identified in the Pre-Screen Analysis to move forward into Screen One. The alternatives are listed in Chapter 3 on page 6 of the i-26ALT study and are shown on Figure 2 of this memo. This initial screening utilized project goals and objectives to identify which alternatives warrant a more detailed review in Screen Two. Criteria used to evaluate the 20 alternatives is located on pages 6-9 of Chapter 3 of the i-26ALT study.

Alternatives that advanced from Screen One included build alignments along I-26, Dorchester Road, US 52, utility corridors, Norfolk Southern rail lines, and CSX rail lines. Modes that were evaluated included BRT, light rail transit (LRT), hybrid rail, and commuter rail. The modes that advanced from Screen One included only BRT and LRT.

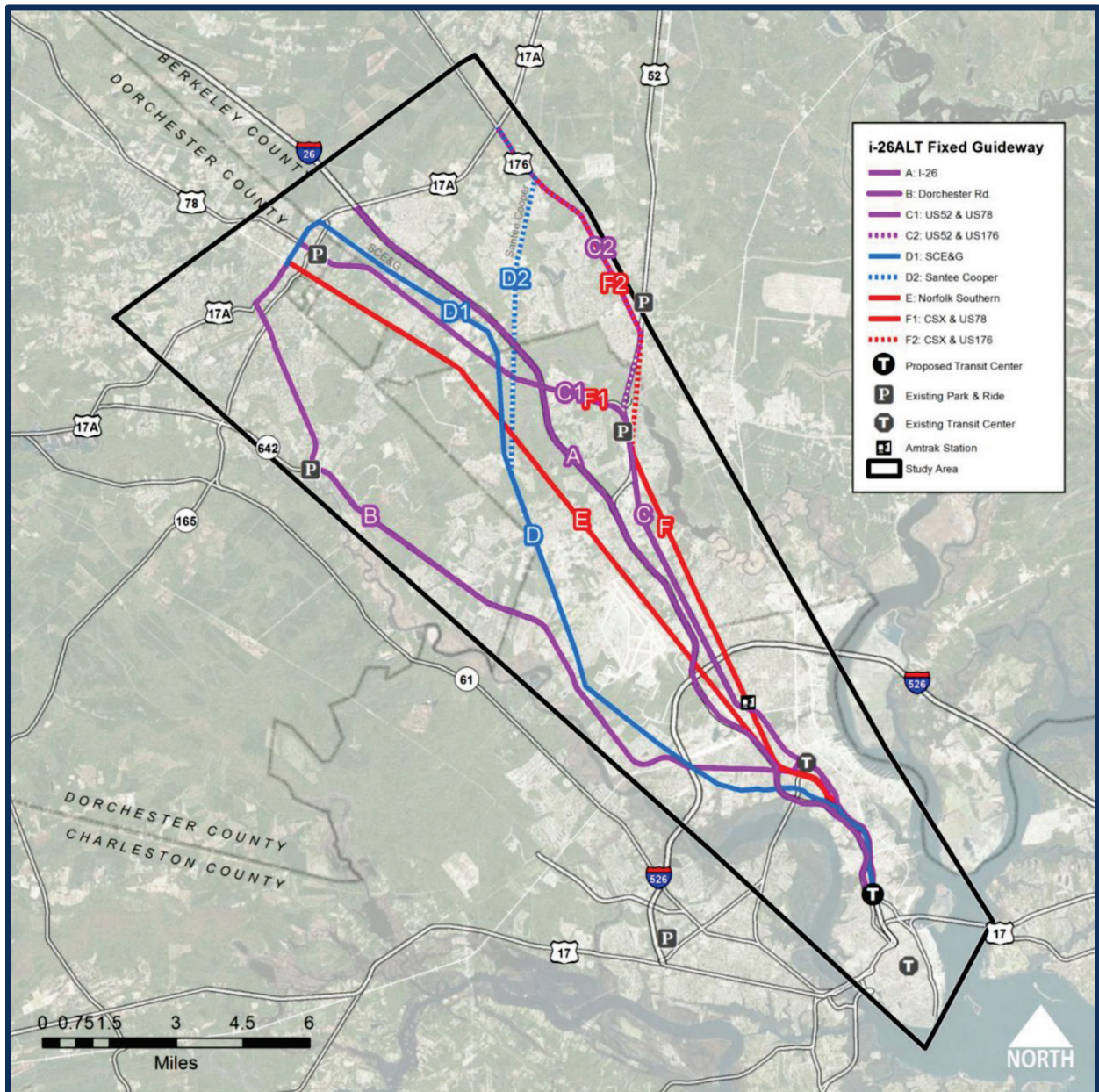


Figure 2 i-26ALT Screen One Alignments

2.2.3 Screen Two (Detailed Screening)

The Screen Two analysis included an evaluation of BRT and LRT alternatives using the FTA's Project Justification criteria on ridership forecasts developed with FTA's Simplified Trips-On-Project Software (STOPS) model, and planning level capital and operating and maintenance (O&M) costs. The alternatives that were evaluated (see Figure 3) in the Screen Two are also listed in Chapter 4, page 1 of the *i-26ALT* study.

- Alternative A: No Build I-26 Commuter Bus
- Alternative B-1/B-2: US 78-US 52-Meeting (BRT/LRT)
- Alternative B-3/B-4: US 78-US 52-East Bay (BRT/LRT)
- Alternative C-1/C-2: US 176-US 52-Meeting (BRT/LRT)
- Alternative C-3/C-4: US 176-US 52-East Bay (BRT/LRT)
- Alternative D-1/D-2: Dorchester Road-Meeting (BRT/LRT)
- Alternative D-3/D-4: Dorchester Road-East Bay (BRT/LRT)

The comprehensive description of the analysis completed for the Screen Two alternatives can be found in Chapters 4 through 6 of the *i-26ALT* study. The alternatives were screened using the FTA's Project Justification Criteria. The Project Justification Criteria includes:

- Cost Effectiveness
- Mobility Improvements
- Congestion Relief
- Environmental Benefits
- Land Use
- Economic Development

The *i-26ALT* study outreach process was designed to provide opportunities for interested parties to receive information, discuss issues, and partake in the decision-making process during the study, particularly at its key milestones. The outreach conducted was focused on engaged participation by a variety of stakeholders and the public with the goal of selecting a preferred alternative for transit improvements along the study corridor. It also supported the ongoing advocacy and outreach activities set forth by the CHATS and the BCDCOG to promote coordinated regional transportation planning. The combination of the technical analysis and the input from the public and stakeholders resulted in the recommendation of an alternative to move further into project development. The *i-26ALT* study Recommended Alternative was Alternative B-1: BRT along US 78/ US 52 (Rivers Avenue) to a terminus at Line Street (see Figure 4).

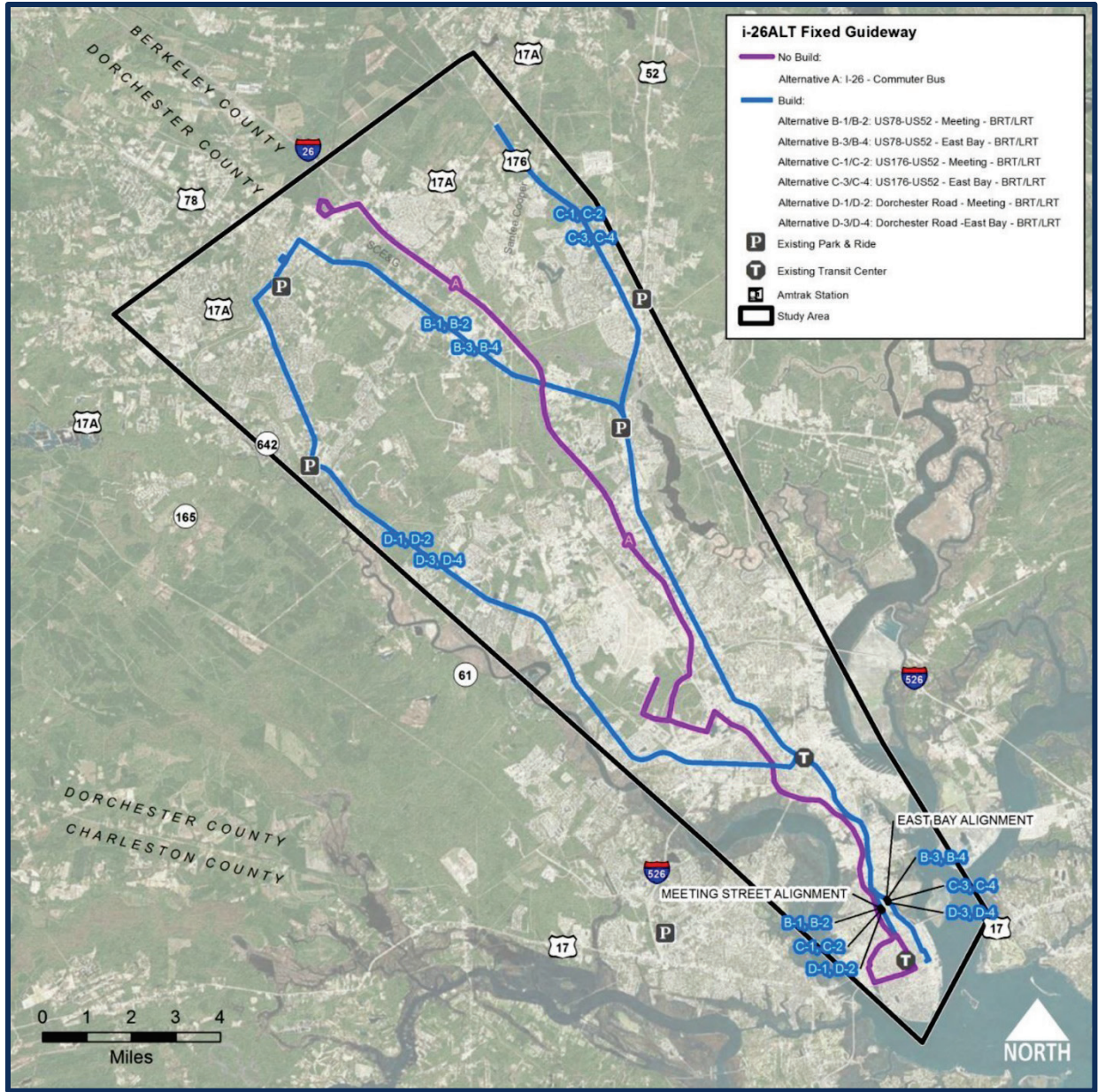


Figure 3 i-26ALT Screen Two Alignments

2.3 Recommended Alternative

The i-26ALT study recommended alternative is a 23.1-mile long alignment with 18 stations, traveling from downtown Summerville along Main Street, south along US 78, Rivers Avenue, and along Meeting Street terminating at Line Street in downtown Charleston. Figure 4 illustrates the recommended alternative alignment and stations. Below are preliminary costs and expected performance characteristics of the i-26ALT Recommended Alternative.

- Total Annual Trips: two million trips per year
 - 3,772 “New” daily transit trips
 - Total system-wide annual trips: 6.5 million
- Planning Level Operating Costs: \$5.9M/year
 - Weekday service span: 4:00 AM – 1:00 AM; with headways of 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
- Planning Level Construction Costs: \$360 million
 - \$15.5 M/mile
 - 23.1 mile corridor
 - 18 stations

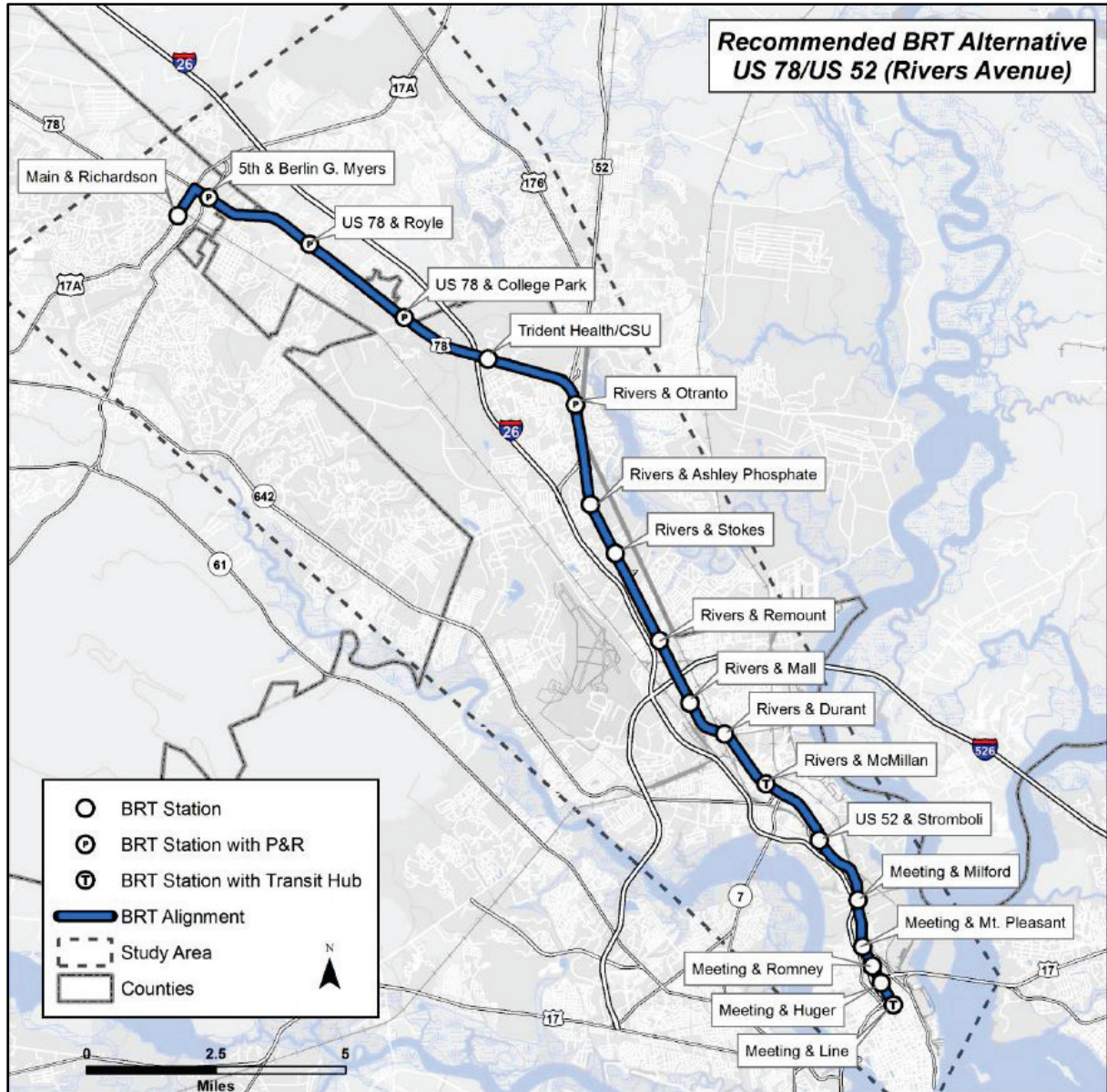


Figure 4 i-26ALT Study Recommended BRT Alternative

3 Advanced Planning and NEPA Preparation

As a result of the collaborative process of i-26ALT study, BCDCOG along with the local agencies and stakeholders moved into the project development phase. As a next step from the i-26ALT study the LCRT project began 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 remainder of this document presents the Phase 1 work that included the identification of alignment options in three key areas of the project study area and the fatal flaw analysis of end to end alignments.

3.1 Advance Planning

The advanced planning task in Phase 1 included a fatal flaw analysis of alignment options for three key areas of the project study area, including:

- the Northern Terminus (The Town of Summerville and the Nexton development);
- the Neck area (Cosgrove Street to Mt Pleasant Street); and
- the Southern Terminus (the Peninsula).

The project team identified and assessed alignment options in all three key areas. The following provides a detailed overview of that process and the identification of reasonable alternatives that advanced into Phase 2 of the project.

3.2 Alignment Options for Three Key Areas

To assess the i-26ALT Recommended Alternative and perform the required analysis for the project, additional alignment options were assessed in three key areas as noted above.

Alignment options in these three key areas was needed for several reasons:

- The emergence of the Nexton development as a major destination warranted exploring an option that would serve that area.
- In the Neck area there are a lot of challenges, especially the railroad crossings, so additional options were explored to minimize the interaction of the BRT vehicle with the railroad.
- The southern end of line from the recommended alternative from the i-26ALT study did not serve the core area of downtown and many key destinations, such as the Medical University of South Carolina (MUSC), the College of Charleston, and the Charleston Visitors Center.

3.2.1 Northern Terminus

The northern end of the recommended alternative that advanced from the i-26ALT study utilizes US 78 (5th Street) and N Main Street (US 17A) to serve downtown Summerville.

3.2.1.1 Northern Terminus – Option 1

Figure 5 shows that the end of North Option 1, the original end of line option from the i-26ALT study, creates a loop extending along N Main Street, W Richardson Avenue, Cedar Street, and Doty Avenue. The narrow section of US 78 north of Market Road near the Coastal Carolina Fairgrounds, coupled with concerns of increased traffic congestion in downtown Summerville by utilizing N Main Street, required additional options to be explored in the northern portion of the study area.

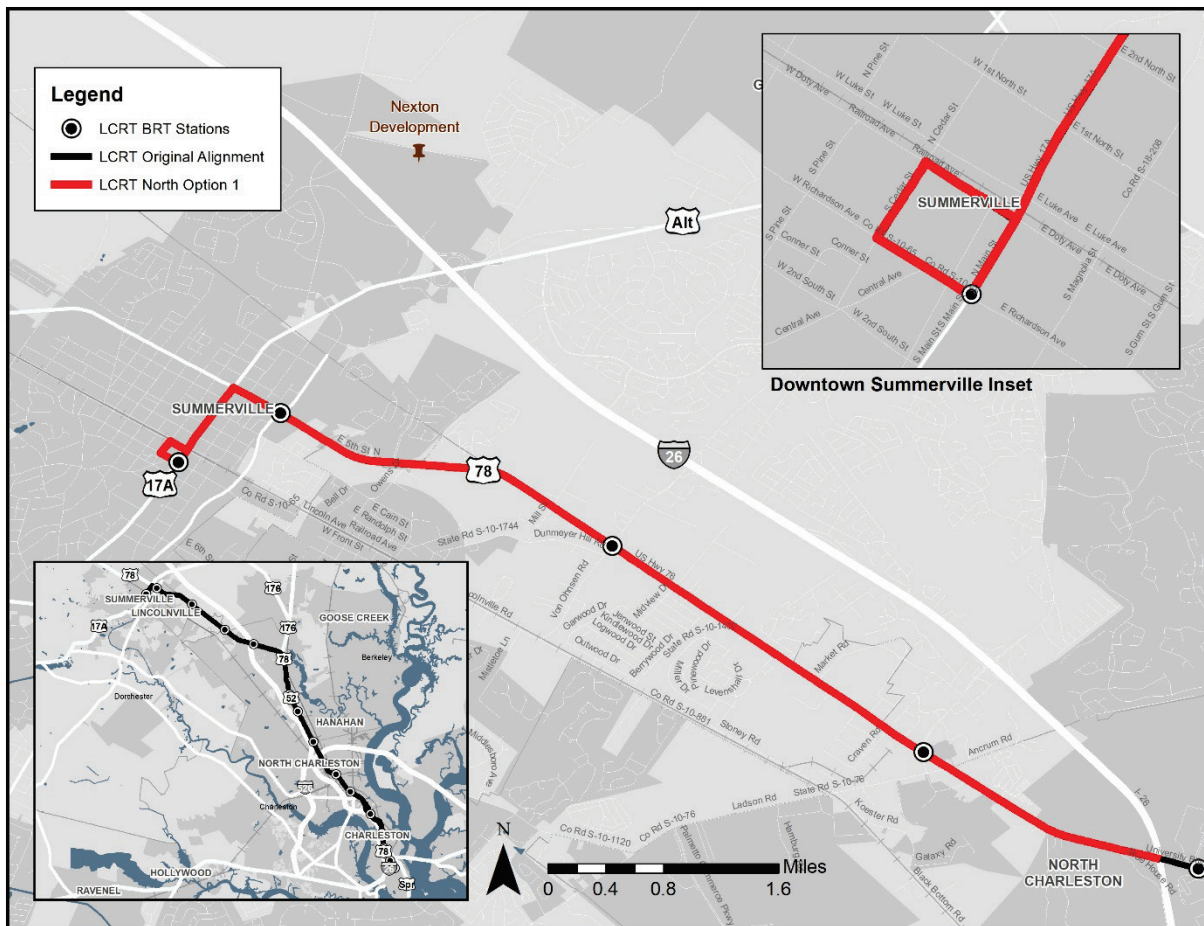


Figure 5 Northern Terminus - Option 1

3.2.1.2 Northern Terminus – Option 2

Option 2 would serve the emerging Nexton development at the northeast corner of US 17A and I-26. The Nexton development is a new community developing in the northeast section of US 17A and I-26. Nexton is approximately 4,500 acres and, once completed, is estimated to accommodate 7,000 households (single and multifamily), schools, shopping centers, and other facilities.

This option would extend along US 78 (Rivers Avenue) and then would utilize I-26 and US 17A to serve the Nexton development (see Figure 6). This alignment option is approximately 6.8 miles in length and would make a more direct connection to the Nexton development and avoid narrow sections of US 78. However, the alignment would not provide a direct connection to the Town of Summerville. This alignment option would travel along I-26 from US 78 to US 17A and could potentially have a long stretch (6.8 miles) without providing service to the community.

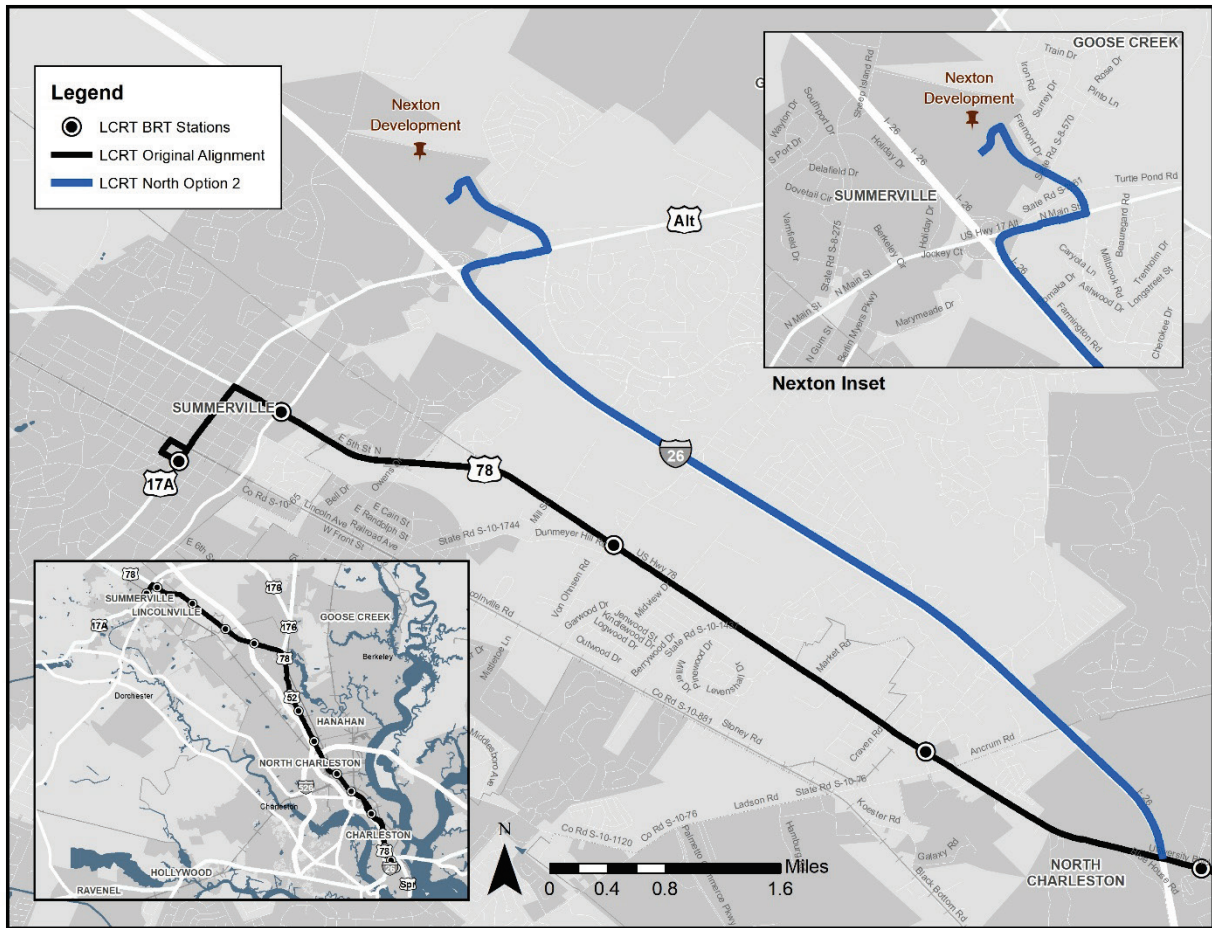


Figure 6 Northern Terminus - Option 2

3.2.2 The Neck Area

The Neck area has experienced challenges over the years and continues to experience them today. These challenges will impact how the BRT would operate and provide service to the community in this area. Transportation infrastructure, such as I-26 and railroads, has severed the community, limiting connectivity and mobility for the individuals that live there. Several future infrastructure projects have been identified that will only add to the challenges that already exist today. There are three alignments that were evaluated in the Neck area, including Option 1 (Carner Avenue/Meeting Street), Neck Option 2 (Rivers Avenue/King Street Extension), and Option 3 (Spruill Avenue/Meeting Street).

3.2.2.1 Neck Area – Option 1

Option 1 would begin at the intersection of Cosgrove Avenue and Rivers Avenue. From there the alignment travels south along Rivers Avenue. It would then take Carner Avenue until it reaches Hackemann Avenue where the street changes to Meeting Street. The alignment would utilize Meeting Street until it reaches Mt Pleasant Street where it ends (see Figure 7).

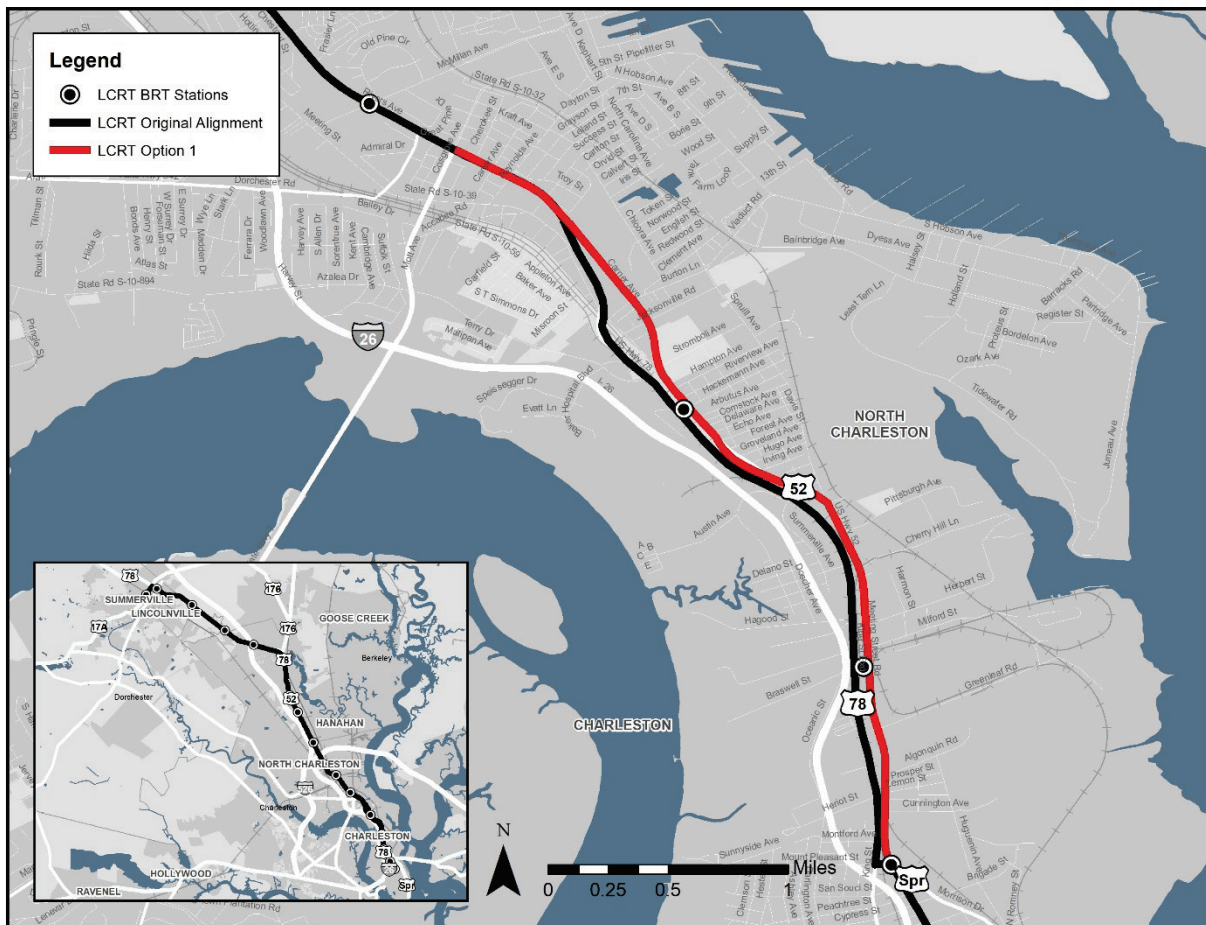


Figure 7 Neck Area - Option 1

3.2.2.2 Neck Area – Option 2

Option 2 would start at the intersection of Cosgrove Avenue and Rivers Avenue. From there, the alignment would operate on Rivers Avenue. Rivers Avenue turns into King Street Extension (US78) near Azalea Drive. The alignment continues on King Street Extension until it reaches Mt Pleasant Street, where it would turn east until it reaches Meeting Street where it ends (see Figure 8).

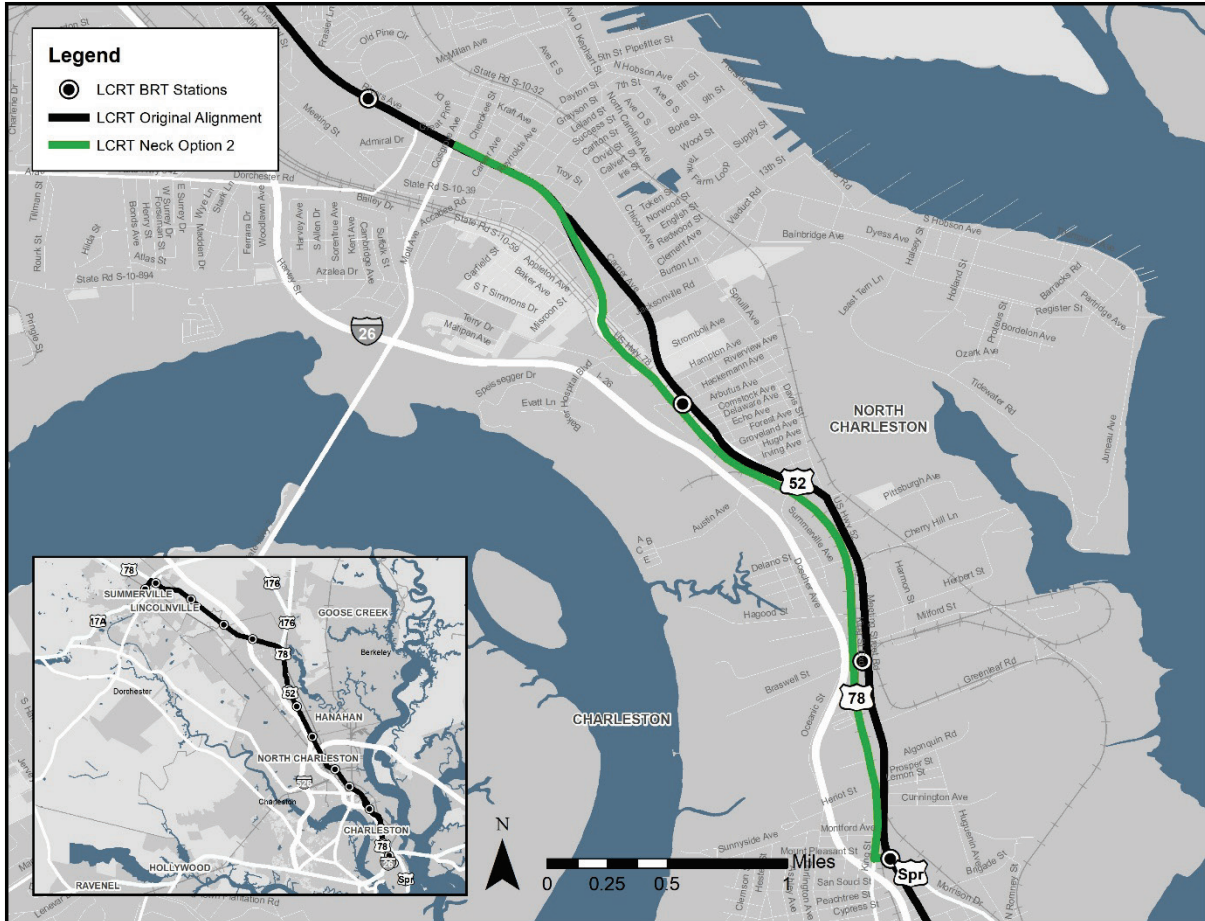


Figure 8 Neck Area - Option 2

3.2.2.3 Neck Area – Option 3

Option 3 would begin at the intersection of Cosgrove Avenue and Rivers Avenue. From there the alignment travels east on Cosgrove Avenue then turns south on Spruill Avenue. The alignment continues on Spruill Avenue until it intersects with Meeting Street. The alignment continues on Meeting Street until it reaches Mt Pleasant Street where it ends (see Figure 9).

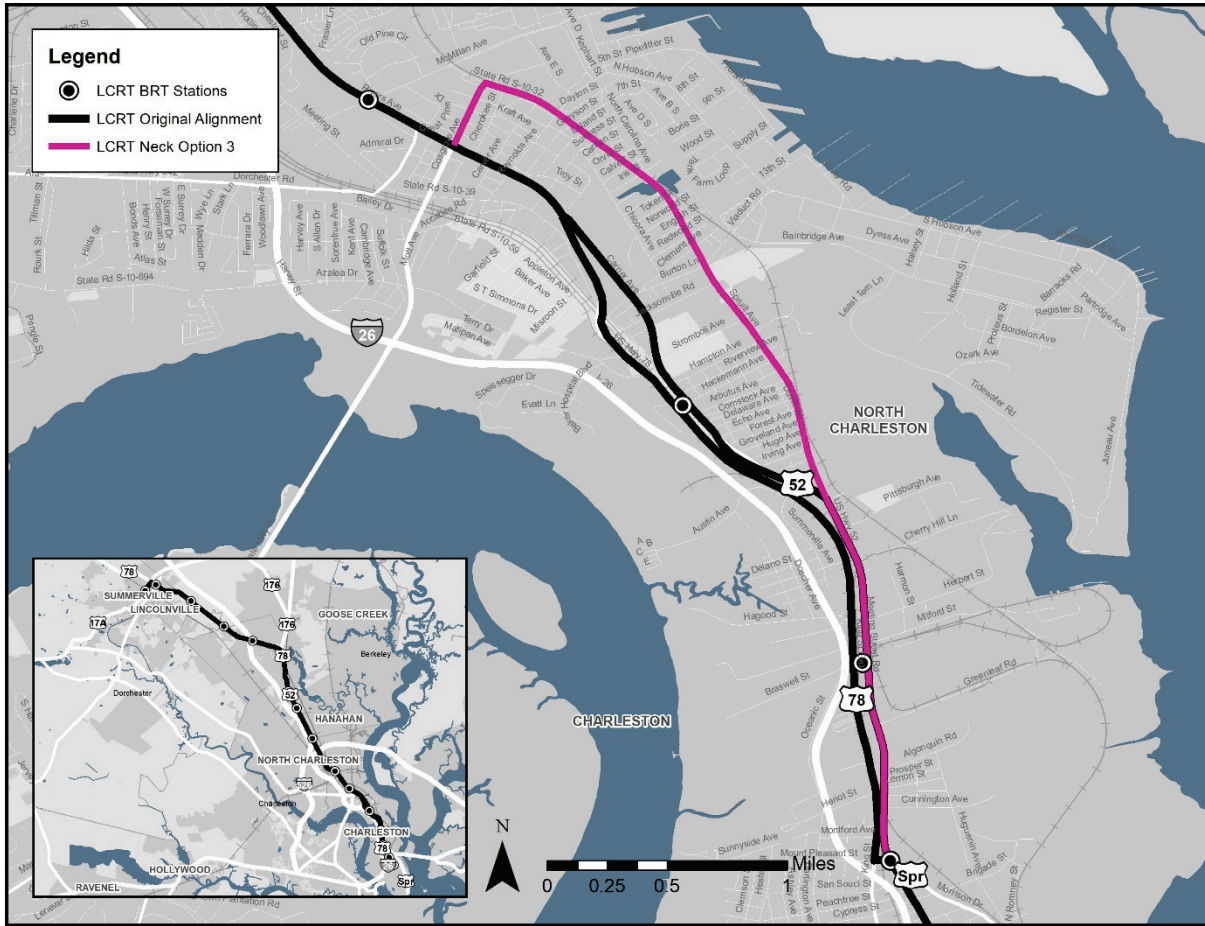


Figure 9 Neck Area - Option 3

3.2.3 Southern Terminus

Since the i-26ALT southern terminus did not serve the core area of downtown and many key destinations, additional options were explored. As the largest employment area in the region, MUSC and the medical district is a critical activity center. The district has the potential to generate high ridership to support the LCRT program; therefore, several options were explored to serve this area. There are some key challenges that exist throughout the Peninsula area, these include, but are not limited to, on-street parking, narrow right-of-way, residential and business access, impacts to historic structures, and impacts to traffic flow. The alignment options being explored utilize the main arterials and try to avoid the historic residential areas of the Peninsula. In addition, due to the historic nature of the area and narrow streets, the built environment and physical constraints south of Broad Street would make it very challenging to operate BRT transit vehicles in this area of the peninsula.

3.2.3.1 Southern Terminus – Option 1

South Option 1, shown on Figure 10 would extend the current alignment south on Meeting Street to Calhoun Street. The alignment would continue along Calhoun Street to MUSC. At MUSC, the alignment creates a one-way loop by using Jonathan Lucas Street, Doughty Street, and Courtenay Drive. This alignment option is approximately 2.2 miles in length and would provide direct connections to the Charleston Visitor Center, the College of Charleston, and MUSC as well as other key destinations in the downtown area.

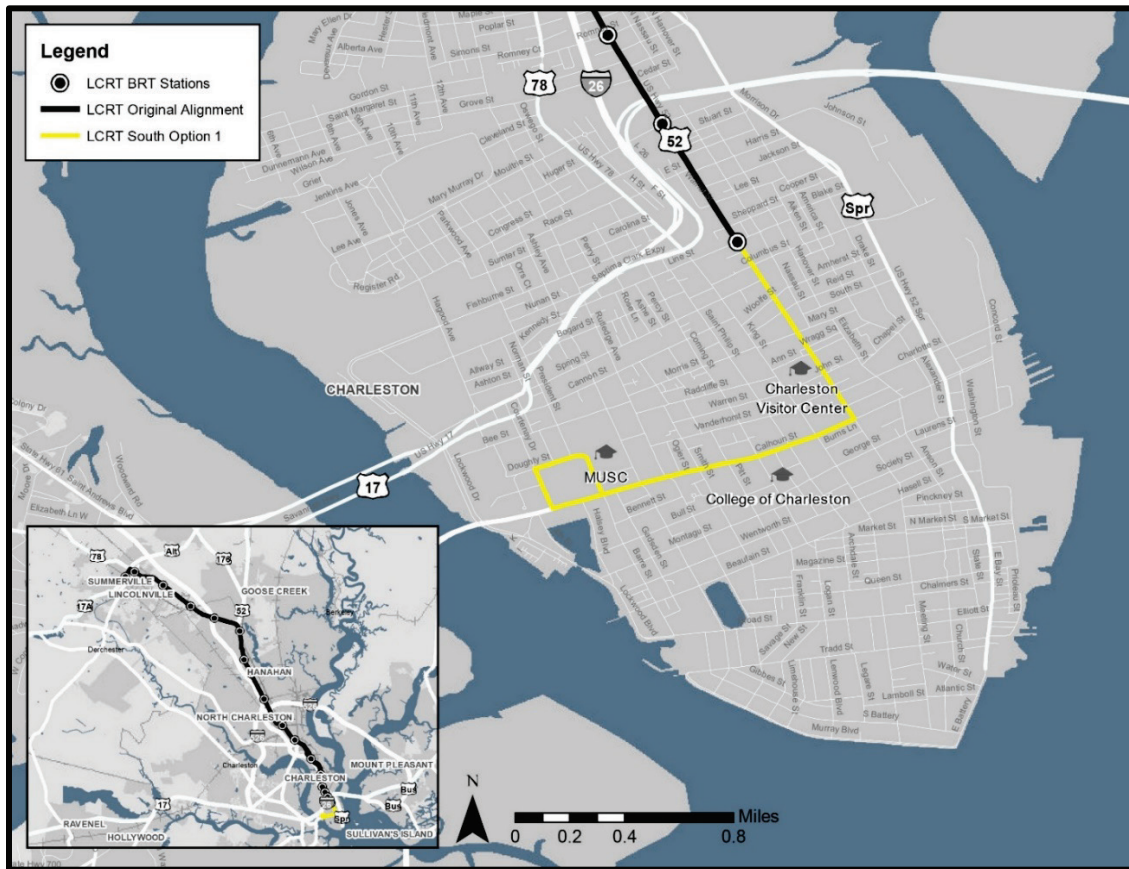


Figure 10 Southern Terminus - Option 1

3.2.3.2 Southern Terminus – Option 2

Similar to Option 1, Option 2 would extend south along Meeting Street to Calhoun Street. The alignment would then travel down Calhoun Street to MUSC. The alignment, shown on Figure 11, would create a one-way loop around the MUSC area by using Jonathan Lucas Street, President Street, Bee Street, and Courtenay Drive. This alignment option is approximately 2.5 miles long and provides direct connections to the Charleston Visitor Center, the College of Charleston, and MUSC as well as other key destinations in the downtown area.

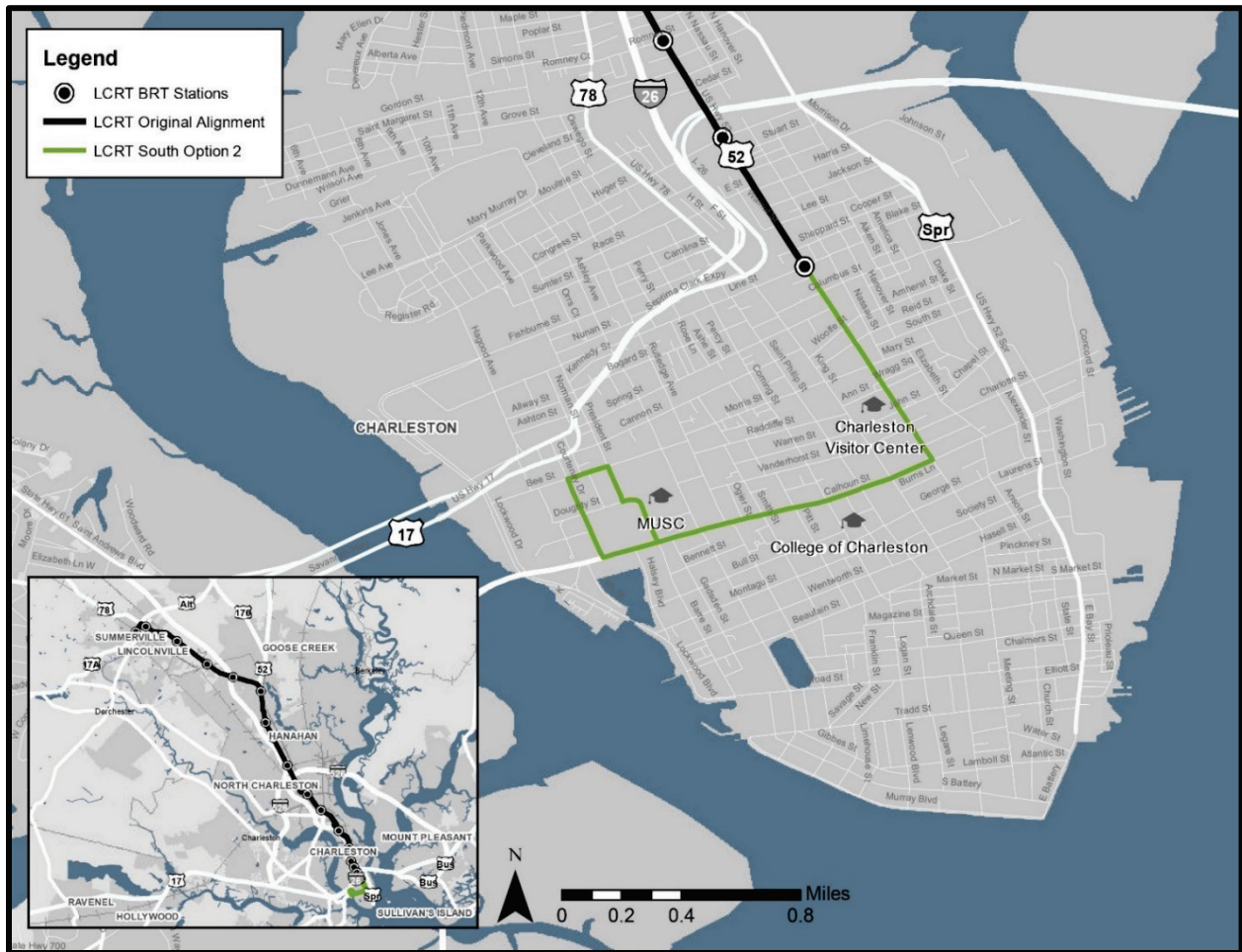


Figure 11 Southern Terminus - Option 2

3.2.3.3 Southern Terminus – Option 3

Option 3 for the southern terminus would extend the existing alignment south along Meeting Street then use a one-way loop via Amherst Street, King Street, Cannon Street, Ashley Avenue, Bee Street, Lockwood Drive, and Spring Street to head back north onto Meeting Street. This option is 2.8 miles long and would provide a direct connection to MUSC and Westedge, but would not serve the Charleston Visitor Center, the College of Charleston or key destinations in the downtown area (see Figure 12).

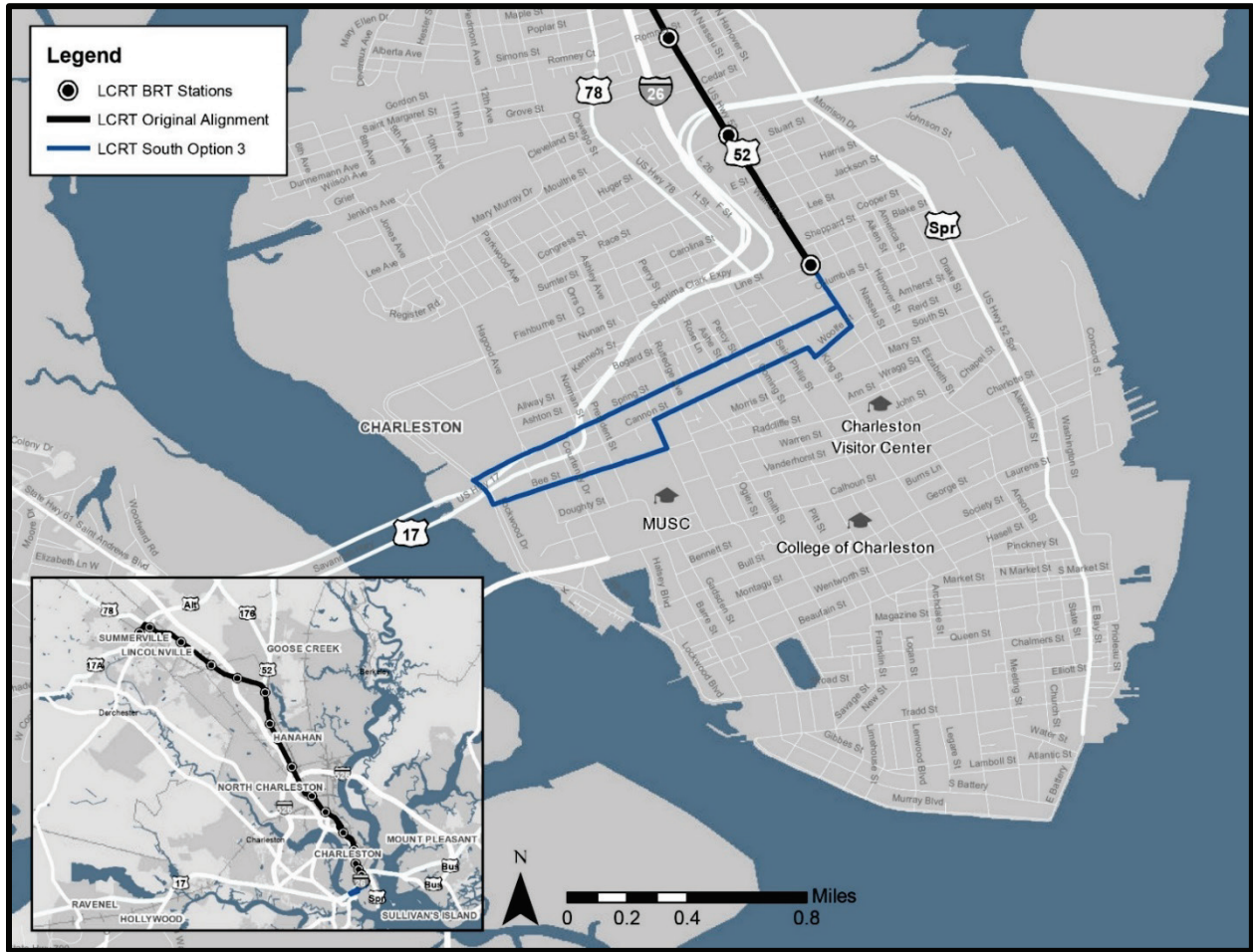


Figure 12 Southern Terminus - Option 3

3.2.3.4 Southern Terminus – Option 4

Option 4 would extend the current alignment south on King Street to Calhoun Street. The alignment would continue along Calhoun Street to MUSC. At MUSC, the alignment creates a one-way loop by using Jonathan Lucas Street, Doughty Street, and Courtenay Drive. This alignment option, shown on Figure 13, is approximately 3.5 miles in length and would provide direct connections to the Charleston Visitor Center, the College of Charleston, MUSC, and other key destinations in the downtown area.

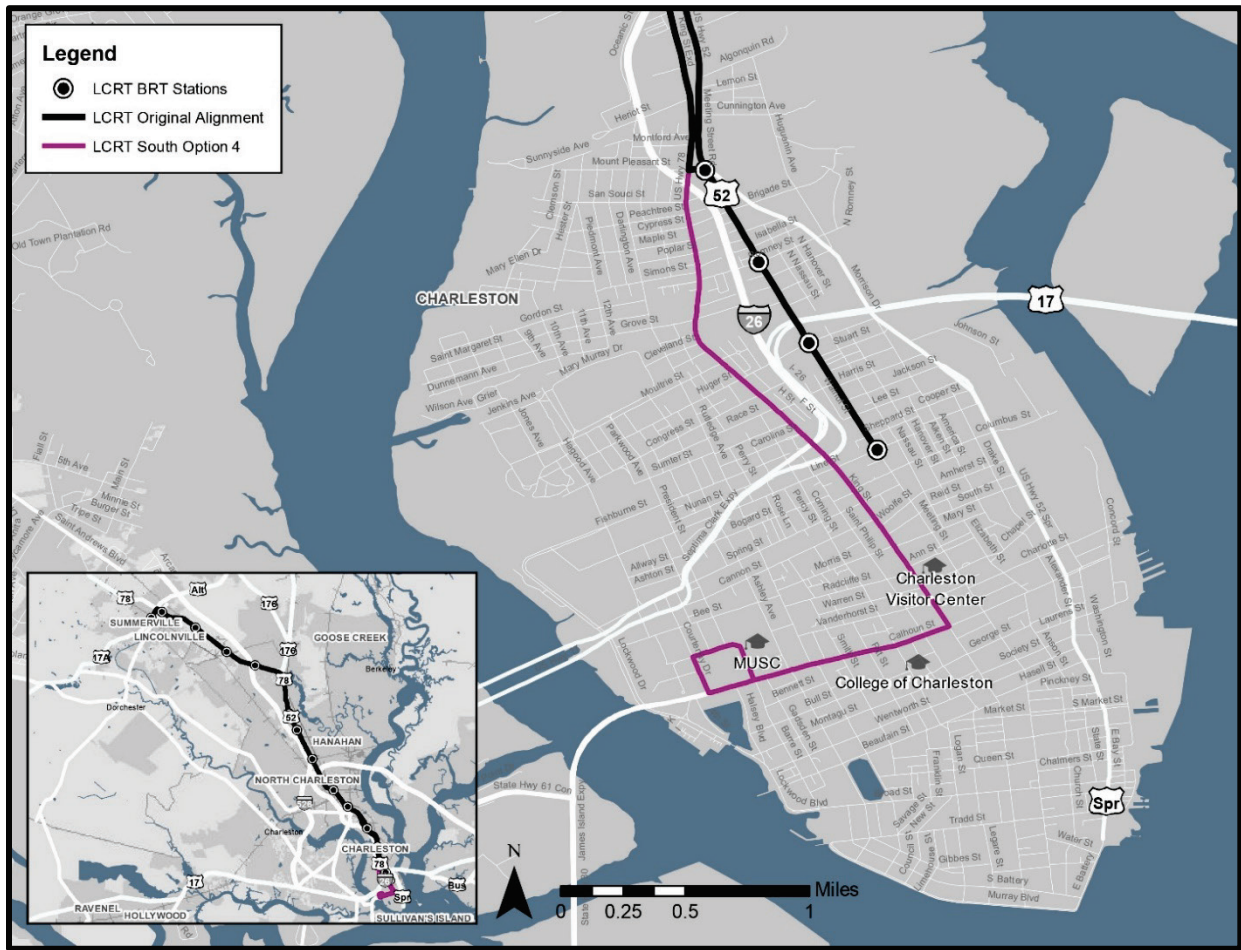


Figure 13 Southern Terminus - Option 4

3.2.3.5 Southern Terminus – Option 5

Option 5 for the southern terminus would extend the existing alignment south along Meeting Street then use a one-way loop via Mary Street, Morris Street, Rutledge Avenue, Bee Street, Lockwood Drive, Cannon Street, King Street, and Amherst Street. From there it would head back north onto Meeting Street. This option is 2.8 miles long and would provide a direct connection to MUSC and Westedge, but would not serve the Charleston Visitor Center or the College of Charleston (see Figure 14)

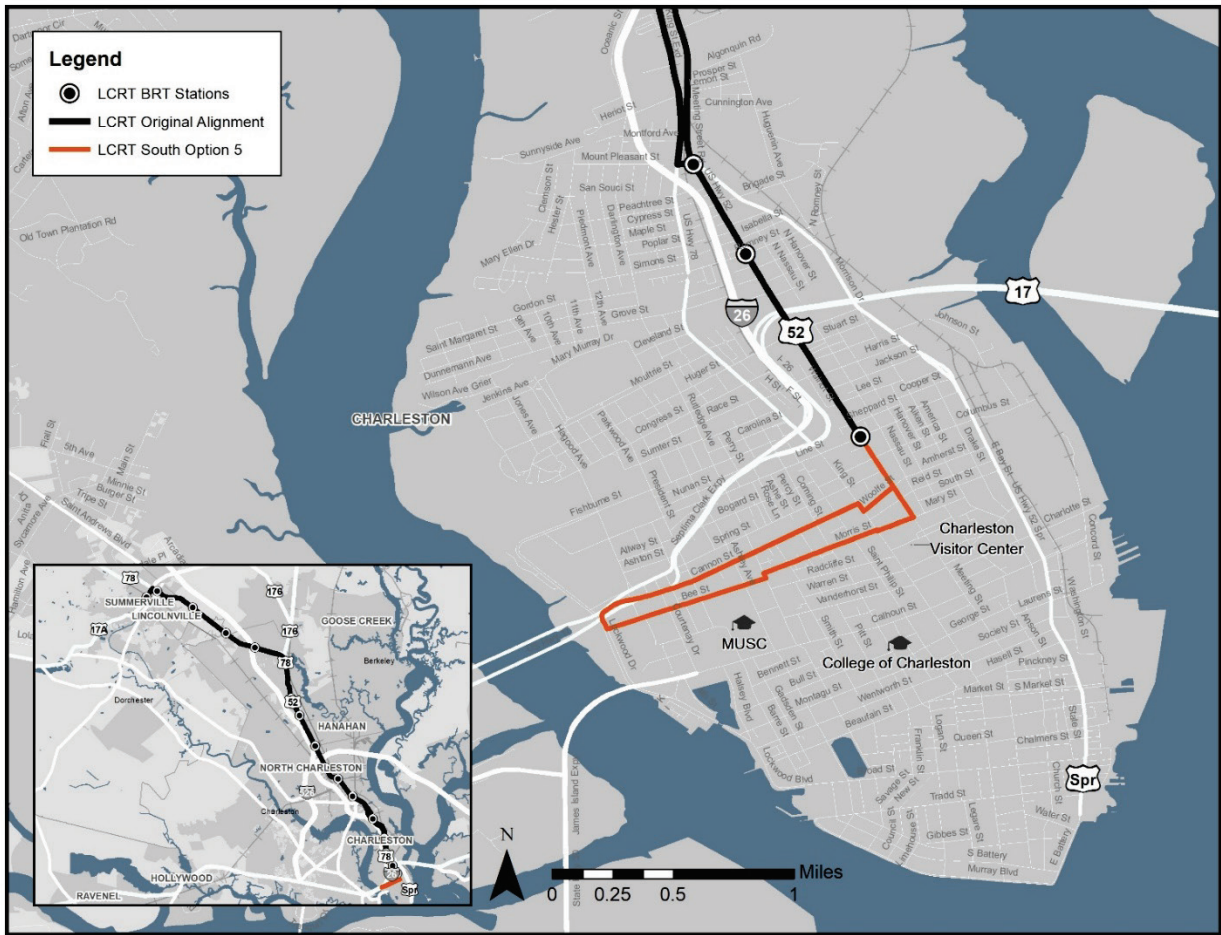


Figure 14 Southern Terminus - Option 5

3.2.3.6 Southern Terminus – Option 6

Option 6 would travel along the existing alignment that advanced from the i-26ALT study from Mt. Pleasant Street along Meeting Street. The southbound portion of the alignment would enter I-26 using the existing on-ramp at Brigade Street. From there the alignment would continue along the freeway and utilize the Crosstown (US 17/Septima Clark Parkway) and then turn south on Courtenay Drive, serving MUSC. From there the alignment continues east onto Bee Street, turns north onto Ashley Avenue (a one-way NB two-lane road), and then east on the Crosstown. The alignment continues north along I-26 and then uses the Romney Street exit traveling NB on Meeting Street to Mt. Pleasant Street. The alignment option is shown on Figure 15.



Figure 15 Southern Terminus - Option 6

3.2.3.7 Southern Terminus – Option 7

The final option that was explored in the downtown area was Option 7. Option 7, shown on Figure 16, utilizes the Low Line multiuse corridor, starting at King Street and Mt. Pleasant, extending south along the corridor until it reaches Spring Street. The alignment would then utilize a combination of Spring Street, Meeting Street and Mary Street where it terminates at the Transit Center.

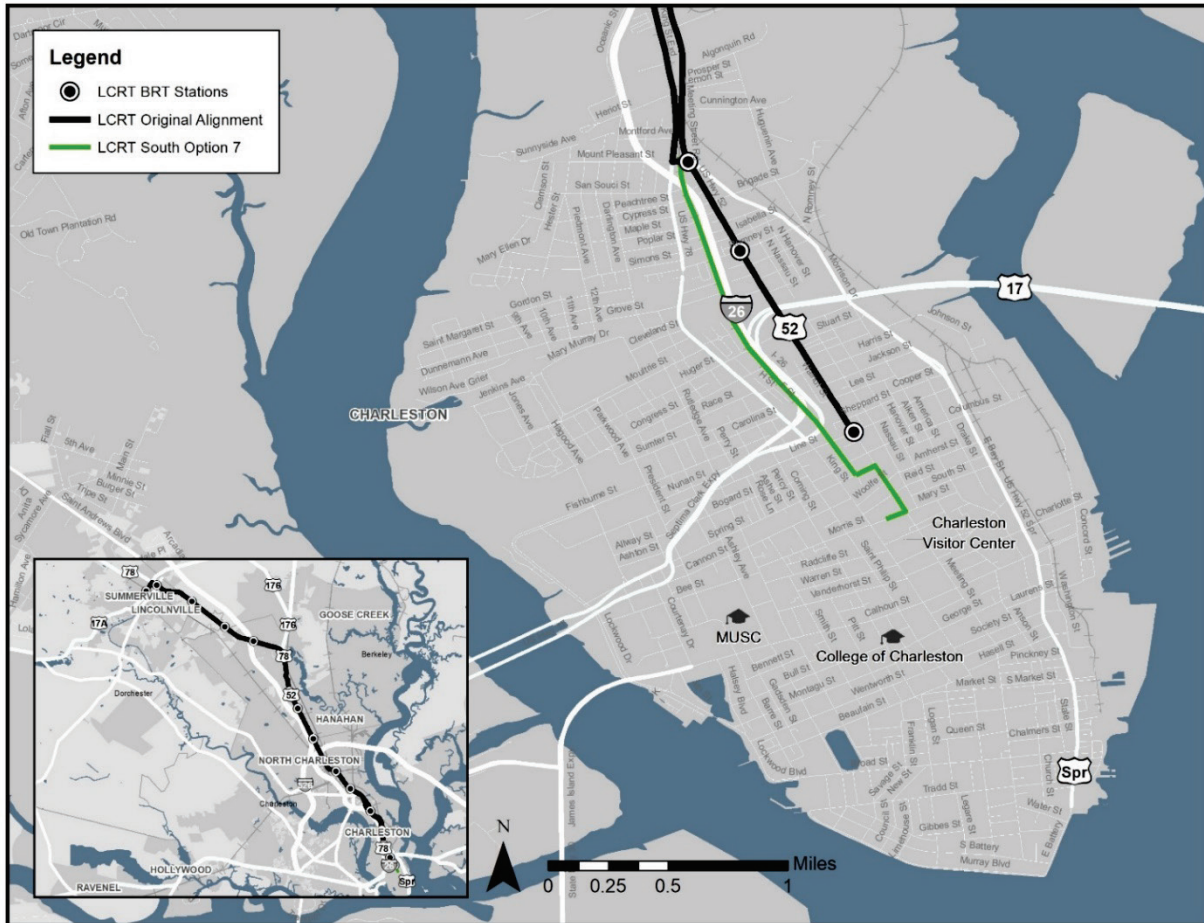


Figure 16 Southern Terminus - Option 7

4 Development of End to End Alignments

The alignment options, shown together on Figure 17, that were discussed in Section 3 were linked together to create a total of 16 end-to-end alignment combinations, see Table 1. The project team developed end to end alignments in preparation of more detailed analysis in Phase 2 of the project. The end-to-end alignments were divided into two groups; (1) those that served downtown Summerville (west) and (2) those that served the Nexton development (east).

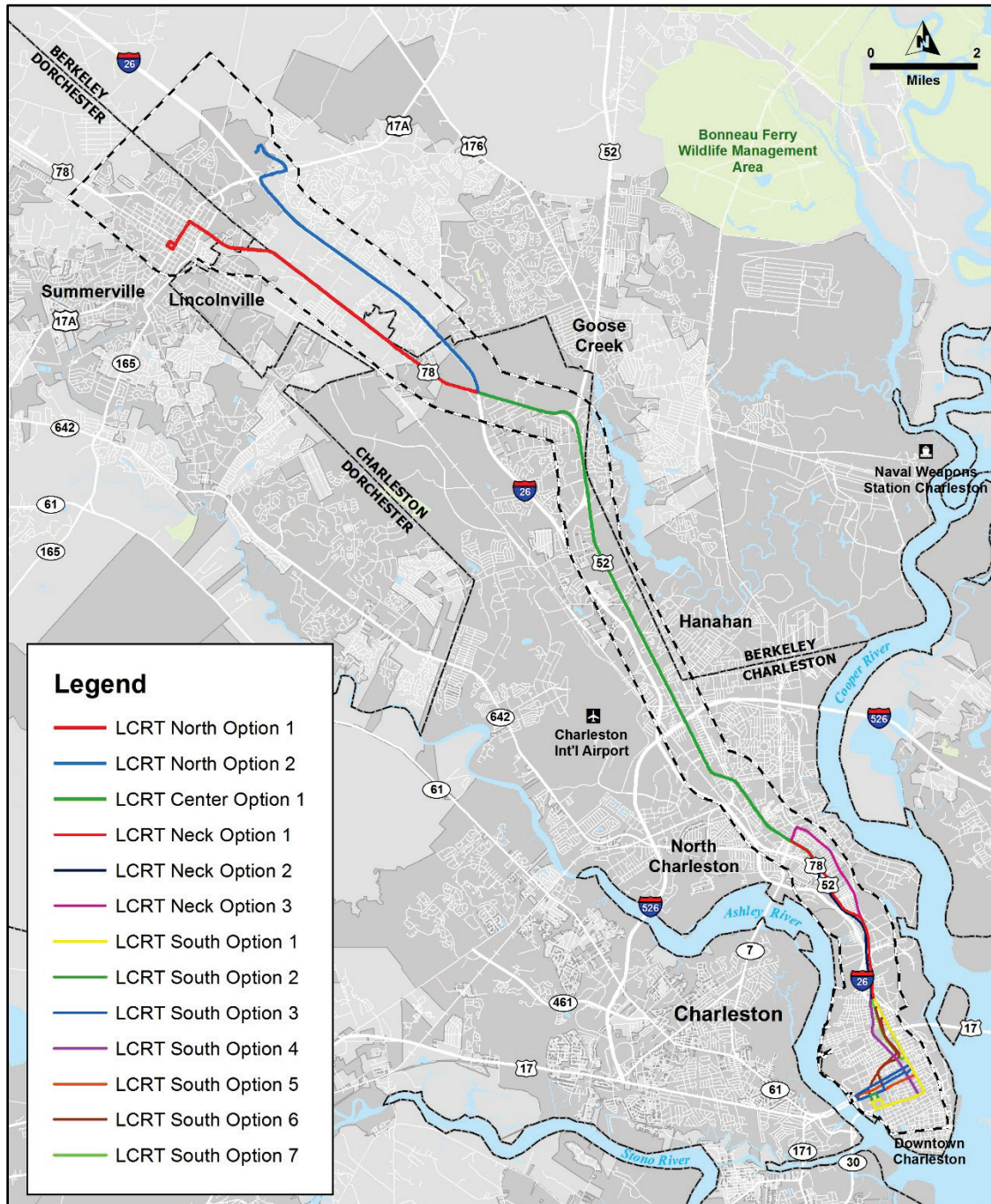


Figure 17 Alignment Options for Fatal Flaw Analysis

Table 1 Alignment Options and Options

	End-to-End Alignment Name	North Option 1	North Option 2	Center Option 1	Neck Option 1	Neck Option 2*	Neck Option 3**	South Option 1	South Option 2	South Option 3	South Option 4	South Option 5	South Option 6	South Option 7
Summerville	West Option 1	X		X	X			X						
	West Option 2	X		X	X				X					
	West Option 3	X		X	X					X				
	West Option 4	X		X	X						X			
	West Option 5	X		X	X							X		
	West Option 6	X		X	X								X	
	West Option 7	X		X	X									X
	West Option 8	X		X			X		X					
Nexton Development	East Option 1		X	X	X			X						
	East Option 2		X	X	X				X					
	East Option 3		X	X	X					X				
	East Option 4		X	X	X						X			
	East Option 5		X	X	X							X		
	East Option 6		X	X	X								X	
	East Option 7		X	X	X									X
	East Option 8		X	X			X		X					

*Given the close proximity of Neck Options 1 and 2 an internal decision was made to only use Neck Option 1 to create end-to-end alignments.

**Neck Option 3 (Spruill Avenue) was added later in the evaluation process. To evaluate this alignment option, it was combined with South Option 2 for both the West and East options.

4.1 Fatal Flaw Review

The purpose of the fatal flaw review was to understand if the LCRT could operate/maneuver in key areas of the study area, in particular in the streets of historic downtown Charleston, and principally south of Mt. Pleasant Street, given the existing constrained right-of-way and built environment. The fatal flaw review focused on the LCRT vehicle operability for a 60' articulated BRT vehicle, 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 directional BRT lanes, bi-directional exclusive BRT lanes, mixed use travel lanes, or reversible lanes with minimal impacts to traffic; and
- **BRT Operability** – Can the roadway accommodate a BRT service operations with minimal impacts to traffic

Each end to end alignment was evaluated based on the three fatal flaw criteria. Table 2 illustrates the results of the fatal flaw analysis. Any alignment receiving one or more “Xs” in a particular category was not recommended to move forward for further analysis. Alignments that were improbable or impossible to construct or operate efficiently, due to prohibitive infrastructure modification (e.g., turning two-way streets to one-way for example) and/or constrained continuous right-of-way requiring multiple acquisitions from properties adjacent the roadway and modifications to existing drainage features, were eliminated. The following sub sections provide a detailed description of the operating and configuration assumptions for each of the alignment options discussed in Section 3.

4.1.1 Operating and Configuration Assumptions

4.1.1.1 North Option 1

From North Main Street in downtown Summerville to Berlin G Myers Parkway, the alignment is proposed to operate BRT in mixed-traffic. BRT stations and park-and-ride facilities would be provided at select locations.

Alternatives identified for the fatal flaw analysis considered the addition of exclusive BRT lanes in downtown Summerville and widening for general traffic lanes. These options were not considered feasible for incorporation into the LCRT project scope due to right-of-way requirements. Additionally, there would have been impacts in the vicinity of downtown Summerville with the removal of on-street parking.

Along US 78, between Berlin G Myers Parkway and I-26 interchange, it is proposed to operate 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 this section of US 78 to add exclusive BRT lanes was also evaluated. Widening was not considered feasible for incorporation into the LCRT project scope due to right-of-way requirements.

The traffic analysis studies being conducted identified roadway and intersection improvements that may be included and considered.

Continuing from Market Road (north of Coastal Carolina Fair and Exchange Park) to the I- 26 interchange, existing US 78 widens to a five-lane roadway. Charleston County has future plans for roadway/intersection improvements through this section of US 78 and coordination between those efforts and the LCRT project are ongoing. At this time the proposed BRT would operate in mixed-traffic through this section.

4.1.1.2 North Option 2

This option provides BRT service to the Nexton development located near the intersection of US 17A and Brighton Park Boulevard. The BRT would operate in mixed-traffic along Brighton Park Boulevard and continue west along US 17A to the I-26 interchange. From this interchange, the BRT would enter I-26 and continue to the US 78 interchange and operate in mixed traffic lanes or as bus on shoulder (BOS) during peak travel times. Exclusive BRT lanes along US 17A and I-26 are not feasible due to right-of-way constraints along US 17A and conflicts with existing bridge overpasses along I-26. BRT operating in mixed use travel lanes is proposed for this option.

4.1.1.3 Center Option

From I-26 to the US 52/78 interchange, BRT would operate in exclusive lanes located in the existing median. The existing curb and gutter on the south side of the roadway was retained to minimize right-of-way impacts since buildings and parking are located closer to the roadway on the south side.

From the intersection of Old University Boulevard to Otranto Road, the exclusive BRT lanes would transition from the median to the outside of the general-purpose lanes as this allows both northbound (NB) and southbound (SB) BRT lanes to navigate the interchange without being in mixed traffic lanes. A concrete roadside barrier and buffer would be added to provide separation between the BRT and general-purpose lanes.

From the Otranto Road intersection to the US 52/I-26 Connector Interchange, the BRT lanes would be located in the median, and the west side curb and gutter was held to minimize right-of-way impacts. Approaching the US 52/I-26 Connector Interchange, both NB and SB BRT lanes would transition from the median to along the SB lanes US 78 through the interchange. This alternative allows the BRT to operate without having to cross US 52 traffic heading north from I-26. The SB BRT lane would be adjacent to the general-purpose US 78 lanes, while the NB lanes would be constructed between the existing bridge pier and bridge abutment. Another option considered in the area was construction of a new flyover bridge for traffic coming off I-26, but constructability issues rule out this option.

From the US 52/I-26 Connector Interchange to Ashley Phosphate Road, BRT lanes would be located in the median. From Ashley Phosphate Road to Piggly Wiggly Drive, Rivers Avenue consists of a wide grassed median with three travel lanes in each direction.

The i-26ALT study proposed concept was reviewed with both directions of BRT lanes located in the center of the existing median. This concept has the advantage of separating the BRT lanes from the general-purpose lanes with a two-buffer between the bus lane and general-purpose lanes. This location will require the BRT lane to shift out in several locations to allow

development of auxiliary lanes and to connect with stations. To maintain rider comfort, the proposed design uses large radii curves for smoother transitions.

A concept was considered that would repurpose the inside lane in each direction for the BRT lanes. This concept would reduce travel lanes from three to two in both directions, which would affect the overall capacity of the roadway as existing and projected traffic volumes exceed 45,000 vehicles per day. This would result in an unacceptable level of service (LOS), according to the Transportation Research Board Highway Capacity Manual, and was discarded based on that factor alone. Dedicated lanes will provide the speed and reliability of the bus system required in the purpose of need.

From Piggly Wiggly Drive to Success Street, Rivers Avenue transitions back to a five-lane roadway section with a two-way left turn lane. Proposed improvements through this section include the addition of exclusive BRT lanes, a sidewalk along the SB lanes, and a 10' shared-use path along the NB lanes. In order to maintain an equal right-of-way impact for both sides of Rivers Avenue, the SB edge of pavement was constant, while the NB edge of pavement was shifted to allow for the placement of the shared-use path. Another option looked at symmetrical widening of the travel lanes, but this resulted in an additional 2' of constant right-of-way impacts along the NB travel lanes.

4.1.1.4 Neck Option 1 – Rivers Avenue/Carner Avenue/Meeting Street

The Meeting Street concept extends the BRT alignment following Meeting Street from Carner Avenue to Mt. Pleasant Street. In two locations, this concept diverts the bus lanes to the outside of the travel lanes to make for more convenient transit station locations, while eliminating conflicts with regular traffic maneuvers in those areas. In the area where NB and SB Meeting Street diverges around the existing I-26/Meeting Street exit ramps, this section could have various alternative concepts depending on the final roadway configuration for the existing interchange and the proposed Port Access Road Interchange. Conceptual transit stations are located at the split of Meeting Street across from Echo Avenue, at the intersection of Meeting Street and Milford Street, and at the intersection of Meeting Street and Mt. Pleasant Street.

4.1.1.5 Neck Option 2 – Rivers Avenue/King Street Extension

The King Street concept extends the corridor following King Street from Carner Avenue to Mt. Pleasant Street. As the alignment bridges over railroad tracks near Clement Avenue, it was determined that the existing structure was not wide enough to maintain two exclusive bus lanes, two travel lanes, and a multiuse path. In order to maintain pedestrian accessibility, the proposed typical section for the bridge over the railroad would need to consist of a sidewalk along the SB lanes, two general purposes travel lanes where buses will be in mixed traffic, and a shared-use path along the NB lanes. At the southern end of the bridge, the exclusive bus lanes are reintroduced, and general-purpose travel lanes are also provided. This concept also shows the placement of the bus lanes along the east side of the travel lanes, where there are fewer conflicts with side roads or business entrances. This configuration also allows the buses to have uninterrupted travel allowing increased speed and reliability. Conceptual transit stations are located at the intersection of King Street and Braswell Street, and at the intersection of King Street and Mt. Pleasant Street. Concepts along King Street showing both NB and SB BRT lanes

were also evaluated, but resulted in significant impacts as active rail lines are located along either side of King Street. The reduced roadway footprint minimizes these impacts while also providing pedestrian accessibility.

4.1.1.6 Neck Option 3 – Spruill Avenue/Meeting Street

From US 52/Rivers Avenue, Spruill Avenue can be reached via McMillan Avenue, Cosgrove Avenue, or Stromboli Avenue. McMillan Avenue generally has right-of-way for a typical BRT configuration. A transit center is being proposed at the intersection of McMillan Avenue and US 52/Rivers Avenue. Nearby CARTA bus stops are currently served by Route 104. The site at the southeast corner of the intersection is ripe for redevelopment. Due to higher right-of-way constraints two alternatives, traveling NB and SB along Spruill Avenue and connecting to US 52/Meeting Street, were reviewed. The first was Spruill Avenue via Cosgrove Avenue. The second, Spruill Avenue via Stromboli Avenue.

The first alternative provides BRT lanes for the alignment from Rivers Avenue following Cosgrove Avenue, Spruill Avenue, Meeting Street to Mt. Pleasant Street. Three concepts were developed for this corridor and are identical in all areas except for along Spruill Avenue between Cosgrove Avenue and North Carolina Avenue. One concept places the exclusive BRT lanes outside of the existing pavement in a space that is occupied by railroad tracks that are believed to be abandoned or unused, to allow traffic to operate as it normally would. BRT lanes would then transition at the intersection of Spruill Avenue and North Carolina Avenue back to the median and continue south. The second alternative concept proposes bus lanes in the existing media for the area between Cosgrove Avenue and North Carolina Avenue. The Spruill Avenue alignment would eventually tie into Meeting Street and continue on to Mt. Pleasant Street as detailed in Neck Option 1. The portion of these two alignments that travels along Meeting Street is also identical to the other concept that travels along Meeting Street. Conceptual transit stations are located at the intersection of Spruill Avenue and Cosgrove Avenue, the intersection of Spruill Avenue and North Carolina Avenue, the intersection of Meeting Street and Milford Street, and the intersection of Meeting Street and Mt. Pleasant Street. The station location at Mt. Pleasant Street is identical to the concept for King Street.

From Stromboli Avenue to Meeting Street, the proposed typical section consists of 11' travel lanes for both the NB and SB directions, a 15' center turn lane, 5' concrete median, and a single bi-directional 12' BRT lane. The BRT lane would be located adjacent to the NB travel lane as a residential community is located to the west of Spruill Avenue with side streets spaced approximately 200' apart. This placement would reduce potential conflicts between passenger vehicles turning across BRT lanes to access this neighborhood. A 10' shared-use path with 5' buffer would be provided along the SB travel lane to replace the existing bike lanes along the roadway and a 5' sidewalk would be provided along the NB travel lane. A proposed transit station would be located near the Hackemann Avenue intersection to provide access to nearby residential areas. An additional BRT lane would be provided near this station to allow for buses to pass each other.

The second alternative provides BRT lanes for the alignment from Rivers Avenue following Carner Avenue, Stromboli Avenue, Spruill Avenue, and Meeting Street to Mt. Pleasant Street.

Beginning at Carner Avenue, NB and SB BRT lanes would be located in the median matching the Rivers Avenue typical section. The BRT lanes would turn east on Stromboli Avenue (part of the Port Access Road project that is currently under construction), which consists of a five-lane roadway with curb and gutter and sidewalk. The south edge of pavement would be retained to accommodate a 10' shared-use path, with all widening of the roadway occurring to the north in new additional right-of-way. As with the Cosgrove Ave/Spruill Alternative, along Spruill Avenue from Stromboli Avenue to Meeting Street, the proposed typical section consists of 11' travel lanes for both the NB and SB directions, a 15' center turn lane, 5' concrete median, and a single bi-directional 12' BRT lane. The BRT lane would be adjacent to the NB travel lane as a residential community is located to the west of Spruill Avenue with side streets spaced approximately 200' apart. This placement would reduce potential conflicts between passenger vehicles turning across BRT lanes to access this neighborhood. A 10' shared-use path with 5' buffer would be provided along the SB travel lane to replace the existing bike lanes along the roadway and a 5' sidewalk would be provided along the NB travel lane. A proposed transit station would be located near the Hackemann Avenue intersection to provide access to nearby residential areas. An additional BRT lane would be provided near this station to allow for buses to pass each other. Near the intersection with Meeting Street, new bridge structures for the Port Access Road project are currently under construction. Bridge columns will be located in close proximity to the back of the proposed sidewalk and shared-use path, but should not be in conflict with BRT operations. There is a high concentration of residential streets along the Spruill Avenue corridor and left turn access across BRT lanes located in the median would be restricted, as these movements would be limited to signalized intersections to reduce crossing conflicts with buses. Eventually, the Spruill Avenue alignment ties into Meeting Street and continues on to Mt. Pleasant Street as detailed in Neck Option 1.

Spruill Avenue is constrained for a dedicated guideway, as there is a single lane in each direction. There are closely spaced residential streets between 200' and 300' along Spruill Avenue between Reynolds Avenue to Meeting Street. To accommodate the center-running BRT operations, left turning movements would be restricted to signalized intersections to allow for safe bus operations. Newly constructed signalized intersections are required to be spaced to meet SCDOT standards, which is typically 1,320'. The design of this option results in consolidation of left turns along the Spruill Avenue corridor. Another constraint to consider is the number of dead-end residential streets between Spruill Avenue and the eastern rail corridor. These dead-end streets between Stromboli Avenue and Arbutus Avenue will adversely impact the turn prohibitions created by the BRT design. Additionally, this concept option requires purchasing of six residential homes due to right-of-way expansion needs. The use of mixed use travel lanes for BRT service along Spruill Avenue was also evaluated. Due to the increase in travel time for buses associated with turning movements along Rivers Avenue and Spruill Avenue, for both the Cosgrove Avenue and Stromboli Avenue alternatives, BRT operability issues make this alternative not feasible for the project.

4.1.1.7 South Option Alternatives

South Alternatives 1, 2, 3, and 5 all share identical alignments along Meeting Street between Mt. Pleasant Street and Line Street. Beginning south of the Meeting Street intersection with Mt.

Pleasant Street, the two bus lanes become a single two-way bus lane in the middle of the outer travel lanes. This alignment utilizes the concept of a single two-way bus lane, two travel lanes in each direction, a sidewalk, and a multi-use path for the majority of the concept from Mt. Pleasant Street to Line Street.

There are three conceptual BRT stations shown at Romney Street, Huger Street, and Line Street, respectively. The pair of conceptual transit stations (intended to function as a single station) located north of and just south of the intersection at Romney Street are located on either side of the two-way bus lane. Between the stations is an area that the buses can pass each other. South of the I-26 entrance ramps, the two-way single bus lane widens into two bus lanes and then narrows back into a single bus lane just north of Stuart Street. The conceptual transit station at Huger Street is located within this transition Option with two bus lanes. A new traffic signal would facilitate pedestrian access to the station and would also control traffic turning left onto the US 17 entrance ramp. The purpose for the proposed buffers at Huger Street is to avoid the travel lanes needing a taper through the intersection. The pair of conceptual transit stations at Line Street utilizes the concept of having a transit station on each side of a two-way bus lane and also provides an area where the buses can pass each other.

Options 6 and 7 utilize portions of the Low Line corridor, an abandoned railroad corridor that runs along the west side of I-26 beginning at Mt. Pleasant Street and ending at Line Street.

4.1.1.8 South Option 1

This option would extend the current alignment south along Meeting Street to Calhoun Street. The alignment would continue along Calhoun Street to MUSC. At MUSC, the alignment creates a one-way loop by using Jonathan Lucas Street, Doughty Street, and Courtenay Drive. This option is approximately 2.2 miles in length and would provide direct connections to the Charleston Visitor Center, the College of Charleston, and MUSC as well as other key destinations in the downtown area and would utilize the pedestrian only mall on Doughty Street for BRT traffic. A reversible lane option would allow for a dedicated bus lane to better accommodate both traffic directions during peak travel periods. Widening of the roadway along Calhoun Street between Jonathan Lucas Street and Rutledge Avenue would be required to allow for 11' travel lanes and would result in additional right-of-way acquisitions and utility relocations. BRT stations for this option could utilize the existing CARTA bus stop at the Charleston Visitors Center along Meeting Street. Along Calhoun Street there are limited locations for an EB BRT station and would require the purchase of additional right-of-way. A clockwise bus movement around the hospital district is preferred to allow for more length along Calhoun Street for EB traffic to merge as they are approaching the city. But with this operation, the bus cannot make a right hand turn at the Calhoun/Courtenay intersection without either encroaching into oncoming traffic lanes or tracking over the existing pedestrian ramps. At the Courtenay/Doughty intersection, the bus must swing wide into the pedestrian only zone. A counter-clockwise movement around the hospital would allow the bus to utilize the existing CARTA bus stop at Jonathan Lucas Street / Doughty Street. However, with this movement, the bus cannot make a right turn at the Calhoun/Jonathan Lucas intersection without either encroaching into oncoming traffic lanes or tracking over the existing pedestrian ramps. Bus

turning movements at these intersections may require minor improvements to allow buses to make these maneuvers.

4.1.1.9 South Option 2

Similar to Option 1, Option 2 would extend south along Meeting Street to Calhoun Street. The alignment would then travel down Calhoun Street to MUSC. The alignment would create a one-way loop around the Medical District by using Jonathan Lucas Street, President Street, Bee Street, and Courtenay Drive. This alignment option is approximately 2.5 miles long and provides direct connections to the Charleston Visitor Center, the College of Charleston, and MUSC as well as other key destinations in the downtown area. A reversible lane option would allow for a dedicated bus lane and better accommodate both traffic directions during peak travel periods.

Currently Calhoun Street is 36' for four 9' travel lanes. Widening of Calhoun Street between Jonathan Lucas Street and Rutledge Avenue would be required to allow for 11' travel lanes and resulting in additional right-of-way acquisitions and utility relocations. BRT stations for this option could utilize the existing CARTA bus stop area at the Charleston Visitors Center along Meeting Street. A clockwise bus movement around the hospital district is preferred to allow for more distance along Calhoun Street for EB traffic to merge as they are approaching Downtown Charleston. In the clockwise direction, the bus cannot make right hand turns at Calhoun/Courtenay, Courtenay/Bee, and Bee/President intersections without either encroaching into oncoming traffic lanes or tracking over the existing pedestrian ramps. A counter-clockwise bus movement around the hospital district will allow better turning movements on Bee Street and can utilize an existing CARTA bus stop at Jonathan Lucas Street and Doughty Street. Even with this operation, the bus still cannot make right hand turns at Dougherty/President or Calhoun/Jonathan Lucas intersections without either encroaching into oncoming traffic lanes or tracking over the existing pedestrian curb ramps. Bus turning movements at these intersections may require minor improvements to allow buses to make these maneuvers.

4.1.1.10 South Option 3

Option 3 for the southern terminus would extend the existing alignment south on Meeting Street (two-way traffic) where the bus would utilize the 12' wide outside lane before making a right turn onto Spring Street (two-way traffic) where the bus would head west utilizing the 10'–12' wide outside lane. The bus would then turn left on Lockwood Drive (two-way traffic) from the inside turn lane and head south on Lockwood Drive in the 12' wide inside lane before turning left onto Bee Street. The bus would then head east on Bee Street (two-way traffic) travelling in the 12' wide outside lane before making a left turn onto Ashley Avenue (one-way traffic) heading north in the 12' wide outside lane. The bus would then turn right onto Cannon Street (two-way traffic) and head east in the 11'–12' wide outside lane. The bus would then turn right onto King Street (two-way traffic) heading south in the 12' lane before turning left on Amherst Street (two-way traffic) heading east in the 12' wide outside lane. Finally, the bus would turn left back onto Meeting Street (two-way traffic) heading north in the 11'–12' wide outside lane. This option, 2.8 miles long, assumes that Spring Street and Cannon Street are converted back into one-way streets, and provides a direct connection to MUSC and Westedge, but would not serve the Charleston Visitor Center or the College of Charleston. This option could utilize existing bus

stop locations with shelters, but their close proximity to present SB traffic would limit construction at these locations. Due to tight corner radii on several of these roads, buses will have difficulty maneuvering with either bus wheel paths off tracking into existing pedestrian curb ramps or encroaching into oncoming traffic lanes. Bus turning movements at these intersections may require minor improvements to allow buses to make these maneuvers. Roadway geometry impacts associated with this alternative, consisting of BRT operating in mixed use traffic on narrow two-lane roadways with on-street parking in downtown Charleston between Meeting Street and Lockwood Drive, mean BRT would not be able to operate without impacts to existing traffic and causing delays to BRT service.

4.1.1.11 South Option 4

Option 4 for the southern terminus would utilize the King Street corridor, from Mt. Pleasant Street to Calhoun Street, travel west on Calhoun Street, north on Jonathan Lucas Street, west on Doughty Street, and south on Courtenay Drive to the end of line. For this section of King Street, the BRT would operate in mixed traffic. This is a dense commercial corridor with many store-fronts and significant on-street parking. Proposed transit stations would be located at Romney Street, Francis Street, and Sheppard Street. At the intersection of King and Huger Streets, existing drainage issues include flooding during rain events with standing water over 2' in depth. This type of event would prevent BRT from operating safely.

4.1.1.12 South Option 5

Option 5 for the southern terminus would extend the existing alignment south on Meeting Street (two-way traffic) where the bus would utilize the 12' wide outside lane before making a right turn onto Mary Street (two-way traffic) where the bus would then head west utilizing the 12' wide outside lane. The bus would continue west on Morris Street (one-way traffic) in the 12' wide outside lane before turning left onto Rutledge Avenue (one-way) utilizing the 12' wide far right lane. The bus would then turn right onto Bee Street (two-way traffic) travelling in the 12' wide outside lane before making a right turn onto Lockwood Drive (two-way traffic) before heading north in the 12' wide far right lane. The bus would then use the 12' wide on ramp to US 17 where it would then continue east on US 17 (one-way traffic) in the 12' wide far left lane. The bus would then shift to the 12' wide far right lane to be able to continue heading east on Cannon Street (one-way traffic) in the 11'–12' wide far right lane. The bus would then turn right onto King Street (two-way traffic) heading south in the 12' lane before turning left on Amherst Street (two-way traffic) heading east in the 12' wide outside lane. Finally, the bus would turn left back onto Meeting Street (two-way traffic) heading north in the 11'–12' wide outside lane. This option, 2.8 miles long, assumes that Cannon Street is converted to a one-way street and would provide a direct connection to MUSC and Westedge, but would not serve the Charleston Visitor Center or the College of Charleston. This option could utilize existing CARTA bus stops with shelters, but their close proximity to present SB traffic would limit construction at these locations. Due to tight corner radii on several of these roads, buses may have difficulty maneuvering with either bus wheel paths off tracking into existing pedestrian ramps or encroaching into oncoming traffic lanes. Priority turn signals for buses may be needed at the Bee Street and Lockwood Drive and US 17 at Courtenay Drive intersections allowing encroachment into adjacent travel lanes to successfully maneuver these tight intersections. Current proposed route shows the bus

travelling in a shared 12' wide lane for the on-ramp to US 17 from Lockwood Drive. A majority of the ramp is 20' wide and the proposed striping of the on-ramp could be changed to add a dedicated bus lane as the on-ramp traffic may back up during peak times. The ramp width reduces at the merge point with US 17 which would require the two-lane ramp to reduce to one lane at this location. Or, the area could be reconstructed to allow enough width for both a dedicated bus lane and a general use lane up to the intersection with Courtenay Drive. Roadway geometry impacts associated with this alternative, consisting of BRT operating in mixed use traffic on narrow one-lane and two-lane roadways with on-street parking in downtown Charleston between Meeting Street and Lockwood Drive, mean BRT would not be able to operate without impacts to traffic and causing delays to BRT service.

4.1.1.13 South Option 6

Option 6 would extend the current alignment south utilizing the Low Line rail corridor (South Option 7) from the Mt. Pleasant Street. The SB portion of the alignment would enter I-26 using the existing on-ramp at Brigade Street. From there the alignment would continue along the freeway and utilize the Crosstown (US 17), and then turn south on Courtenay Drive, providing a direct connection to the Medical District but not serving the Charleston Visitors Center or the College of Charleston. From there the alignment continues east onto Bee Street, turning north onto Ashley Avenue, and then east on the Crosstown. The alignment continues north along I-26 and then uses the Romney Street exit where it re-enters the Low Line rail corridor going north to Mt. Pleasant Street. The BRT would operate in mixed traffic travel lanes.

4.1.1.14 South Option 7

Option 7 utilizes the Low Line corridor, which is a city-owned abandoned railroad corridor that runs along the west side of I-26 from Mt. Pleasant Street to Line Street. This alternative is designed to accommodate a single two-way bus lane. The corridor is approximately 1.3 miles long with two proposed BRT Stations near Romney Street and Huger Street. To reduce waiting and travel times, there are four passing zones proposed within the corridor. Passing zones allow one bus to wait for another bus in the opposite direction to pass. The first passing zone is located at the southern end at the Low Line corridor near Line Street. The second passing zone is on the BCDCOG owned property north of Mt. Pleasant. Additional passing zones are located at the BRT stations at Huger Street and Romney Street, respectively. Designing a single lane with passing zones allows the corridor to incorporate bike and pedestrian facilities while maintaining the functionality for buses. Additional options evaluated included two BRT lanes allowing buses to operate without the use of passing zones. This would result in narrower bike / pedestrian facilities and a reduction in buffer distances between the bus lane and bike / pedestrian paths, which may result in reduced safety for pedestrians.

Table 2 Alignment Fatal Flaw Analysis

Conceptual End to End Alignment Options (General alignment descriptions below)	Roadway Geometry ³	Right-of-Way Availability ⁴	BRT Operability ⁵	Alignment Recommended for Further Analysis
West-Option 1 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, Meeting St, Calhoun St, Doughty St	✓	✓	✓	✓
West-Option 2 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, Meeting St, Calhoun St, Bee St	✓	✓	✓	✓ ⁶
West-Option 3 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, Meeting St, Spring St, Lockwood Dr	✗	✓	✗	✗
West-Option 4 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, King St, Calhoun St, Doughty St	✓	✓	✗	✗
West-Option 5 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, Cannon St, Lockwood Dr	✗	✓	✗	✗
West-Option 6 - Downtown Summerville, US 78/US 52 to Brigade St/Romney St, Septima Clark, Courtenay Dr	✓	✓	✓	✓
West-Option 7 - Downtown Summerville, US 78/US 52 to Mt. Pleasant St, Low Line/ Meeting St/ Calhoun St/ Doughty St	✓	✓	✓	✓
West-Option 8 - Downtown Summerville, US 78, Cosgrove Ave, Spruill, US 52 to Mt. Pleasant St, Calhoun St, Doughty St	✗	✓	✗	✗
East-Option 1 – Nexton, I-26, US 78/US 52 to Mt. Pleasant St, Meeting St, Calhoun St, Doughty St	✓	✓	✓	✓
East -Option 2 - Nexton, I-26, US 78/US 52 to Mt. Pleasant St, Meeting St, Calhoun St, Bee St	✓	✓	✓	✓ ⁶
East -Option 3 – Nexton, I-26, US 78/US 52 to Mt. Pleasant St, Meeting St, Spring St, Lockwood Dr	✗	✓	✗	✗
East -Option 4 – Nexton, I-26, US 78/US 52 to Mt. Pleasant St, King St, Calhoun St, Doughty St	✓	✓	✗	✗
East -Option 5 – Nexton, I-26, US 78/US 52 to Mt. Pleasant St, Cannon St, Lockwood Dr	✗	✓	✗	✗
East -Option 6 – Nexton, I-26, US 78/US 52 to Brigade St/Romney St, Septima Clark, Courtenay Dr	✓	✓	✓	✓
East -Option 7 – Nexton, I-26, US 78/US 52 to Mt. Pleasant St, Low Line/ Meeting St/ Calhoun St/ Doughty St	✓	✓	✓	✓
East -Option 8 – Nexton, I-26, US 78, Cosgrove Ave, Spruill, US 52 to Mt. Pleasant St, Calhoun St, Doughty St	✗	✓	✗	✗

³ Roadway Geometry - Are there roadway constraints impacting the ability for a BRT vehicle to make the necessary turns along the route

⁴ Right-of-Way Availability – Is there sufficient right-of-way availability along the route for a BRT vehicle to operate in exclusive directional BRT lanes, bi-directional exclusive BRT lanes, mixed use travel lanes, or reversible lanes with minimal impacts to traffic

⁵ BRT Operability – Can the roadway accommodate a BRT service operations with minimal impacts to traffic

⁶ Due to their alignment similarities, it is recommend that West-Option 1 and West-Option 2 be combined into a single option to simplify the evaluation process.

4.2 Fatal Flaw Results

Based on the fatal flaw analysis, eight of the 16 end-to-end alignments, as shown in Table 2, were eliminated from further consideration:

- West – Option 3
- West – Option 4
- West – Option 5
- West – Option 8
- East – Option 3
- East – Option 4
- East – Option 5
- East – Option 8

The fatal flaw considerations eliminating these alignments are provided below.

4.2.1.1 West and East – Option 3

Both West – and East – Option 3 from Mt. Pleasant Street extend south on Meeting Street, west on Spring Street (two-way traffic), south on Lockwood Drive (two-way traffic), and east on Bee Street to the end of line. From the end-of-line the LCRT would head east on Bee Street, north on Ashley Avenue (one-way traffic) east on Cannon Street (two-way traffic), south on King Street (two-way traffic), east on Amherst Street (two-way traffic) and north on Meeting Street (two-way traffic) to continue north and resume regular routing. Due to the physical constraints of this route, the LCRT vehicle would be unable to make the necessary turns on to Spring Street and Cannon Street as the vehicle would encroach on a pedestrian curb ramp and into oncoming traffic.

4.2.1.2 West and East – Option 4

Both West – and East – Option 4 from Mt. Pleasant Street, west on Mt. Pleasant, south on King Street, west on Calhoun Street, north on Jonathan Lucas Street, west on Doughty Street, south on Courtenay Drive to the end-of-line. From the end-of-line, the alignment continues south on Courtenay Drive, east on Calhoun Street, and north on King Street to continue the NB alignment. This portion of King Street is constrained for dedicated guideway, there is only one lane in each direction for an extended length and there's not enough flexibility for a bi-directional BRT Lane. Also, speeds within the roadway would be reduced in the area to accommodate on-street parking and business access.

4.2.1.3 West and East – Option 5

Both West – and East – Option 5 from Mt. Pleasant Street extend south on Meeting Street, west on Mary Street (two-way traffic) and continue on Morris Street, south on Rutledge Avenue (one-way traffic), west on Bee Street to the end of line. From the end of line the LCRT would head west on Bee Street, north on Lockwood Drive (two-way traffic), the vehicle would continue onto Savannah Highway, east on Cannon Street (one-way traffic), south on King Street (two-way traffic), east on Amherst Street (two-way traffic) and north Meeting Street (two-way traffic) to continue north and resume regular routing. Similar to West and East Option 3, the LCRT vehicle would be unable to make the necessary turns onto Mary Street, Bee Street, and Cannon street as the vehicle would encroach into a pedestrian curb ramp and into oncoming traffic.

4.2.1.4 West and East – Option 8

Both West – and East – Option 8 from US 52 travels northeast on Cosgrove Avenue, southeast on Spruill Avenue, merges with and continues south on US 52/Meeting Street, west on Calhoun Street, north on Courtenay Street, to the end of line at Bee Street. From the end of line, the alignment continues west on Bee Street, south on President Street and Jonathan Lucas Street, east on Calhoun Street, and north on Meeting Street to continue to the NB alignment. Spruill Avenue is constrained for a dedicated guideway as there are closely spaced residential streets. Center-running BRT requires that left turning movements be restricted to signalized intersections and given the number of dead-end residential streets between Spruill Avenue and the eastern rail corridor, this would adversely impact the turn restrictions created by the BRT design. Lastly, this concept requires purchasing six homes due to the need for additional right-of-way.

4.2.2 Phase 1 Reasonable Alternatives Recommendation

It is recommended that both the Downtown Summerville, along US 78, and Nexton, along I-26, alignment options north of the US 78 and I-26 interchange be analyzed as part of the NEPA process to allow for a detailed alignment review. The Downtown Summerville and Nexton alignments parallel each other and their differences in such aspects as land use, potential station access, and ridership necessitate further analysis. Based on the two northern alignment options and following the fatal flaw analysis, six end-to-end alignments were identified as reasonable for further review;

- West – Option 2 (the result of the combined West – Option 1 and West – Option 2)
- West – Option 6
- West – Option 7
- East – Option 2 (the result of the combined East – Option 1 and East – Option 2)
- East – Option 6
- East – Option 7

It is also recommended that Rivers Avenue/King Street Extension (US 78) and Carner Avenue/Meeting Street (US 52) from Cosgrove Avenue to Mt. Pleasant Street, be further analyzed through the NEPA process. Rivers Avenue/King Street Extension (US 78) and Carner Avenue/Meeting Street (US 52) from Cosgrove Avenue to Mt. Pleasant Street run parallel to each other, with Rivers Avenue/US 78 traveling on the west side of the study area and Carner Avenue/Meeting Street/US 52 traveling on the east side of the study area. These two roads split near Success Street and adjoin at Mt. Pleasant Street. At its furthest, the linear distance between the two parallel roads is less than 0.2 mile. An active freight railroad line travels in between the two roads; with two railroad tracks flanking the Rivers Avenue/US 78 roadway from north of Azalea Drive to Discher Street. Large industrial sites, low to moderate density residential and commercial uses flank Rivers Avenue/US 78 and Carner Avenue/Meeting Street/US 52 roadways on the east and west. More established residential uses exist on the east side of Carner Avenue/Meeting Street/US 52. In addition to the existing uses, there is a 31-acre mixed-use development known as Magnolia proposed on the west side of Rivers Avenue/US 78 in this area. A pedestrian bridge would be proposed for either Meeting Street or

King Street options to connect either the Union Heights Neighborhood to King Street or the Magnolia Development to Meeting Street.

5 Next Steps and Phase 2 Evaluation

The project team has recommended that six end-to-end alignments move forward into Phase 2 for further detailed analysis and refinement. The next steps in the process will include refinement of the alignments using detailed quantitative and qualitative analysis, and factoring in input from the public, key stakeholders, and the technical advisory committee. The outcome of the detailed analysis in Phase 2 will be an agreed upon locally preferred alternative to enter into project development for NEPA and detailed engineering. Figure 18 shows the next steps of the project as it moves into project development. Figure 19 shows the Reasonable Alternatives advancing into the NEPA phase of this project.

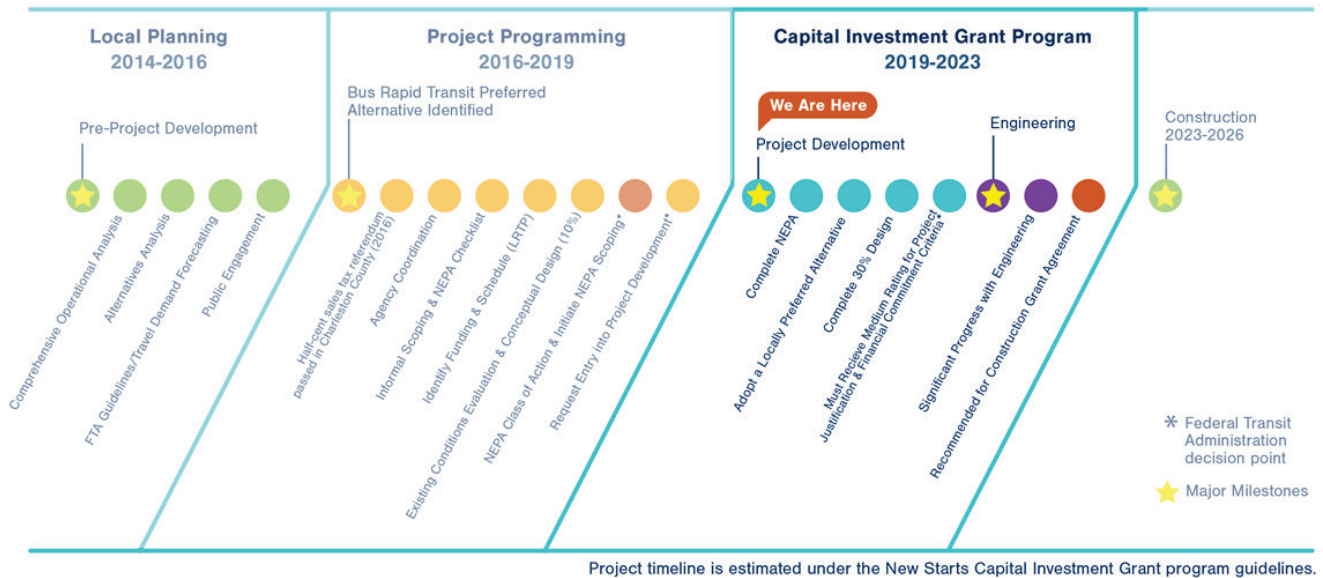


Figure 18 LCRT Project Timeline

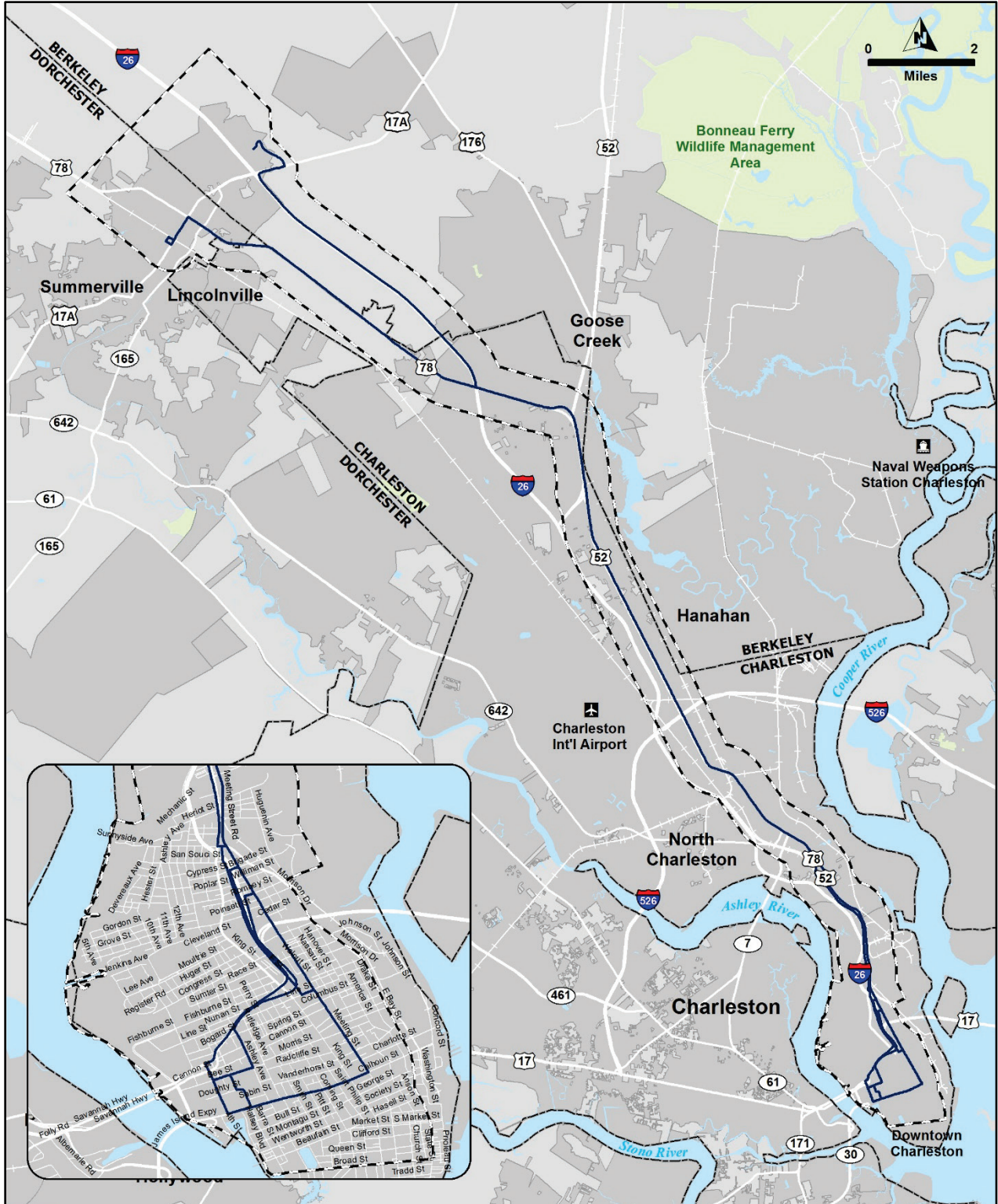


Figure 19 LCRT Reasonable Alternatives



4400 Leeds Avenue, Suite 450
North Charleston, SC 29405-7547
843.414.3700

hdrinc.com

© 2020 HDR, Inc., all rights reserved