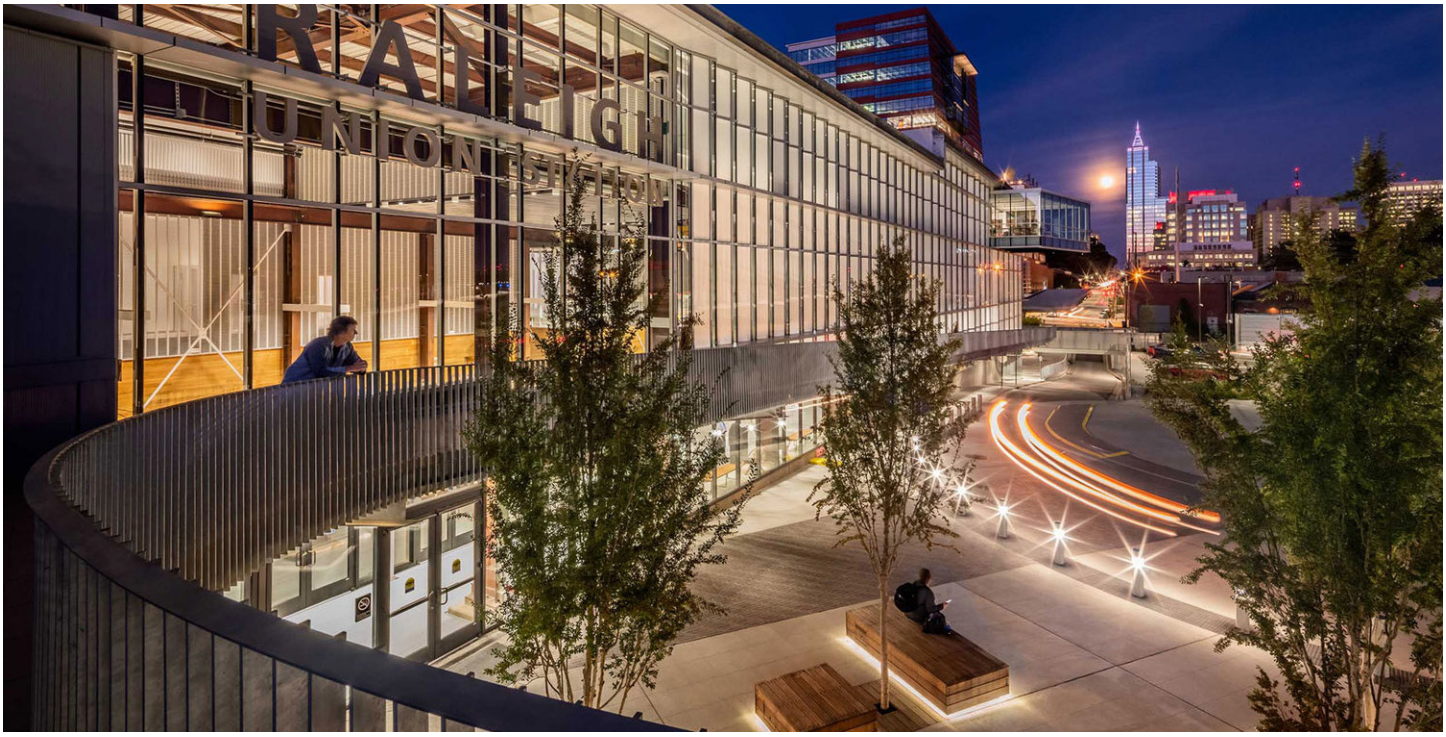
FAYETTEVILLE-RALEIGH

PASSENGER RAIL FEASIBILITY STUDY | 7●29●2020

DRAFT REPORT



CONTENTS

ABOUT THE FAYETTEVILLE AND CAPITAL AREA METROPOLITAN PLANNING ORGANIZATIONS

This study was jointly supported by the Fayetteville and Capital Area Metropolitan Planning Organizations (MPOs) inside the study area. The MPOs are an ideal vehicle for undertaking this type of study, closely connected to both the local governments and state department of transportation, which would be primary stakeholders in any new passenger rail venture. The private operators in these corridors were also invited to participate and did so to the extent that they wished to be involved.

The Fayetteville Area Metropolitan Planning Organization (FAMPO) was established in 1975. After the 2010 census, the planning area was expanded to include portions of Cumberland, Harnett, Hoke, and Robeson counties, and the municipalities within those areas. The total population is approximately 372,000 inside the FAMPO planning jurisdiction.

The Capital Area Metropolitan Planning Organization (MPO) grew from a collaborative project between Cary, Raleigh, Garner, and Wake County known as the Greater Raleigh Urban Area Thoroughfare Plan of 1964. After 2005, the planning area now includes parts of Franklin, Granville, Harnett, and Johnston counties as well. Within the CAMPO planning jurisdiction live approximately 1.25 million residents.

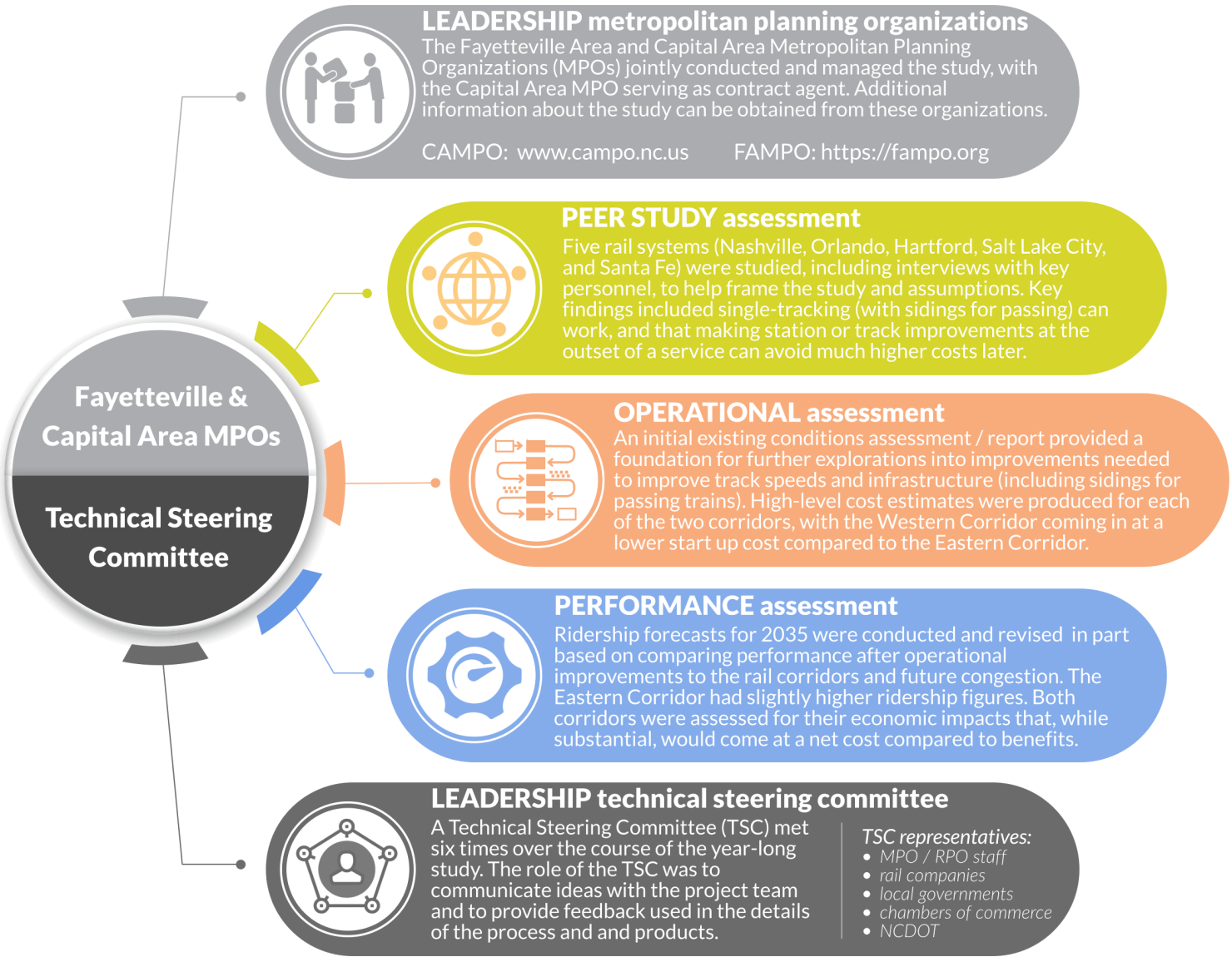
PROJECT TEAM
CRYSTAL ODUM, PROJECT MANAGER, CAMPO
JOEL STRICKLAND, PROJECT CO-MANAGER, FAMPO
SCOTT LANE, CONSULTANT MANAGER, METRO ANALYTICS
MATT MILLER, METRO ANALYTICS / RYAN WHITE, STANTEC

EXECUTIVE SUMMARY

The Capital Area and Fayetteville Area MPOs, with technical support from NCDOT, commissioned Metro Analytics and Stantec on August 15, 2019 to complete this Passenger Rail Feasibility Study. The study's objectives were to (1) assess suitability of two active rail corridors for new or additional passenger rail services; (2) understand costs for reasonably implementing such a service; (3) conduct a preliminary estimate of anticipated passenger boardings for scenario-driven train and frequency configurations; and (4) if no fatal flaws were discovered in either of the two routes, then determine if a Phase II exercise is viable to advance passenger rail service in one of these two corridors.

While both corridors were determined to have advantages and disadvantages, there is not a definitive choice for a preferred option. The following briefly explains the organization, process, key findings, and conclusions of the study.

THE STUDY PROCESS



The Fayetteville-Raleigh Passenger Rail Feasibility Study, through the review of approximately 30 prior studies and documents; assessment of five peer services around the country, four focus groups, six meetings of the Technical Steering Committee (TSC), and independent analyses conducted of the current and potential operations, ridership and economic impacts, provides a wealth of information to move forward to a second phase of study. The Western Corridor is shorter, closer physically to Fort Bragg's population, less expensive to implement, and does not have as much competing freight rail traffic now or expected in the future as the Eastern Corridor. The Eastern Corridor has better track geometry, many more sidings, higher speeds, and has a slightly higher forecasted ridership. Neither corridor appears to have a "fatal flaw" that would prevent implementation of passenger rail service, but both would require extensive coordination and collaboration with existing private rail entities.

KEY FINDINGS AND CONCLUSIONS

While many rail studies have been conducted (or are ongoing), none were focused on the Raleigh-Fayetteville corridor uniquely.

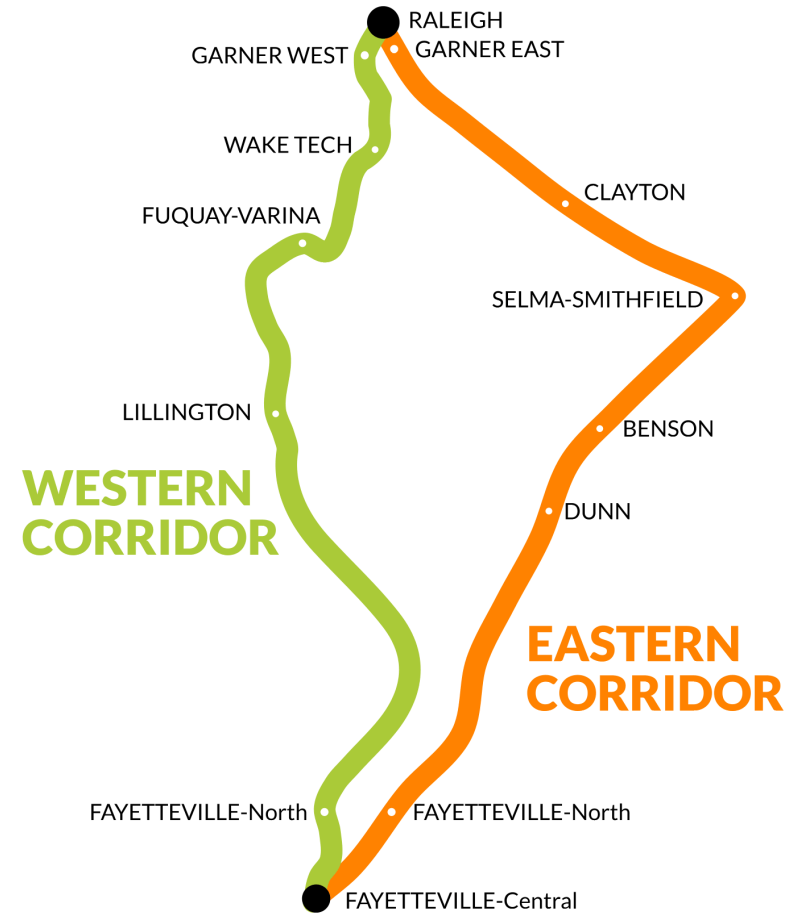
Five peer studies provided numerous insights into the (varying) start-up costs and pathways of each service.

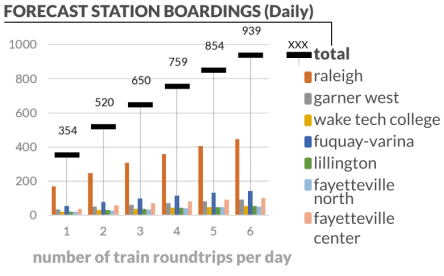
The proposed service in this study falls somewhere between a regional rail service (longer distances, higher speeds, fewer stops) and a commuter rail service that emphasizes commuting from suburban areas. This "in-between" nature poses some difficulty in applying past experiences to this one.

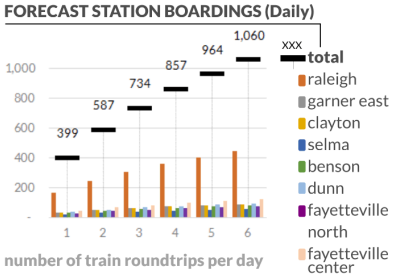
Capital improvements were estimated at a planning level, and were considerably higher (approximately $169-175 million) in the Eastern Corridor compared to the Western ($131 million). Costs included additional passing sidings, mainline track geometry upgrades, and station construction. Improvements to the Raleigh, Selma-Smithfield, and Fayetteville stations to improve turn-around maneuvering were also included. Costs are preliminary and will rise as advanced design and engineering proceeds.

Forecasted ridership was slightly higher (13%) in the (more populous) Eastern Corridor. Connections to the north and south, as well as to Fort Bragg at the Fayetteville-North station, may increase ridership, but increasing densities in station areas is also crucial to meeting the forecasted ridership figures.

A follow-on study, described in detail in the report's appendix, would consider support for one corridor over another first, then proceed to conceptual design, rail operations modeling, and station layout as well as identifying the location of maintenance and storage of train sets.







PASSENGER RAIL SERVICE FEASIBILITY STUDY

PURPOSE & OBJECTIVES

The Fayetteville-Raleigh Passenger Rail Feasibility Study ("Study") is designed to create a better understanding of existing conditions that support or impede the future implementation of passenger rail between two of North Carolina's key cities and regions.

The Fayetteville-Raleigh Passenger Rail Feasibility Study (the "Study") was developed to create a clearer understanding of the current and future conditions that would support intercity passenger rail service between Raleigh and Fayetteville, North Carolina. Passenger rail service connecting the Triangle and Sandhills regions potentially benefits travellers in several ways.

- Increase the reliability of personal travel by offering another option for travellers in the increasingly congested US 401 and I-40 corridors.
- Increase the mobility choices for populations that may have limited or no access to a private automobile.
- Increase the capacity between two of the five largest cities in North Carolina along a corridor that is developing both residentially and commercially.
- Provide additional mobility for residents along the routes explored in this study, including Fort Bragg and communities in Wake, Harnett, Cumberland, and Johnston counties.

The two corridors studied (refer to the following section on existing conditions and contexts) offer some challenges to passenger rail services. These challenges include track capacity, condition/speed tolerances, existing freight and long-haul passenger rail operations, crossings with existing roadways, and lower-density segments served by major arterial and freeway facilities that don't traditionally offer a strong basis for transit service.

To understand these benefits and challenges better, this study developed a ranged method for estimating current and future passenger rail ridership, revenue generation from that ridership, and basic start-up and operating challenges. Assumptions about train speeds and characteristics are based on the understanding of project team members as well as an investigation of five peer rail systems. The materials gathered in the first phase were then used to produce preliminary assessments of the operational needs and ridership forecasts for each of the proposed stations along both routes. The study concludes with an assessment of economic impacts associated with the proposed service and a suggested scope of work for progressing either corridor towards design and construction.

This study was sponsored by the two metropolitan planning organizations (MPOs) in the study area, with input from local communities, the N.C. Department of Transportation (NCDOT), and freight rail operators including CSX, Norfolk Southern, North Carolina Railroad, and Amtrak.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

82% reduction

244 train-vehicle collisions in 1988

43 in 2017

PEOPLE IN THE TWO METROPOLITAN PLANNING ORGANIZATIONS

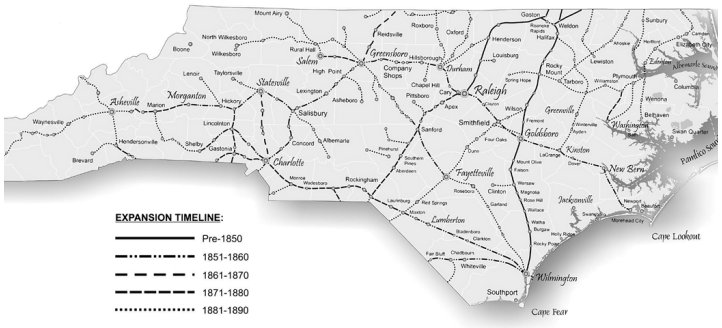
1.6 MILLION

Study Highlights

Forecasted 2035 Ridership *(4 trains per day)*: 759-857

Estimated Improvement Costs *($million)*: 101-175

a history of rail



North Carolina has a long history of rail travel, dating back to at least 1840 with the Wilmington & Weldon Railroad (originally the Wilmington & Raleigh)

$1.8 BILLION

ECONOMIC IMPACT OF RAIL IN NORTH CAROLINA

Jason Orthner, P.E., Rail Division Director, 2019

110mph (Hartford)

peer train speeds

10mph (Nashville)

FIVE Peer Studies

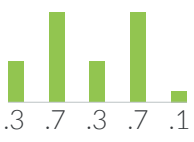
4

Existing Freight and Passenger Rail Operators in Two Study Corridors

138

At-grade crossings along the two study corridors

Annual per-Mile Operating Costs for five peer passenger rail systems studied ($millions)



study committee members

The **Technical Study Committee (TSC)** consisted of representatives from local / regional governments, transit operators, rail operators / owners, and other stakeholders in the area such as chambers of commerce and Fort Bragg military base. The TSC met six times over the course of the study to review and provide input on draft subject matter.

Chris Lukasina, Capital Area MPO
Crystal Odum, Capital Area MPO, Project Manager
Shelby Powell, Capital Area MPO
Alex Rickard, Capital Area MPO
Patrick Pierce, Town of Clayton
Samantha Wullenwaber, Town of Clayton
John Dillard, CSX
George Adler, City of Dunn
Steven Neuschafer, City of Dunn
Joel Strickland, Fayetteville Area MPO, Project Mngr.
Katrina Evans, Fayetteville Area MPO
Gaby Lawlor, Town of Garner
Mark Locklear, Harnett County
Jay Sikes, Harnett County
Cristine Michaels, Fayetteville Chamber of Com.
Randy Hume, Fayetteville Area System Transit
Randy Franklin, Fort Bragg
Akul Nishawala, Town of Fuquay-Varina
Pam Davison, Town of Fuquay-Varina
Kaitlin Hughes, GoTriangle
Sharon Chavis, GoTriangle
David Eatman, GoRaleigh
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Mike Rutan, Mid-Carolina RPO
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Phil Geary, NCDOT Transportation Planning Div.
Hemal Shah, NCDOT Transportation Planning Div.
Scott Saylor, NCRR
John Edwards, Norfolk Southern
Mike Manacuso, Triangle East Chamber of Com.
James Salmons, Upper Coastal Plain RPO
Tim Gardiner, Wake County

Consulting Team
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Matt Miller, Metro Analytics
Ryan White, Stantec Consulting Services Inc.

DURATION	
pre-study	1.1 Preliminary scoping meetings with Project Management Team and Technical Steering Committee (TSC) 1.2 Refined scope of services and master schedule
2 months	2.1 Identify, with TSC, measures of success and passenger rail service standards 2.2 Identify existing and planned rail services; conduct key stakeholder interviews 2.3 Conduct peer review of five comparable passenger rail services
2 months	3.1 Verify list of related plans and summarize / map relevant content 3.2 Document and map travel behaviors, network / condition, and infrastructure
1 month	4.1 Based on prior tasks, complete technical memorandum on deficiencies / opportunities 4.2 Review with CAMPO Project Team, TSC, and revise Technical Memorandum No. 1
2 months	5.1 Create conceptual plans for passenger rail ridership on two corridors and costs 5.2 Develop most-likely and ridership and revenue forecasts
2 months	6.1 Develop sensitivity testing parameters and create optimistic / pessimistic forecasts 6.2 Review with TSC and CAMPO Project Team; refine models and outputs
2 months	7.1 Conduct review of environmental and human (economic, safety, mobility) impacts 7.2 Monetize environmental, mobility, safety, and other benefits-costs
occurs throughout project	8.1 Conduct six TSC meetings (including one scoping meeting) 8.2 Develop and maintain project portal (on-line) for use of project team and TSC 8.3 Conduct Key Stakeholder interviews, as needed and described in approach
2 months	9.1 Prepare initial findings Technical Memorandum (no. 2) and present to TSC / CAMPO 9.2 Create draft evaluation matrix, variables summary (including variation), illustrations 9.3 Revise Technical Memorandum No. 2 and submit with full draft report (Task 10)
3 months	10.1 Submit draft report (InDesign / PDF) including graphics, maps, evaluation matrix 10.2 Present draft to TSC, MPO Boards (3); Refine draft based on comments received 10.3 Prepare final report and, if appropriate, detailed scope of work for Phase II study

PASSENGER RAIL SERVICE FEASIBILITY STUDY

SUMMARY OF PAST PLANS & RELEVANCY

No project begins from a clean slate, and the ideas and findings from other, prior studies are the focus of this section. An overview of the key findings and their relevance to the Fayetteville-Raleigh Passenger Rail Feasibility Study is followed by summaries of each plan and document reviewed.

HIGHLIGHTS FROM REVIEWS OF PAST PLANS

1

LOTS OF STUDIES...BUT NOT LIKE THIS ONE. The range, number, and varying objectives of studies and technical reports available for review create important context, but there has not been a study that looks at the Fayetteville to Raleigh pairing specifically. Most of the work completed to date has focused on the existing corridors served by Amtrak, part of the Wake transit initiatives, Southeast High-Speed Rail Corridor, or connections with Wilmington.

2

NOT A LOT OF HARD CONCLUSIONS. The literature reviewed did not usually say if creating new passenger rail services was a good idea, either assuming that the service was a sound concept or the study reported information pertinent to the study's purpose(s) without making service recommendations (land use-oriented and policy objectives were included in some studies). A notable exception is the 2010 NCRR/Steer Davies Gleave study that had a technical robust logit modeling approach for forecasting ridership. Other studies are otherwise useful but are becoming dated, such as the 2004 EastTrans document. Additional documents that are updated frequently, outdated, or may have only tangential ramifications to the current study were reviewed but not summarized in this section.

3

GOOD STUDY HABITS. Clear graphics, especially flow diagrams, are very helpful in streamlining the flow of information to a lay audience for which this current study is intended. Clear, concise language with defined acronyms help readers move through the material faster; a high-level summary not just at the outset but accompanying each chapter is also useful for stakeholders with less time to delve into the details of the report.

NOTABLE DOCUMENTS

While all the plans reviewed in this section - and the more than 30 additional documents reviewed by the project team - are potentially valuable, the following have specific utility to the study elements of the Fayetteville-to-Raleigh Passenger Rail Study.

NCRR Ridership Study (technically robust ridership information)

Wake County MIS Reports (details north end bus connectivity)

NCDOT Comprehensive State Rail Plan (funding options and details on costs of service)

CRT System Level Guidelines & Evaluation (guide for peer study and build scenario evaluation)

BizNS Article (insights into a Class I rail company that balances freight and passengers)

SOUTHEASTERN NORTH CAROLINA PASSENGER RAIL STUDY

July 2005 | NCDOT

The report frames the need for additional passenger rail service in terms of alternatives in the wake of the terrorist attacks of September 2001; economic downturns that create mobility needs for long-distance commuters; and addressing concerns about congestion, air pollution, and rising fuel costs.

The 124-mile-long route being considered is between Rocky Mount and Wilmington, connecting (in Rocky Mount) to the Northeast High Speed Rail Corridor and New York. Connections between Wilmington and Charlotte or Raleigh are also discussed. Three investment levels (Basic, Moderate, and Major) produce different start-up capital costs as well as ridership figures ranging from 25,400 to 32,000 per year for the Rocky Mount route and 46,700 to 74,100 passengers per day for the Wilmington to Raleigh routes. Improvements to tracks also benefit freight movements and economic development, and hence were supported by resolution from a number of local governments dating back to the 2001 release of the initial feasibility study. Annualized revenues ($2.4 million to $3.7 million)* and operating losses ($1.7 million to $3.6 million) were also forecasted for the Wilmington-Raleigh routes (two were examined, one through Fayetteville and one through Goldsboro). One segment of one of these routes, from Pembroke to Raleigh, closely emulates the eastern (Selma) route in this study. The results indicated in that study are shown below for the entire route, from Wilmington through Fayetteville to Raleigh at three investment levels (2019 dollars).

Metric (year)	Basic	Moderate	Major
Riders	46,700	49,300	58,900
Capital	$96.6m	$106.5m	$180.1m
Revenue	$2.4m	$2.5m	$2.9m
Operating	-$3.6m	-$3.5m	-$3.1m

RELEVANCY TO CURRENT STUDY

- Studied similar route pairing as the Selma route, including ridership and cost estimates for 79mph computer-dispatch service
- Established that local governments have an interest in passenger rail service, as do some private, freight rail operators

COMPREHENSIVE STATE RAIL PLAN

August 2015 | NCDOT Rail Division

This statewide plan addresses the existing system and proposed initiatives; funding sources and trends; demographic and social trends impacting travel behaviors; and critical examinations of issues and programs. For instance, the ridership changes on Amtrak routes was noted then as being greater for the Cary station as opposed to the more-populated Raleigh station, due to overcrowded parking conditions at the latter station (only eight miles distant from the Cary stop). In total, passengers riding Amtrak in North Carolina went up by 8.3% between 2011 and 2013 (nearly 980,000 riders). Demographic trends, fuel prices, and freight-passenger train interference complicate the understanding of future rail ridership trends in key corridors.

The report describes station improvements, as well as North Carolina's concerted efforts to reduce fatalities and collisions through awareness and crossing improvement programs. The results have been impressive, with an 80% reduction in train-vehicle crashes and fatalities since 1988 (to 2017, according to a presentation by NC Rail Division in March 2019). Factors affecting ridership include delays, but delays are impacted by construction programs that ultimately improve service and ridership.

Funding details, such as requirements for legislative approval for $5m / $3m capital/operating expenditures, are also relevant for consideration in the current study. All available programs are reviewed in substantive detail. Partners like the State Department of Commerce receive attention in this report.

> **"INCREASING FUEL COSTS MAY HAVE THE MOST SIGNIFICANT IMPLICATIONS FOR PASSENGER RAIL IN THE MORE CONGESTED AREAS OF NORTH CAROLINA, ESPECIALLY THE PIEDMONT....CONGESTED HIGHWAYS AND INCREASING FUEL COSTS COULD LEAD MORE RESIDENTS TO USE INTERCITY PASSENGER RAIL."** *PAGE 295*

RELEVANCY TO CURRENT STUDY

- Identifies suite of then-existent funding programs and considerations
- Increasing fuel costs and demographics do and will play major roles in passenger rail ridership
- The longer term plans include implementing passenger rail service from Wilmington to Raleigh by 2035 at a cost of $2.88 million ($2019)

**Note: All dollar amounts shown have been converted to 2019 values using the Bureau of Labor Statistics Consumer Price Calculator.*

EXISTING CONDITIONS: WAKE COUNTY CRT CORRIDOR

May 2018 | Wake Transit

Since the passage of a half cent sales tax in 2016 for Wake County, leadership continues to plan for the future of transit services for the area. The Wake county CRT Corridor report describes demographic changes and existing commuter flows in the Triangle Region. Past plans are summarized briefly as well. Relative to the current study, these flow assessments do not extend past the Raleigh-to-Selma segment on the eastern route, or the Raleigh-to-Fuquay-Varina segment on the western route.

The purpose of the report is to suggest volumes of travellers as well as to identify environmental consequences from human (including environmental justice) and natural points of view, typically applying a high-level screening and within one-half-mile of the centerline of the route.

RELEVANCY TO CURRENT STUDY

- Suggests methods of evaluating ridership potential in corridors
- Suggests criteria for high-level screening of environmental impacts

PASSENGER RAIL—NS AIMS TO PROTECT ITS FREIGHT BUSINESS

October 2012 | BizNS (corporate new journal)

Not a plan but an interview with John Edwards, General Director of Passenger Policy for Norfolk Southern. Mr. Edwards frequently deals with passenger rail initiatives that seek to co-locate or otherwise impact NS properties.

The article notes that about 2,000 miles of NS rail lines also serve passengers, including some non-Amtrak intercity services. The article provides insights into the balancing of interests that have to take place when passenger rail services are discussed that may use NS trackage. A $1 billion project in Charlotte that required relocating NS tracks for a Blue Line extension is highlighted as a good example of a win-win outcome.

"WE TRY TO BE A GOOD CORPORATE CITIZEN, AND IF A COMMUNITY, OR STATE, OR AMTRAK HAS A PROJECT THEY WANT TO DO, WE DO OUR BEST TO ACCOMPLISH THEIR GOALS WITHOUT DIMINISHING ANY OF OUR OWN" *PAGE 17*

RELEVANCY TO CURRENT STUDY

- Provides insights into private rail freight operator perspectives on passenger rail proposals

MAJOR INVESTMENT STUDY (MIS): COMMUTER RAIL PEER REVIEW

November 2018 | Wake and Durham Transit Plans

Part of a suite of documentation and research underpinning recent transit investments in the Triangle Region, this report summarizes 11 peer systems from across the U.S. While some of these systems are the same as those reviewed for the current study, there is not perfect overlap and the focus areas and conditions were different in the 2018 peer study. For example, there was only one route being considered locally, and it has fairly frequent freight and passenger services whereas many segments of the two options in the current study do not. Densities of development, station spacing, markets / rider characteristics, and train frequencies are also likely to be very different in the current study than those that were focused on in this 2018 report.

Features of this report that are good practices to follow include a "key features" note for each system's description, and a summary table at the end of the report describing these and other key features (listed below) in a tabular comparison.

- System Miles
- Year of Opening
- Number of Round Trips Per Day
- Peak (Off-Peak) Headway
- Number of Stations
- System Capital Cost
- (Year of Opening Dollars)
- System Capital Cost
- System Capital Cost Per Mile
- Annual Operating Cost
- Operating Expenses per Veh. Revenue Mile
- Average Weekday Riders
- Central Business District Parking Price (daily)
- Connecting Transit Systems
- Types of Vehicles Used
- Funding Source
- Shared with Freight and/or Intercity Rail
- Dispatching Responsibility
- Number of Tracks (Shared Use Arrangement)
- Capital Investments1 Station Quality
- Fare Structure

While there is a "key takeaways" summary, it is extremely brief and points out that two of the 11 systems reviewed - VRE/Virginia and SunRail/Orlando - are the most similar to the proposed service between Raleigh and Durham.

RELEVANCY TO CURRENT STUDY

- Key points for each system and comparison table are relevant good practices for the current report
- The outcomes of the peer comparisons in the subject report may enhance characterizations of the proposed services in the current study

TRAVELING TO WORK IN WAKE: EXPLORING THE COMMUTER RAIL OPTION

June 2016 | NCSU Center for Urban Affairs & Community Services

As the title implies, the 108-page Traveling to Work in Wake report focuses on a relatively narrow geographic area of one county (although Durham is discussed at some length). However, the content is wide-ranging, from speaking to land use-transit relationships to assessing worker flows to discussing commuter attitudes towards rail (they like it, according to a 2003 NCDOT survey).

The study uses the concept of "catchment areas" to describe services and demographic characteristics within Wake County that may or may not support future commuter rail services. Traffic flows in and out of these catchment areas (using the US Business Census data, a source to be used in this current study), challenges with the trackage itself, and places and populations served are worthy of a second look as the build scenarios are constructed for the Fayetteville-Raleigh Passenger Rail Study.

The report concludes favorably with a recommendation for more study of key factors influencing the success of potential future rail service, like mode choice surveys and commuter attitudes towards rail services.

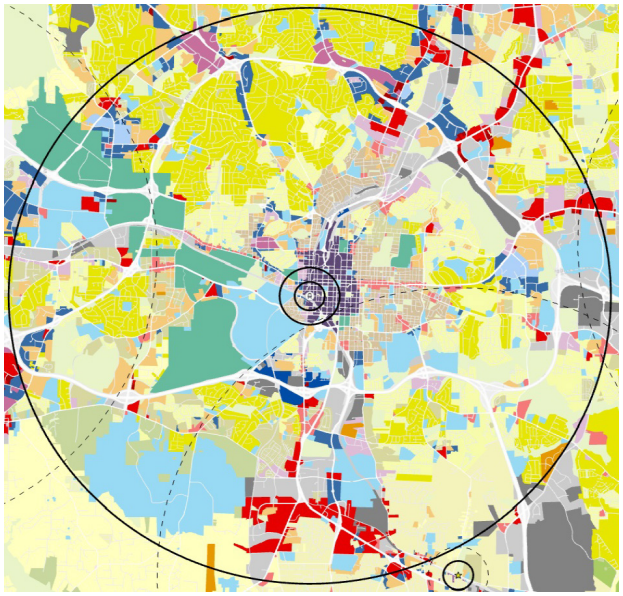


FIGURE 1. PLACETYPE MAP

(source: Traveling to work in wake county, page 18)

RELEVANCY TO CURRENT STUDY

- The study identifies and describes some "catchment areas" that overlap the study area (Clayton, Garner, Fuquay-Varina)
- The use of flow data is positive, but graphically reporting flows as found in some other studies is advisable as well

GOTRIANGLE SHORT-RANGE TRANSIT PLAN: FINAL REPORT

November 2018 | GoTriangle

At the same time that the peer study review described previously was being completed, the short-range (through 2027) plan was also published. The recommendations in this plan are fairly specific and cover all modes of travel including some discussion of passenger rail services.

As the time horizon of this plan is relatively short in the world of long-range planning (about 9 years), passenger rail service was infrequently discussed compared to additional express forms of bus transit. Transit centers, bus maintenance facilities, and stop improvements were also discussed in the report. The report assumes that commuter rail service is in place and operational by 2027, therefore the specific bus transit recommendations sometimes refer to that service and the ability of bus service to "feed" the commuter rail services.

> **"GOTRIANGLE ALSO DOES A GOOD JOB OF SERVING REGIONAL COMMUTE TRIPS IN AREAS THAT CAN SUPPORT FIXED-ROUTE TRANSIT SERVICES. HOWEVER, THE ORIGINS OF A LARGE VOLUME OF COMMUTE TRIPS IN THE REGION ARE HIGHLY DISPERSED AND WOULD BE DIFFICULT TO SERVE WITH TRADITIONAL FIXED-ROUTE TRANSIT."** *PAGE I*

RELEVANCY TO CURRENT STUDY

- Identifies specific recommendations to support bus connections to future commuter rail service, a key consideration in the success of other commuter rail services
- Some station-level improvements are described that may support the proposed passenger rail service being described in this current study

CRT SYSTEM LEVEL GUIDELINES & EVALUATION MAJOR INVESTMENT STUDY: WAKE AND DURHAM COUNTY TRANSIT PLANS (ATTACHMENT D)

December 2018 | GoTriangle

Another one of the reports that arrived at the end of 2018 was this one, which focused considerable attention on a peer review study, although the information being studied was somewhat different than that presented in the November 2018 *Commuter Rail Peer Review*.

Peer Characteristic	Peer Average
Number of Round Trips Per Day	25
Peak (Off Peak) Headway	30 min (1 hour)
System Miles	46
Number of Stations	11
Average Station Spacing (in Miles)	4.7
Operating Expenses per Vehicle (Passenger Coach) Revenue Mile	$30.0
Operating Expenses per Passenger Boarding	$19.2
Farebox Recovery	20%
Passenger Boardings per Vehicle (Passenger Coach) Revenue Hour	44

Importantly, the report goes into additional detail on how these performance metrics were interpreted (including subjective items like station quality).

A second set of metrics was developed for evaluating build alternatives, a method that is potentially valuable for the current study or in future studies (in addition to maintaining some consistency with past work). These metrics include the following.

- Connectivity (connections, ease of access)
- Speed/Travel Time Competitiveness
- Equity (minority, low-income access)
- Ridership
- Transit Supportive Land Use (density)
- Sustainability (environmental impact)
- Regional Access (on-site parking)

RELEVANCY TO CURRENT STUDY

- Peer study comparison criteria, and their explanations, are good practice in this document
- A second set of evaluation criteria are also noteworthy, some of which could be applied to the current study (page 19)

WAKE COUNTY TRANSIT PLAN MIS: EXISTING CONDITIONS REPORT

November 2018 | GoTriangle

As with the other components of this MIS, the focus is not outside of Wake County unless it is the Durham area. The report has utility in several respects.

First, the existing conditions report identifies flows from different sub-markets (within Wake and Durham counties). Second, to produce those estimates it was necessary to discuss the growth in those sub-markets, some of which fall inside the current study's planning area, particularly the Raleigh CBD (Central Business District). Finally, the report goes into some detail on the travel conditions on major roadways, citing the importance of understanding the flows of trips and people in each corridor as an important determination of potential transit ridership, particularly where travel conditions (congestion) are poor.

An environmental screening, largely consisting of maps identifying various features likely to be considered in more detailed design and environmental documentation efforts, is included in this report. Notably, this report included a screening for environmental justice communities (low-income and minority, although zero-car households and English language proficiency are also discussed). The plan notes, for instance, that the New Bern Avenue corridor has the highest incidence of these populations of any of the corridors studied.

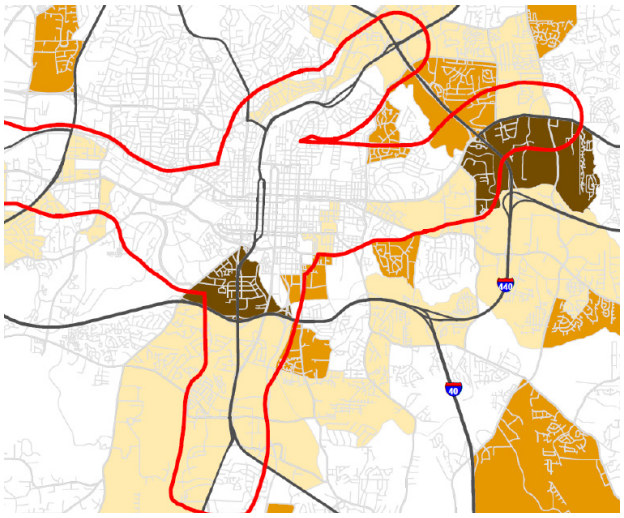


FIGURE 2. LEP SCREENING (FIGURE 62)

(source: Wake County Transit Plan MIS: Existing Conditions Report, page 6-6)

RELEVANCY TO CURRENT STUDY

- This report provides information on several subareas and corridors of relevance to the current project and study
- Treatment of vulnerable populations exhibits sound practice

NCRR COMMUTER RAIL RIDERSHIP & MARKET STUDY

May 2010 | NCRR

This ridership study, built upon a prior Corridor Capacity Study, focused on a corridor between Goldsboro and Greensboro, a corridor maintained by Norfolk Southern for their freight traffic, along with several Amtrak routes. According to the study itself, it "...is intended to fall between a sketch planning exercise and an investment-grade forecast."

The study begins by examining journey-to-work flows along this corridor, as well as population and employment changes past and forecasted. The study makes an important analytical departure from others in that it describes the creation of a unified travel demand model built from (and expanded upon) three existing travel demand models being operated in three separate metropolitan planning organizations (MPOs). Some assumptions had to be made to get this system to work within the scope of the study, including developing a fixed demand for university-area stations. These three models had different base years that required interpolation, as did conversion of external-external trip matrices. Equally remarkable is the development and execution of a panel of 6,500 households (1,670 completed surveys of which 125 were transit riders) travel behavior survey to help calibrate the model. Finally, scenarios testing the sensitivity of the model to population, fare (very sensitive), and service frequency (less sensitive) were conducted. In short, this study looked to be technically robust in terms of demand estimation.

The ridership and revenue estimates* are shown below; the study cross-checked these results using a separate aggregate rail ridership forecasting model.

Scenario	Annual Ridership	Annual Revenue
2009	1.2 million	$4.0 million
2012	1.2 million	$3.8 million
2017	1.6 million	$5.5 million
2022	2.9 million	$10.7 million

The study concludes that the most viable segment is between Durham and Wilson's Mills, from a ridership perspective.

RELEVANCY TO CURRENT STUDY

- The report contains a number of important observations useful to modeling ridership and revenue generation
- The methodology includes an aggregate forecasting model similar to the one proposed here

FAMPO AND CAMPO METROPOLITAN TRANSPORTATION PLANS

date varies | Metropolitan Planning Organizations

The metropolitan transportation plans are relevant for several reasons, representing the long-term aspirations of transportation development across modes of travel in terms of both projects and supportive policies.

The FAMPO plan has a dedicated rail element (as opposed to rail being part of a more comprehensive transit element of the MTP). Passenger rail service should be "strongly pursued," with special attention paid to the Southeast High Speed Rail Corridor.

The CAMPO long-range transportation plan is conducted jointly with the neighboring Durham-Chapel Hill-Carrboro MPO. Rail recommendations include passenger service between Raleigh and Smithfield-Selma. Shorter-term commuter rail recommendations are mostly focused on westward (Raleigh to Durham) connections.

RELEVANCY TO CURRENT STUDY

- These reports represent an adopted position of the two MPOs on rail service projects
- Important multimodal connections and policy / program initiatives are also outlined in the MTPs

ADDITIONAL DOCUMENTS REVIEWED

with potential guidance for build scenarios or other efforts

- Traffic Separation Study for the City of Fayetteville (2004) (also other separation / crossing studies completed for other segments)
- Fuquay-Varina Crossing Consolidation Plan (2009)
- Fare Integration Study GoCary, GoDurham, GoRaleigh, and GoTriangle: Final Report (2018)
- Fiscal Year (FY) 2020 Recommended Wake Transit Work Plan (includes descriptions of operating fund amounts)
- Wake Forest to Raleigh Commuter Rail conceptual Infrastructure Analysis (2017)
- EasTrans Commuter Rail Feasibility Study: Final Report (2004) (somewhat dated but should be consulted when developing ridership estimates)

**Note: All dollar amounts shown have been converted to 2019 values using the Bureau of Labor Statistics Consumer Price Calculator.*

PASSENGER RAIL SERVICE FEASIBILITY STUDY

EXISTING ROUTE CONDITIONS

The Passenger Rail Service Feasibility Study considers two alternative routes: one running roughly north-south, the other angling eastward to Selma before turning sharply westward to Raleigh through Eastern Wake County. The current conditions for both routes are summarized briefly here, but note that only preliminary judgements on key factors like station locations were assumed. Additional, detailed data may also impact any assessment of the two routes.

HIGHLIGHTS OF ROUTE CONDITIONS ASSESSMENT

1

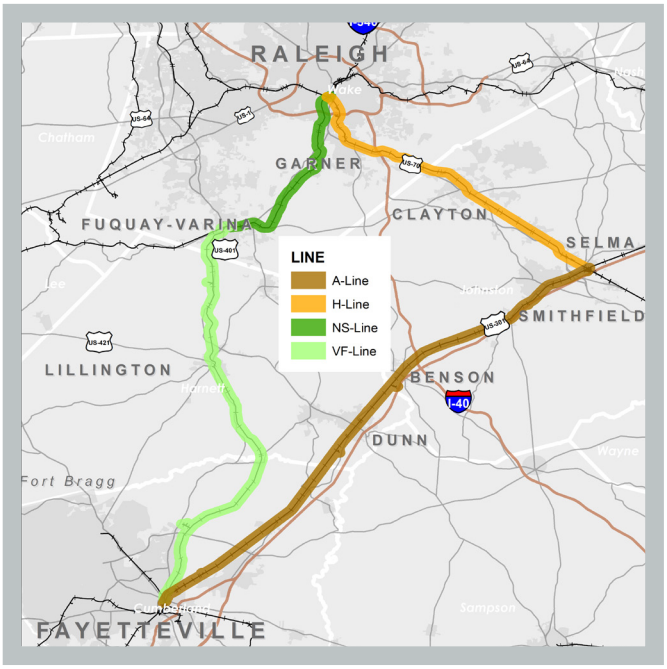
CONDITIONS VARY CONSIDERABLY. By any dimension discussed in this section of the report, the two rail corridors (described herein as the "Fuquay-Varina" or green line, and the orange "Selma" line) are different. Access to terminal stations, sidings, speeds, train volumes, and the presence of existing (Amtrak) passenger rail service are different between the two routes. These differences make a preferred route more difficult to assign since that evaluation has to involve trade-offs between hard-to-compare variables.

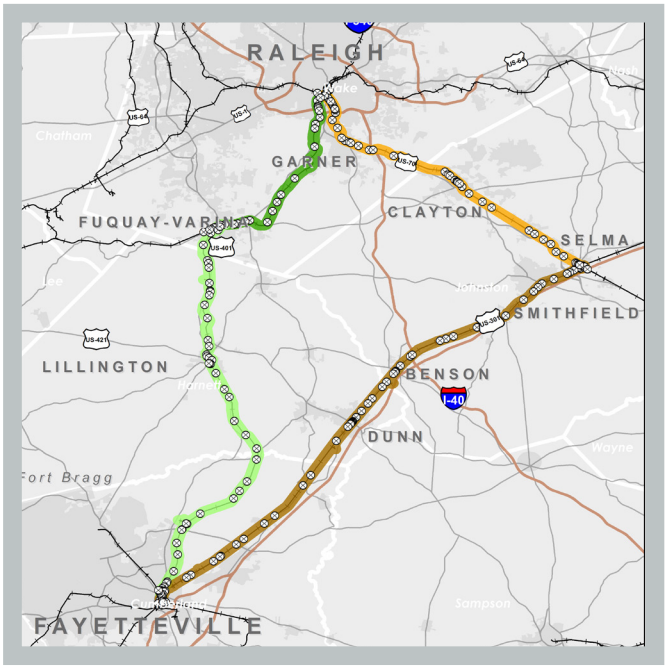
2

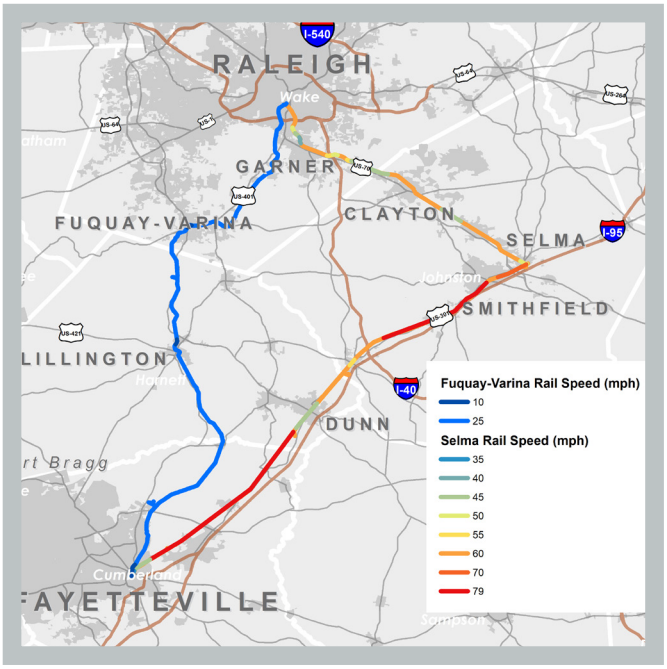
END-OF-LINE STATION ACCESS. The Fuquay-Varina Line (green) involves some circuitous maneuvers for trains to reach the stations in Fayetteville and Raleigh. Reversing the train sets, which creates more disruption for at-grade crossings and passenger delays, are currently involved unless major improvements are undertaken. Although the shorter of the two routes, travel speeds are much slower and passing sidings are non-existent now.

3

PASSENGERS HAVE ARRIVED. The Selma (orange) route is longer, but also has passenger rail service already operated by Amtrak. The existence of passenger rail service greatly complicates the operations along this route. However, sidings are already in place which makes operations smoother, and there may be potential for jointly developing additional passenger service with Amtrak (also see Hartford Peer Study).







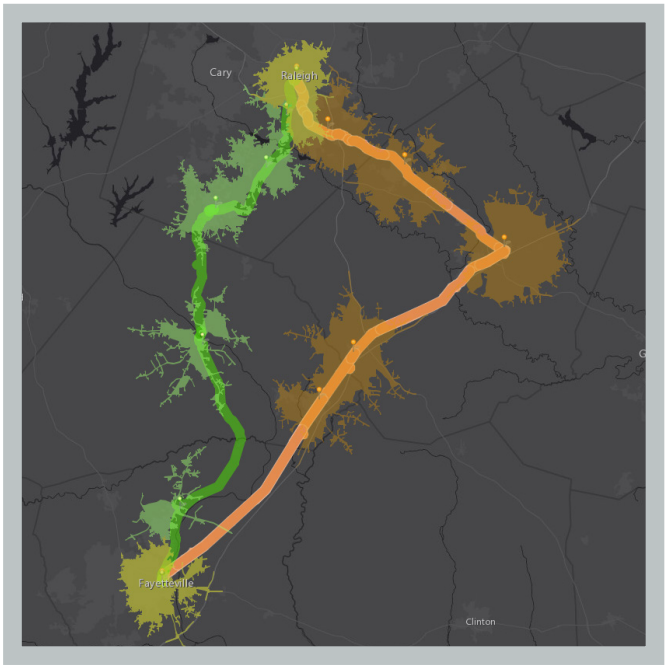


FIGURE 3. CONDITIONS SUMMARY MAPPING
TOP-LEFT: TWO ROUTES AND FOUR SEGMENTS DESCRIPTION OF STUDY AREA
TOP-RIGHT: CROSSINGS
BOTTOM-LEFT: MAXIMUM RAIL SPEEDS, BY SEGMENT
BOTTOM-RIGHT: 10-MINUTE DRIVE TIMES (TYPICAL WEEKDAY, 8AM TO POTENTIAL STATION AREAS)

FAYETTEVILLE-SELMA-RALEIGH

THE A-LINE

Fayetteville to Selma | CSX Company

The A-Line is part of CSX's primary north-south rail corridor extending from Northern New Jersey to central Florida, paralleling I-95 for its entirety. It connects the major population centers of the mid-Atlantic, including NY/NJ, Philadelphia, and Baltimore-Washington, DC with the Southeast. Because of this connectivity the corridor carries a wide variety of freight including intermodal, manifest (mixed freight), and unit trains carrying coal and grain.

There are ten spur tracks along the corridor which provide access to adjacent industrial sites. CSX's Milan Yard, located just north of downtown Fayetteville, is the primary switching yard for freight originating or destined for industrial and commercial sites around Fayetteville and Fort Bragg. The A-Line is a high-volume rail corridor, averaging over 20.1 million gross tons annually (*source: NCDOT Comprehensive State Rail Plan, 2015*).

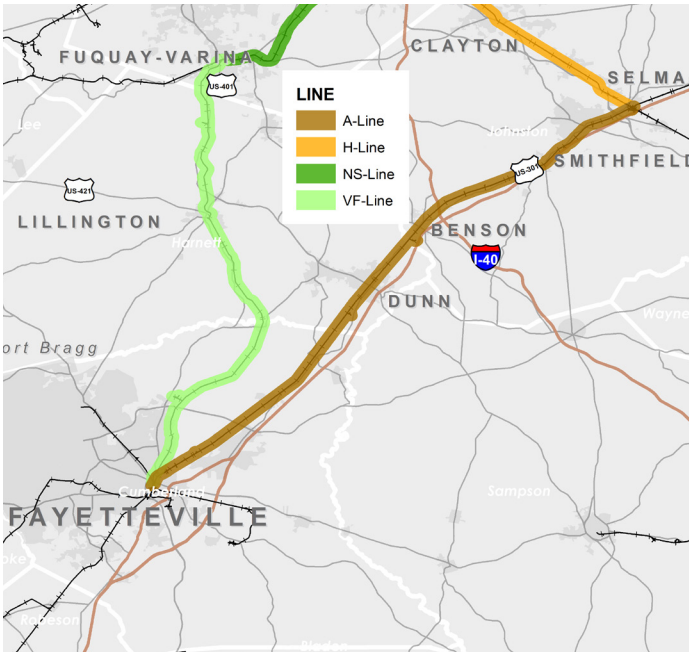
The section of the A-Line being considered under this study averages between 18 and 23 freight trains per day. The A-Line could be considered a one and half-track mainline as it consists of a single track with numerous double-tracked segments along its length to allow same and opposite direction passing.

In addition to freight, Amtrak operates daily service through this corridor. Destinations include New York City, Washington, Savannah, and Orlando. Stations in North Carolina include Selma Union Depot (Carolinian/Palmetto) and Fayetteville Station (Silver Star/Palmetto)

The CSX Transportation Florence Division timetable notes authorized speeds range from 40 to 60 mph for manifest freight and up to 70 mph for intermodal trains. Passenger train speeds range from 45 – 79 mph. In downtown Fayetteville, all trains are restricted to a maximum speed of 35 mph.

As with all of the proposed lines, the major concern is the frequency and design of at-grade crossings. There are 50 at-grade railroad crossings between Selma Junction and the Fayetteville Amtrak Station. Positive train control (PTC) has been installed throughout the A-Line in North Carolina. The corridor also has centralized traffic control in place, which precedes PTC installation.

The tables on this page and the next (Figures 4-5) summarize train speeds, siding section length, and crossing types at important crossing locations.



Train Name	Train Number	Destinations
Silver Meteor	97/98	New York/Miami
Palmetto	89/90	New York/Savannah, GA
Auto Train	52/53	Lorton, VA (Washington, DC) to Sanford, FL (Orlando)
Silver Star	91/92	New York/Miami
Carolinian	79/80	New York/Charlotte

Siding	Approximate Milepost	Length
S. Micro – N. Smithfield	A 157 – A164.4	6.3 mi
Four Oaks – Alaska	A172 – A176.3	4.6 mil
N. Dunn – Kay	A185.2 – A190.4	5.06 mi
S. Godwin – N. Wade	A194.6 – A197.1	2.45 mi
S. Beard – Cape Fear River	A204.1 – A207.4	3.17 mi
N. Milan – S. Hope Mills	A207.6 – A218.6	10.93 mi

FIGURE 4. THE A-LINE ROUTE
A-LINE ROUTE MAP (TOP), AMTRAK DESTINATIONS (MIDDLE) AND SIDING LENGTHS (BOTTOM)

Begin MP	End MP	Maximum Speed	Notes
A160.9	A161.0	50	
A161.1	A164.5	70	
A164.5	A165.1	60	
A165.1	A172.0	79	
A172.0	A176.3	70	
A176.3	A179.4	79	
A179.4	A180.3	55	Benson – Municipal Ordinance
A180.3	A185.2	79	
A185.2	A187.3	45	Dunn – Municipal Ordinance
A187.3	A190.4	70	
A188.5	A207.4	79	
A207.4	A207.6	60	Milan Yard
A207.6	A208.6	60	
A208.6	A209.0	45	
A209.0	A209.6	35	Fayetteville Station – Municipal Ordinance

FIGURE 5. THE A-LINE ROUTE

SPEEDS (TOP-LEFT), ESTIMATED TRAIN MOVEMENTS PER DAY (MIDDLE), AND STRUCTURES (BOTTOM).

INFORMATION SHOWN IS FOR MAJOR CROSSINGS, NOT ALL CROSSINGS.

Intersecting Roadway	Mile Post	Municipality	Estimated Train Movements Per Day	Car AADT
SR 2302 (Ricks Rd)	A161.84	Selma	18	5097
SR 2403 (Peedin Rd)	A163.7	Smithfield	18	6369
SR 1007 (Brogden Rd)	A165.82	Smithfield	18	6053
SR 1162 (N. Main St)	A171.69	Four Oaks	18	3243
NC 50	A179.85	Benson	18	9496
Parrish St	A179.92	Benson	18	1978
SR 1100 (Chicopee Rd)	A181.11	Benson	19	1174
US 301 (Granville St)	A185.40	Dunn	19	5188
Harnett St	A185.87	Dunn	20	1365
US 421 (Cumberland St)	A186.08	Dunn	19	15215
SR 1780 (Arrowhead Road)	A188.24	Dunn	19	3378
SR 1714 (River Rd)	A206.68	Fayetteville	22	2193
Cumberland St	A208.94	Fayetteville	23	1555
Hay Street	A209.63	Fayetteville	18	9400

Intersecting Bridge	Mile Post	Municipality	Bridge Length (feet)	Notes
US 70 Bus. (E. Market St)	A164.79	Smithfield	58	1 track superstructure; Substructure can accommodate dual tracks
Neuse River	A167.37	Smithfield	283	
Mingo Swamp	A181.33	Benson	60	Single Track Bridge
Stoney Creek	A185.76	Dunn	35	Single Track Bridge
Black River	A189.58	Dunn	576	Single Track Bridge
Cape Fear River	A207.5	Fayetteville	551	Single track bridge (active); Inactive single-track bridge
US 401 BUS (Ramsey St)	A208.84	Fayetteville	100	Three-Track Structure
Cross Creek	A210.6	Fayetteville	51	Dual track structure 300 feet from Fay. Station

FAYETTEVILLE-SELMA-RALEIGH (CONTINUED)

THE H-LINE

Selma to Raleigh | North Carolina Railroad / Norfolk Southern

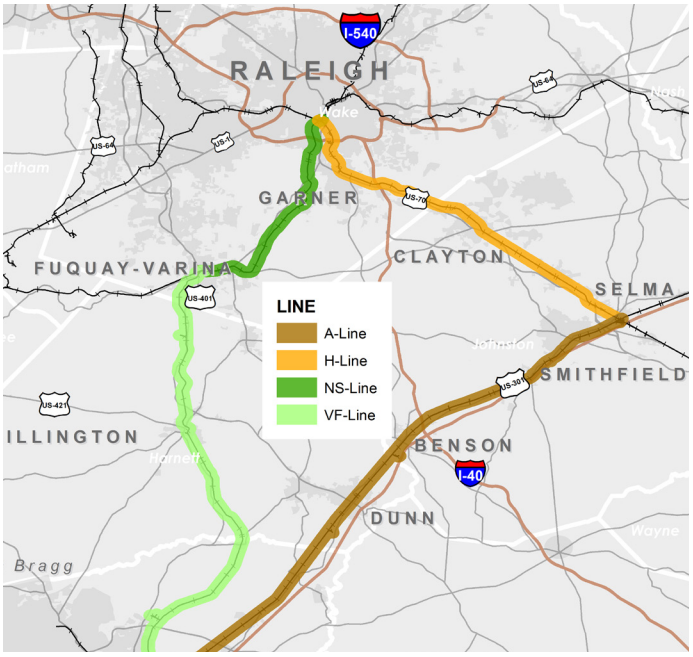
The H- Line runs from Raleigh Union Station/Boylan Junction (MP H80.9) to Selma Junction/CSX A-Line (MP H109.4). The Boylan Junction is the location of Raleigh Union Station and the intersection of the Norfolk Southern H-Line, the Norfolk Southern NS-Line, and the CSX S-Line. Municipalities served include Raleigh, Garner, Clayton, Wilson's Mills, and Selma.

The Norfolk Southern H-line is the company's primary freight corridor between its mainline in Greensboro and eastern North Carolina. It connects North Carolina's Piedmont Region and its major manufacturing and population centers to the state port at Morehead City. The route also connects with other Norfolk Southern branch and CSX branch lines in Goldsboro, New Bern, and Havelock. Additionally, there are 13 spur tracks providing direct access to industrial sites in South Raleigh, Garner, Clayton and Selma. The project team continues to research the number of manifest trains per day, with the operator carrying a variety of freight in this corridor. The corridor carries a moderate amount of freight, carrying an average of 6.1 to 10.0 million gross tons of freight annually (*source: NCDOT Comprehensive State Rail Plan, 2015*).

This route also carries passengers on three Amtrak trains. Stations served are Raleigh Union Station (Carolinian/Silver Star/Piedmont) and Selma Union Depot (Carolinian/Palmetto).

Train Name	Train Number	Destinations
Silver Star	91/92	New York/Miami
Carolinian	79/80	New York/Charlotte
Piedmont	73/74/75/ 76/77/78	Raleigh/Charlotte

The H-Line is a primarily single-tracked secondary mainline. Freight train speeds east of the Boylan Wye to Selma Interlocking ranges from 40 to 50 mph. Passenger train speeds range from 40 – 79 mph. The route traverses 32 at-grade crossings and 12 grade-separated crossings between the Boylan Wye in Raleigh and Selma Junction. Positive train control (PTC) has been installed and is currently in use between Boylan and Selma Junction. The corridor also has centralized traffic control in place, which precedes PTC installation.



Siding	Approximate Milepost	Length (ft)
E. Garner Siding	H84.2 – 85.5	10,000
Auburn – Wake Siding	H90.4 – H94	17,960
Clayton Siding	H95.3 – H96	3,696
Powhatan – Neuse Siding	H100 – H102	10,110

FIGURE 6. THE H-LINE ROUTE (TOP) AND SIDING LENGTHS.

The tables on this page and the next (Figures 6-7) summarize train speeds, siding section length, and crossing types at major crossing locations.

Begin MP	End MP	Maximum Speed (mph)
81	83.4	60
83.4	83.8	50
83.8	84.8	45
84.8	85.4	40
85.4	85.96	70
85.96	88.1	79
88.1	88.5	55
88.5	89	50
89	90	79
90	90.3	55

Begin MP	End MP	Maximum Speed (mph)
90.3	90.7	70
90.7	91.5	79
91.5	92.1	70
92.1	94.6	79
94.6	94.8	70
94.8	96.4	79
96.4	97.3	70
97.3	106.25	79
106.25	108.8	60
108.8	109.3	50
109.3	109.1	32

FIGURE 7. THE H-LINE ROUTE
SPEEDS (TOP-LEFT), ESTIMATED TRAIN MOVEMENTS PER DAY (MIDDLE), AND STRUCTURES (BOTTOM).

INFORMATION SHOWN IS FOR MAJOR CROSSINGS, NOT ALL CROSSINGS.

Intersecting Roadway	Mile Post	Municipality	Estimated Train Movements Per Day	Car AADT
Cabarrus Street	H81.17	Raleigh	6 - 12	2,332
Rush Street	H83.4	Raleigh	6 - 12	9,191
SR 2561 (Vandora Springs Rd)	H85.96	Garner	6 - 12	7,586
SR 5520 (Jones Sausage Rd)	H88.1	Garner	6 - 12	8,872
SR 2555 (Auburn-Knightdale Rd	H90.3	Garner	6 - 12	4,701
SR 2558 (Guy Road)	H92	Clayton area	6 - 12	4,000
SR 1553 (Shotwell Rd)	H94.8	Clayton	6 - 12	9,610
N. O'Neill St	H96.14	Clayton	6 - 12	6,495
NC 42	H97.74	Clayton	6 - 12	22,753
SR 1901 (Powhatan Rd)	H100.00	Wilson's Mills	6 - 12	6,021
SR 1003 (Buffalo Road)	H107.64	Selma	6 - 12	6,594
US 301/NC 96/NC 39	109.08	Selma	6 - 12	14,990

Intersecting Bridge	Mile Post	Municipality	Bridge Length (feet)	Notes
W. Lenoir Street / Dawson Street	81.30	Raleigh	195	
W. South Street	81.35	Raleigh	83	
McDowell Street	81.40	Raleigh	151	
MLK, Jr. Blvd	81.61	Raleigh	225	
Walnut Creek	82.60	Raleigh	111	Crosses Walnut Creek Greenway
Benson Highway	86.30	Garner	117	Single track / dual track substructure
I-40	88.42	Garner	333	
Old US 70	95.2	Clayton	51	
Neuse River	106.5	Wilson's Mills	306	

FAYETTEVILLE-FUQUAY-VARINA-RALEIGH

THE VF-LINE

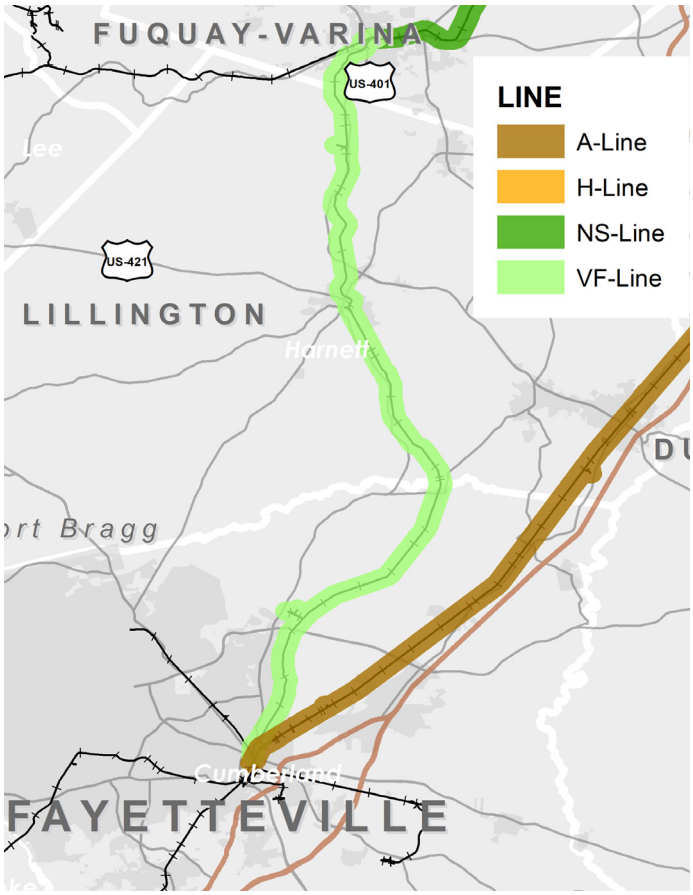
Fayetteville to Fuquay-Varina | Norfolk Southern

Norfolk Southern's VF-Line runs from the junction with the Norfolk Southern NS-Line (MP VF0.0) in Fuquay-Varina to A-Y Junction in downtown Fayetteville (VF42.2). Municipalities served are Fuquay-Varina, Lillington, Linden, and Fayetteville.

The Norfolk Southern VF-Line serves as the company's only connection to Fayetteville. The branch line allows Norfolk Southern local freight trains to service a number of small industrial sites in Harnett and Cumberland counties, as well as the Goodyear Tire Plant in Fayetteville. Thus the traffic on the line consists of shorter, local freight train sets originating in Fuquay-Varina. It is a low tonnage route, carrying no more than 2.5 gross million tons of freight annually (*source: NCDOT Comprehensive State Rail Plan, 2015*). An average of one local freight train per day operates along the VF-Line.

The Norfolk Southern VF-Line is a single-tracked branch line. Freight trains are limited to 25 mph with 45 at-grade, and four grade-separated, railroad crossings between the NS-Line in Fuquay-Varina and AY-Junction in downtown Fayetteville. The VF-Line runs down the middle of Hillsboro Street from VF42.01 to Junction with CSX AE-Line. The VF-Line is unsignalized from Varina (connection with the NS-Line) to MP VF41.5 (use of track is authorized by direction of Train Dispatcher/Control Operator).

There are no passenger trains using this line currently; however, this route presents other challenges to passenger rail service. There is not a direct connection between the VF-Line and the Fayetteville Amtrak Station, and Norfolk Southern has trackage rights over the CSX AE-Line in downtown Fayetteville. Based off the current network, southbound trains would use the AE-Line and cross over the A-Line at AY Junction (north of the Fayetteville Amtrak Station). Trains would then have to back up northbound onto the connector track between the AE-Line and the A-Line (track #3) and clear the crossover track. Once the crossover track is cleared, the train would then travel southbound on track #3 and use the crossover to enter track #1 to access the Amtrak Station.



Siding	Approximate Milepost	Length (ft)
Setner	VF17.7	1,587
Terr	VF24.7	1,225
Kelly Springfield	VF 35.1	1,579

FIGURE 8. THE VF-LINE ROUTE (TOP) AND SIDING LENGTHS.

A new connector track between the VF-Line and the A-Line was noted in the 2004 *Fayetteville Traffic Separation Study*. The proposed connector would run from north of the Hoffer Drive Crossing (VF40.81) and connect with the A-Line in the vicinity of Milan Yard.

The tables on this page and the next (Figures 8-9) summarize train speeds, siding lengths, and crossing types at major crossing locations.

Begin MP	End MP	Maximum Speed
VF0.0	VF41.5	25
VF13.6	Cape Fear River Bridge	10
VF41.5	VF43.0	10

FIGURE 9. THE VF-LINE ROUTE

SPEEDS (TOP-LEFT), ESTIMATED TRAIN MOVEMENTS PER DAY (MIDDLE), AND STRUCTURES (BOTTOM).

INFORMATION SHOWN IS FOR MAJOR CROSSINGS, NOT ALL CROSSINGS.

Intersecting Roadway	Mile Post	Municipality	Estimated Train Movements Per Day	Car AADT
SR 1108 (Wake Chapel Rd)	VF0.40	Fuquay-Varina	1	8,024
W. Academy St	VF 0.80	Fuquay-Varina	1	8,319
S. Judd Pkwy	VF 1.53	Fuquay-Varina	1	2,042
US 401	VF 7.40	Chalybeate Springs	1	9,431
US 401	VF 12.65	Lillington	1	11,696
US 401 (S. Main Street)	VF 14.50	Lillington	1	24,135
SR 2016 (McNeill St)		Lillington	1	4,313
US 401 Business (Ramsey Street)	VF 41.45	Fayetteville	1	38,935
Cumberland St	VF 42.15	Fayetteville	1	2,685
Hillsboro Street	AE 209.03	Fayetteville	1	

Intersecting Bridge	Mile Post	Municipality	Bridge Length (feet)	Notes
Neills Creek	VF11.20		300	
Goff Creek	VF11.40		99	
Cape Fear River	VF13.70	Lillington	1373	10 mph track speed on bridge
	VF19.10		53	
Upper Little River	VF19.50		362	
	VF20.10		53	
Little River	VF25.00		283	
	VF33.60		163	
	VF35.50	Fayetteville	119	
	VF35.80	Fayetteville	135	
	VF37.10	Fayetteville	99	
	VF37.90	Fayetteville	207	

FAYETTEVILLE-FUQUAY-VARINA-RALEIGH (CONTINUED)

THE NS-LINE

Fuquay-Varina to Raleigh | Norfolk Southern

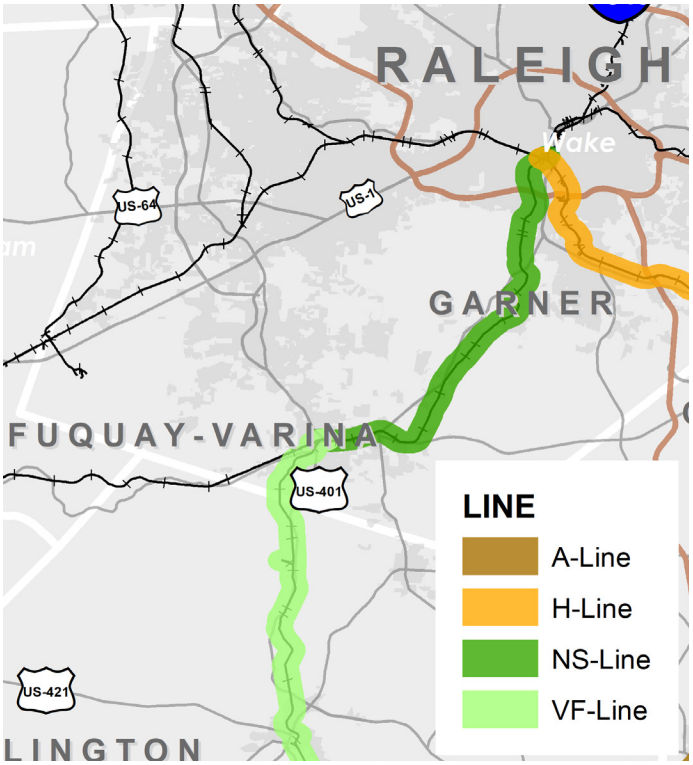
Norfolk Southern's NS-Line extends from Raleigh's Union Station/Boylan Junction (MP NS233.1) to the junction of the VF-Line in Fuquay-Varina (MP NS 251.7). It serves the municipalities of Raleigh, Garner, and Fuquay-Varina.

The NS-line is a branch line running from Raleigh to Cumnock, just north of Sanford. The line serves to connect industries in central North Carolina with the remainder of Norfolk Southern's rail network. Local trains operate between Norfolk Southern's yard in Raleigh; the smaller railyard in Fuquay-Varina; and industrial and commercial sites along the corridor and other branch lines. An average of three local freight trains per day operate along the section of the NS-Line being evaluated in this study. It is a low tonnage route, carrying no more than 2.5 gross million tons of freight annually (*source: NCDOT Comprehensive State Rail Plan, 2015*).

The NS-Line is a single-tracked branch line with freight train speeds are limited to 25 mph. Notably, there are no sidings for this line, which excludes passing and overtake opportunities. There are 14 at-grade and 11 grade-separated railroad crossings between the Boylan Wye and the junction with the VF-Line. The NS-Line is unsignalized from Boylan to Varina (connection with the VF-Line); use of the is authorized by direction of Train Dispatcher/Control Operator.

Although there are no passenger trains on this line there are concerns facing the implementation of passenger rail service along its length. Along with the lack of sidings, there is not a direct connection between the NS-Line and the Raleigh Union Station. Based on the existing configuration at Boylan Wye, there are two access scenarios to reach Union Station.

1. NB train enters the H-Line, traveling eastbound. The train would continue eastbound beyond the eastern leg of the wye (CP Hunt) and cross a bridge over West Lenoir/Dawson Street. Once the switch is cleared, the train backs westward onto the Raleigh Union Station platform track.
2. The second scenario sees the train traveling up the NS-Line beyond the Jones Street crossing in order to clear the crossover. The train would then back southward through the crossover to enter the CSX S-Line, continuing southward onto the eastern leg of the Boylan Wye beyond Cabarrus Street to clear the switches to the station tracks. Once the switch is clear, the train would proceed forward into Raleigh Union Station.



Siding	Approximate Milepost	Length
Setner	VF17.7	1587
Terr	VF24.7	1225
Kelly Springfield	VF 35.1	1579

FIGURE 10. THE NS-LINE ROUTE (TOP) AND SIDING LENGTHS.

The figures on this page and the next (Figures 10-11) summarize train speeds and crossing types at major crossing locations.

Intersecting Roadway	Mile Post	Municipality	Estimated Train Movements Per Day	Car AADT
SR 1009 (Lake Wheeler Road)	NS234.4	Raleigh	3	8450
SR 2753 Dwight Roland Rd)	NS247.45	Willow Springs	3	3057
SR 1301 (Sunset Lake Rd)	NS250.53	Fuquay-Varina	3	18970
SR 5056 (N. Judd Pkwy NE)	NS250.84	Fuquay-Varina	3	15365
NC 55 (N. Ennis ST)	NS251.70	Fuquay-Varina	1	10055
Intersecting Bridge	**Mile Post**	**Municipality**	**Bridge Length (feet)**	**Notes**
Western Boulevard	NS233.39	Raleigh	400	
Walnut Creek	NS234.663	Raleigh	133	Walnut Creek Trail
I-40	NS234.91	Raleigh	385	
Swift Creek	NS240.60		149	
Terrible Creek	NS246.5		189	
US 401	NS249.52	Fuquay-Varina	189	

FIGURE 11. THE NS-LINE ROUTE
ESTIMATED TRAIN MOVEMENTS PER DAY (TOP) AND STRUCTURES (BOTTOM).

INFORMATION SHOWN IS FOR MAJOR CROSSINGS, NOT ALL CROSSINGS.
MAXIMUM TRAIN SPEEDS ARE 25MPH THROUGHOUT.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

PEER STUDY ASSESSMENT

Previous studies have focused on peer assessments with somewhat different service characteristics in mind. The peer transit systems reviewed in this section address service characteristics, but also (1) use telephone interviews to enhance the baseline data, and (2) extract information from these peer reviews that may enhance the methods used in the current study.

HIGHLIGHTS FROM REVIEWS OF PEER TRANSIT SYSTEMS

1 **SINGLE-TRACK WITH PASSING SIDINGS WORKS. Double-tracking (two tracks side-by-side in one corridor) is expensive and generally unavailable in many corridors. However, the services reviewed here make single-track routes work even when shared with freight and other passenger rail service.**

2 **START-UP LESSONS. All peers studied here have publicly owned track. Trackage is either by the state department of transportation (DOT), Amtrak, or a state-owned railroad. Anticipate a cost of between $5million to $15million per mile for track acquisition cost, and another $1.0 to $2.0 million per mile for annual operating cost. Costs for station site acquisition/development, engineering, rolling stock and miscellaneous start-up costs can easily surpass $500 million.**

3 **NOT EVERY TRIP IS A WORK TRIP. With respect to these peers (and other services), non-commuter riders are important, often accounting for 40% of ridership. Special event trains (e.g., sporting, major public festivals) are not uncommon, implying that flexible service arrangements are important to accommodate these non-recurring trip types.**

4 **THINK AHEAD. If minimizing the capital outlay to purchase trackage is a goal now, then expanding service in the future will be much harder. The same can be said of lateral space to create additional siding or dual-track options, as well as creating more space for stations and station expansions.**

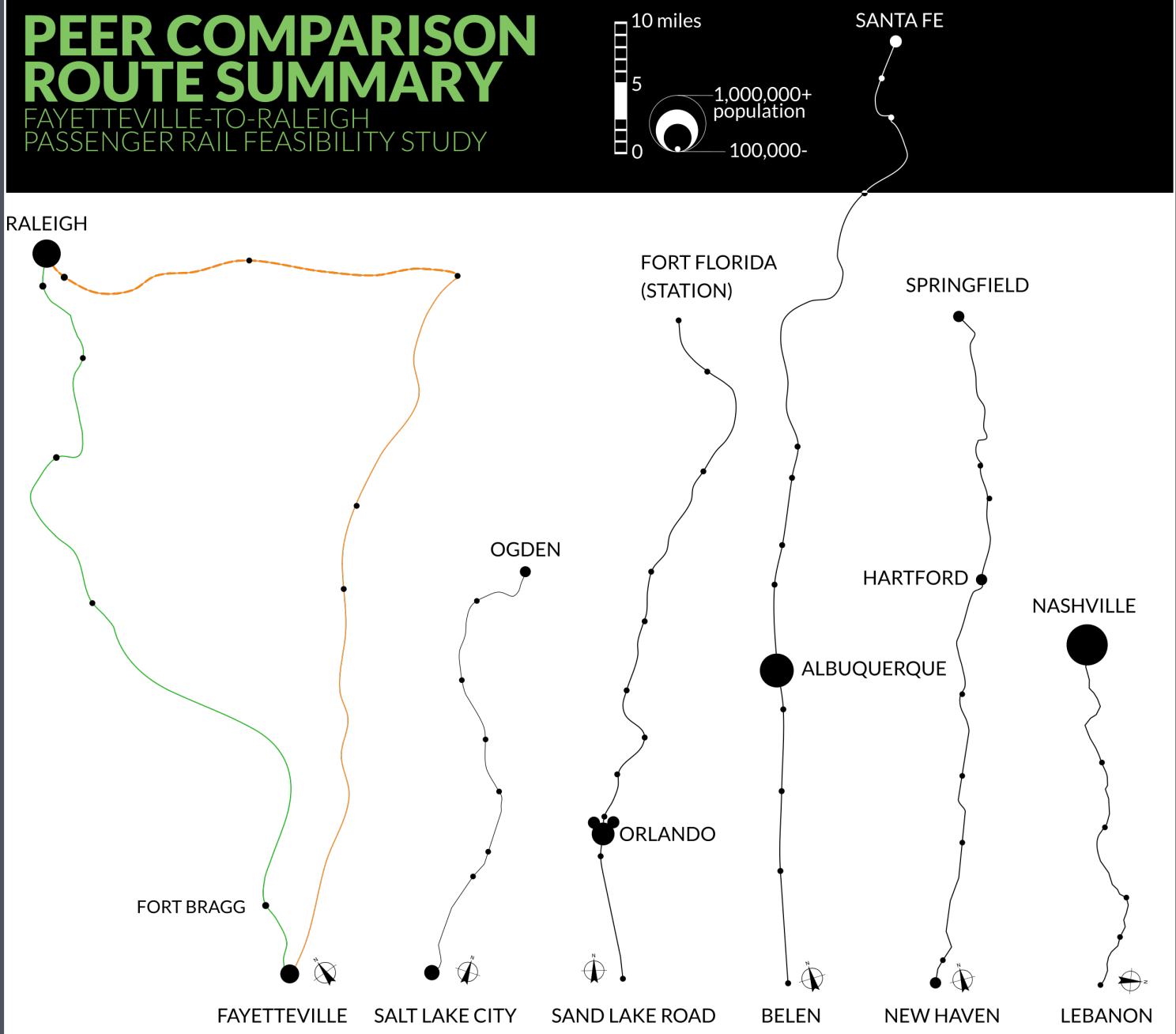
5 **VISION GOOD, DELUSION BAD. While not true in every case, in the majority of instances the initial construction costs for passenger rail service are usually higher and ridership usually lower than projected. As more details are discovered the price goes up, exacerbated by escalating right-of-way costs in developing corridors.**

FIGURE 12 (OPPOSING PAGE). SUMMARY OF PEER STUDIES

THE GRAPHIC ON THE NEXT PAGE INDICATES THE ROUTE LENGTHS, RELATIVE POPULATION SIZE OF MUNICIPALITIES, AND KEY STATISTICS AVAILABLE FOR EACH ROUTE. THE TWO ROUTES STUDIED FOR THE FAYETTEVILLE-RALEIGH PASSENGER RAIL STUDY ARE SHOWN AT LEFT FOR THE PURPOSE OF COMPARISON (NOTE THAT STATION LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE).

PEER COMPARISON ROUTE SUMMARY

FAYETTEVILLE-TO-RALEIGH PASSENGER RAIL FEASIBILITY STUDY

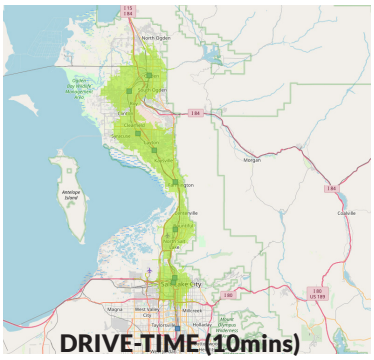


	FAYETTEVILLE TO RALEIGH	FRONT RUNNER	SUNRAIL	RAILRUNNER	CTRAIL	MUSIC CITY STAR
length (miles)	61-77	44	49	97	62	32
population (10-min. drive)(1)	326,659	599,359	424,340	377,907	624,380	231,721
population density	971	3,275	2,737	1,507	2,889	1,319
employees (10-min. drive)(1)	230,076	312,000	391,555	329,925	486,162	223,301
employment density	684	1,706	2,525	1,316	2,249	1,271
track maximum speed (mph)	25-79	79	79	79	110	59
shared track	✓	⊘	✓	✓	⊘(2)	✓
station spacing (miles)	8.7	5.5	3.1	6.5	6.9	4.6

Notes:
(1) Population and Employment figures estimated in 2019; Drive Times calculated for typical Tuesday at 8am driving into station (sources: ESRI Business Analyst). Station locations are preliminary and subject to change.
(2) Shares tracks and is operated / maintained by Amtrak.

metro analytics

FRONTRUNNER

Service (Route) Name	FrontRunner (North)		
Largest City and State	Salt Lake City		Utah
Location: The route studied extends north from Salt Lake City to the City of Ogden. The same route extends southward and connects with other service in Salt Lake City. Map at left shows complete (with South and North) FrontRunner route; map at right shows station locations and 10-minute drive times to each station at 8am on a typical Tuesday morning.	 LOCATION		 DRIVE-TIME (10mins)
Length (miles)	44 (North only)	**Type of Service**	commuter
Population / Jobs (10-minute drive)	599,359 / 312,148	**Population / Job Density (10-minute drive)**	3,275 / 1,706
Average Station Spacing (miles)	5.5	**Average / Max. Speed (mph)**	39 / 79mph
Shared Trackage	No		
Operator Name	Utah Transit Authority		
Contact	Kerry Doane, UTA		
Peak Period Fare (adult, one-way)	$2.50	**Began Operations**	April 26, 2008
Annual Trips 2017[1]	4,854,099	**Trips Five Years Ago (2013)[1]**	3,816,414
Days Operating Weekday Hours of Operation	M-SA 4:25am-11:25pm	**Headway (peak / off-peak)**	30 / 60 mins.

Main Takeaways

- No need to buy the whole corridor – one side will do
- Passing sidings can be added as frequency increases, over time
- May be able to purchase maintenance facility with track

Notes: (1) All commuter rail service for Utah Transit Authority, not just FrontRunner North.

Service Name	FrontRunner

Interview Summary

Start Up and Annual Maintenance Costs
$61m start-up capital cost for 38 miles of single track. Predicted cost, entering into preliminary engineering was $408m, but rose due to unexpected complexity related to drainage ditches ($167m) and upgrade signal system ($21m) [35]. Annual operating costs in 2010 (prior to the opening of FrontRunner South) were $15.6m; the cost for the combined system (81 miles) in 2017 was $27m [36].

Details of Shared Track Agreement(s)
No shared track. UTA purchased a 20' strip from the edge of Union Pacific (UP) ROW in 2000/2002, to create a single-track system [32]. There are sufficient passenger sidings to permit trains to pass one another, which limits headway to no more than every 30 minutes [33]. UTA previously ran trains to Pleasant View on shared track but quit doing it in 2018, no longer feasible due to requirement for positive train control [32]. Amtrak does not use FrontRunner ROW. Very limited Union Pacific use of FrontRunner track, typically only when a freight train needs to pass over FrontRunner track to reach a spur route serving a customer; maintained through time-separation [32].

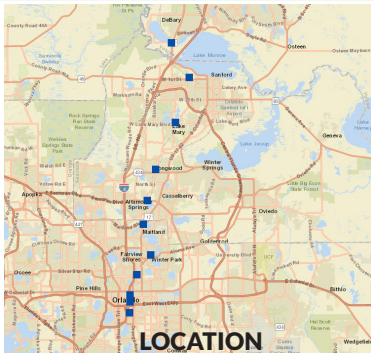
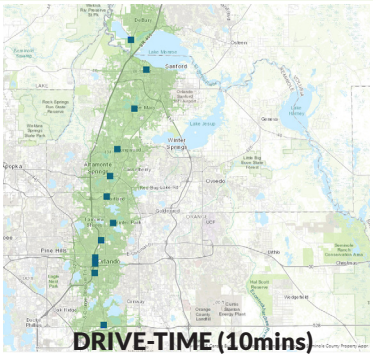
Ridership demographics and trip purposes
Substantial student ridership; special event ridership also significant [45]. Substantial commuter use, partially due to employer-provided pass program [32].

Maintenance / storage of trains when not in use
UTA purchased the building that would become the Warm Springs Maintenance facility from UP at the same time the track purchase was made. Nestled into a UP yard to the north, northwest of downtown, which required much rehabilitation and remodeling. UTA does not store trains elsewhere except at ends of station for first run in the morning. [32]. Facility contains shop, dispatch center, rail yard, operational simulators, and a small museum [37]. The facility is larger than needed, and UTA has attempted to lease part of it out. [38]

Governance / Ownership and operators / dispatching
UTA manages the entire system. Communication agreements with UP regarding grade crossings - incidents at the gate in dispatch when that happens. All the signal houses talk to one another. Grade crossings, UTA on one side, UP on the other. Freight operation on FrontRunner - access is shared with temporal separation. Very few UP customers that require access to track (customer spurs).

How was the service funded and "sold" to decisionmakers and the public?
Commuter rail part of conversation from the start, as a multi-modal solution to travel demand in a linear / long NS corridor; FrontRunner is seen as a vital way to accommodate travel demand. Air quality not a primary motivation at first, mostly about travel demand at the outset of planning [32]. Commuter rail providing higher speeds than parallel I-15 at peak times [30].

SUNRAIL

Service (Route) Name	SunRail		
Largest City and State	Orlando		Florida
Location: The SunRail system extends from just south of the popular tourist destinations in the City of Orlando north to the Town of DeBary (population: 21,000). Passengers wishing to reach Disney are required to take a bus from the closest station; notably, the service does not run on weekends.	 LOCATION	 DRIVE-TIME (10mins)	
Length (miles)	48.9	**Type of Service**	commuter
Population / Jobs (10-minute drive of stations)	424,340 / 391,555	**Population / Job Density (10-minute drive of stations)**	2,737 / 2,525
Average Station Spacing (miles)	3.1	**Average / Max. Speed (mph)**	34 / 79
Shared Trackage	Yes; FDOT owns the trackage but there is an agreement with CSX to run freight at night and Amtrak service (3 trains)		
Operator Name	SunRail, Florida DOT		
Contact Information	Steve Olson, Communications Manger, FDOT		
Peak Period Fare (adult, one-way)	$2 to $5 (zone)	**Began Operations**	May 1, 2014
Annual Trips 2017	901,156	**Trips Three Years Ago (2015)**	959,037
Days Operating Weekday Hours of Operation	M-F 5:45am-9:55pm	**Headway (peak / off-peak)**	30 / 60 mins.

Main Takeaways

- Dispatching and operations are subcontracted to a third party (Bombardier Technologies)
- Extensive visioning exercise - and a recognition that demographic changes and roadway expansion costs could not continue to support auto-dominated travel - drove the decision process forward
- Special event accommodation for sporting events
- An important income source is the fees collected from private freight company (CSX) to allow trackage rights for freight movement

Service Name	SunRail

Interview Summary

Start Up and Annual Maintenance Costs
$432 million deal to buy the 61-mile CSX line and spent another $615 million to build the system, and including double-tracking the line [40]. As of 2018, only 48.9 miles are in use [41]. The annual cost (operations+maintenance) of the initial route ran $33m, offset by $5m in revenue of which over half is fees from CSX for use of the rail line [42]. This sale of the CSX A-line was feasible because CSX owned a parallel railroad (S-Line). Part of deal included upgrades to another rail line [47]. The cost for an additional 12 miles of double-track with signal upgrades is estimated at $77m [48]. Phase 2 South is budgeted at $187m for 17 miles.

Details of Shared Track Agreement(s)
The Florida Department of Transportation (FDOT) owns the rails but Central Florida Commuter Rail Transit (CFCRT) has arrangements with both Amtrak and CSX to permit operations. CSX maintains a perpetual easement (right of travel) on the corridor [63]. CSX owned both the S-line and the A-line; the latter was sold to FDOT. Amtrak's consent was a precondition to the sale [61]. For the portion of the track shared by the Florida Central Railroad company, the state negotiated a contract containing time-separation provisions, including midnight to 5am as exclusive to freight but guaranteeing priority to commuter rail and passenger rail during 'mixed traffic' windows [63]. CSX continued to own side-track in the corridor; an agreement to resolve contracts made by CSXT for corridor use for broadband/fiber-optic billboards and utility poles was necessary, and not all could be severed with the transfer of ownership [62]. Insurance/liability negotiations with Amtrak were contentious [47]. FDOT is liable for any commuter rail activity, and Amtrak for any Amtrak activity, with liability as determined in a court of law in the event of an accident involving both parties, with a provision that good-faith efforts would be made to transition Amtrak to a 'No-Fault liability' status through the Florida Legislature.

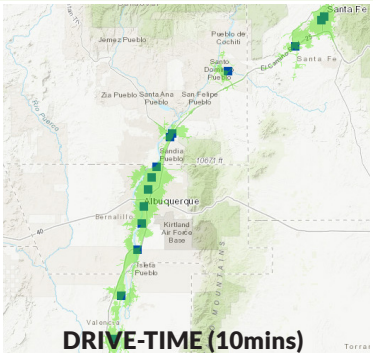
Ridership Demographics and Trip Purposes
Commute ridership works traditional hours and lives within 5 miles of a station [67], and has a strong role: 57.5% ride SunRail 4/5 times per week [50]. Special event trains for Orlando Magic games [49]. Contrary to expectations and predictions, non-work trips represent almost a third of the average daily ridership [68].

Maintenance / Storage of Trains when not in Use
Maintenance performed by Amtrak employees under a Memorandum of Understanding, at the Auto Train maintenance and yard in Sanford, Florida; parts are supplied by Central Florida Commuter Rail Transit. The agreement includes storage for up to 28 DMU vehicles [43]. As of 2013, Bombardier Technology operates and maintains rolling stock under contract to FDOT [44]. Currently, most equipment is stored at the main vehicle maintenance and storage facility at the Sunrail Operations Control Center [66], located 2 miles northwest of the Sanford auto train station. There is also a small maintenance yard north of Poinciana station [66], the southernmost existing station, where there is also a storage siding. As of 2013, Bombardier Technology operates and maintains rolling stock under contract to FDOT [44]. Track and signal maintenance is provided by Herzog, under contract to it's TRANSITAMERICA subsidiary [65].

Governance / Ownership and Operators / Dispatching
FDOT owns the track [46]; CFCRT owns the rolling stock. Operations and dispatching are provided by Bombardier, under contract to CFCRT as noted [44]. This includes dispatching for Amtrak Trains [64]. FDOT may not discontinue or abandon any part of the corridor [64]. Amtrak leases stations along the corridor from FDOT [64].

How was the Service Funded and "Sold" to Decisionmakers and the Public?
The planning and concept resulted from an 18-month regional visioning exercise, recognizing exponentially worsening road delay. Demographic change presented by millennials and aging baby boomers were motivators as well, and the proposed services was seen as cheaper alternative to road expansion [40].

RAIL RUNNER

Service (Route) Name	Rail Runner Express		
Largest City and State	Albuquerque		New Mexico
Location: Rail Runner is one of the few systems that operates a (limited) schedule on both Saturday and Sunday, and it is the longest of the peers at 97 miles. Ridership has slipped since 2010, possibly in part due to a lack of serious congestion on parallel roadways in the corridor. The Kirtland Air Force Base is just to the east of the route.	 LOCATION		 DRIVE-TIME (10mins)
Length (miles)	97	**Type of Service**	commuter
Population / Jobs (10-minute drive of stations)	377,907 / 329,925	**Population / Job Density (10-minute drive of stations)**	1,507 / 1,316
Average Station Spacing (miles)	6.5	**Average / Max. Speed (mph)**	43 / 79
Shared Trackage	NMDOT owns the tracks to ensure priority; Amtrak shares some trackage		
Operator Name	Rio Metro Regional Transit District, New Mexico DOT		
Contact Information	Tony Silvester, MRCOG		
Peak Period Fare (adult, one-way)	$2 to $10 (zone)	**Began Operations**	July14, 2006
Annual Trips 2017	835,561	**Trips Five Years Ago (2013)**	1,089,500
Days Operating Weekday Hours of Operation	M-Su[1] 4:30am-8:30pm	**Headway (peak / off-peak)**	30 / 75 mins.

Main Takeaways

- Alternate to high cost of widening long freeway (70 miles) very attractive
- Community opposition to train resulted in 'greenfield' segment
- Minimal dead-heading made possible with storage tracks

Note: (1) Schedules are reduced in frequency on weekends.

Service Name	Rail Runner Express

Interview Summary

Start Up and Annual Maintenance Costs
The cost was $135m for first phase, $250m for second phase, with anticipated operating costs of $10m for phase 1 and $20m for phase 2 [13]. The 21 miles of new corridor in the I-25 median cost $140m [23]. In 2017 the anticipated 2030 cumulative cost was $723m [19]. In 2011, annual operating cost was $28m a year, with a 2027 cost of $794m [22], when the O&M contract with Herzog is about $19m [22] decreased from $20.6m in 2010 [23]. In 2017, total annual costs currently ran $28m/year, and fares offset about $3m [20]. The 2003 estimate was $200m [22]. In 2010, fares covered only 10% of operating costs [23].

Ridership has fallen steadily from 2010 levels; 2018 ridership was only 63% of 2010 ridership; FrontRunner was initially free to ride, and the discontinuance of free fare is correlated with falling ridership [13]. In 2018 revenue was $14.4m, with $2m coming from fares, and another $2.1m from trackage rights for BNSF and Amtrak. Expenditures totalled $33m, less than the $34m in revenues. However, $44m of revenues come from Federal grants, which may not be a sustainable source of funding. Positive train control required $60m in improvements [19], partially funded from a loan from the state infrastructure bank and partially through $31m in Federal grants [24]. A detailed breakdown of future capital expenditures included revitalization of rolling stock, grade crossing improvements, and a parking garage to spur TOD [24].

Details of Shared Track Agreement(s)
NMDOT purchased the track from Belen to Santa Fe. The corridor also includes a section of greenfield light rail, and part of the corridor runs in the median of I-25 [13]; BNSF retains exclusive freight trackage rights [15]. Amtrak also makes use of 81 miles this track [24,25].

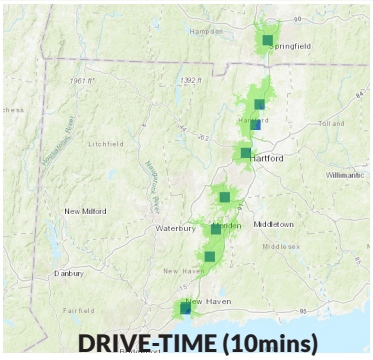
Ridership Demographics and Trip Purposes
Average daily ridership of 1,531 [1]; "Operator CTrail, which is part of the state DOT, will launch customer surveys to determine how many riders are choosing to ride instead of drive" [5]; Survey suggests that use is: 46% social/recreational, commute to work 25%, and business 14%. [11].

Maintenance / Storage of Trains when not in Use
Stored in a railyard adjacent to station in downtown Albuquerque [13], across from Alvorado Transit Center, next to the 'Herzog Transit Services' on 100 Iron Avenue, SW which is east of the maintenance shed. Storage in a central location causes 'dead-heading' issues [22] dispatching trains from Albuquerque to Belen and Santa Fe.

Governance / Ownership and Operators / Dispatching
Track and rolling stock owned by NMDOT, operated and maintained by Herzog Transportation, under contact to the Rio Metro Transit District (RMRTD), but operated and maintained by Herzog Transportation [14, 15]. Herzon provides O&M services for many commuters rail systems in the US [18]. RMRTD is legally responsible for ensuring FRA compliance, such as positive train control [16]. NMDOT provides dispatching [17]. NMTOD lacks a seat on the RMRTD board [25].

How was the Service Funded and "Sold" to Decisionmakers and the Public?
The project had an initial feasibility study conducted in 1994; a second feasibility study in 2001; and was part of a larger rail feasibility study in 2005 [1]. Project initiated by the State. Advertised as fast (110 mph) service between Springfield & New Haven as an economic development measure [4]. Revitalization and redevelopment, for area 45 minute ride from New Haven [5]. Improved employment access for areas between New Haven and Springfield [12]. Economic development of station areas [9,12]. Congestion on I-91 cited [12]. Dual-tracking to provide increased reliability over existing Amtrak service, including 17 daily trips rather than six [12]. Connectivity to existing rail services was also mentioned [12].

HARTFORD LINE

Service (Route) Name	Hartford Line (CT*rail*)		
Largest City and State	New Haven		Connecticut
Location: Similar to the Carolinian and Piedmont services in North Carolina, a partnership between Amtrak and two state departments of transportation finances and operates the Hartford Line. It was expected to carry 630,000 passengers in its first full year of operation. It's operating speeds make travel between New Haven and Springfield by train competitive with driving.	 LOCATION		 DRIVE-TIME (10mins)
Length (miles)	62	**Type of Service**	commuter
Population / Jobs (10-minute drive of stations)	624,380 / 486,162	**Population / Job Density (10-minute drive of stations)**	2,889 / 2,249
Average Station Spacing (miles)	6.9	**Average / Max. Speed (mph)**	45 / 110
Shared Trackage	Amtrak operates on this line, but shares operations and maintenance costs		
Operator Name	Amtrak, with ConnDOT		
Contact Information	Richard Jankovich, Assistant Rail Administrator, CDOT		
Peak Period Fare (adult, one-way)	$3 to $12.75 (zone)	**Began Operations**	June 16, 2018
Annual Trips 2018-2019 (1 year)	630,000[1]	**Trips Five Years Ago (2013)**	NA
Days Operating Weekday Hours of Operation	M-Su[2] 5:15am-10:25pm	**Headway (peak / off-peak)**	30 / 90 mins.

Main Takeaways

- Partnering with Amtrak already an established practice both here and for this peer
- Economic development of station areas was a main selling point
- Congestion on parallel routes (e.g., I-91) as well as train speed make the service competitive with driving
- Connectivity to existing rail services provides another incentive for making this mode choice

Note: (1) Estimated, based on 51,000 boardings / month; (2) Schedules are somewhat reduced in frequency on weekends.

Service Name	Hartford Line (CT*rail*)

Start Up and Annual Maintenance Costs
Existing, single-track railway with passenger sidings with an additional $769m ($204m Federal, $564m CT) between 2010 and 2017 [2]. Annual operating cost of $43.9m, partially offset by $7.2m in Revenue [11].

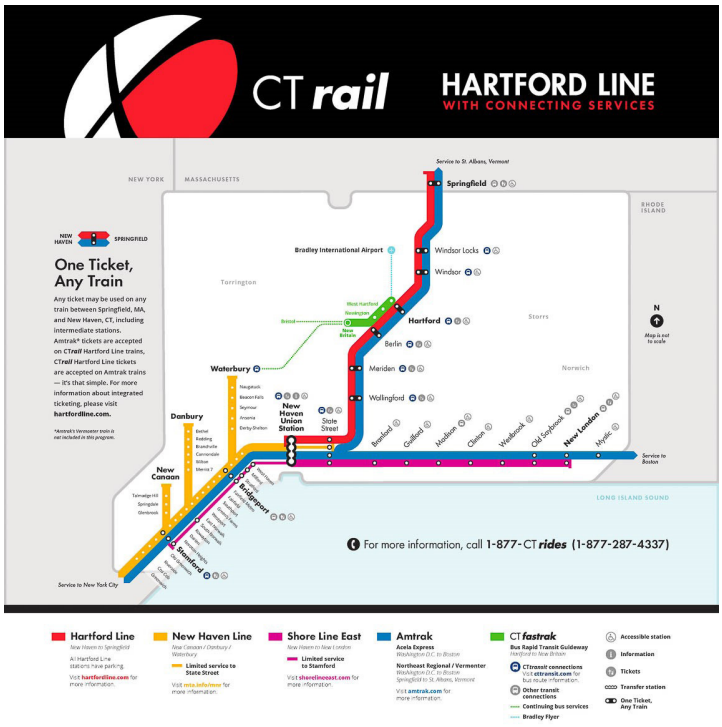
Details of Shared Track Agreement(s)
Amtrak owns the track [1]; track shared with Acela Express & Northeast Regional [3]. Amtrak is responsible for maintenance of the line.

Ridership demographics and trip purposes
Average daily ridership of 1,531 [1]; "Operator CTrail, which is part of the state DOT, will launch customer surveys to determine how many riders are choosing to ride instead of drive" [5]; Survey suggests that use is: 46% social/recreational, commute to work 25%, and business 14%. [11].

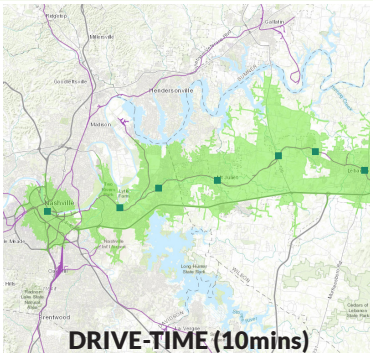
Maintenance / storage of trains when not in use
Armory Street, Springfield [7], adjacent to Union Station - temporary use of Union Station as an interim measure.

Governance / Ownership and Operators / Dispatching
Joint venture by States of Mass & Connecticut, branded at CTrail, operated under $45m contract by TransitAmerica Services [1]. "Amtrak is responsible for maintenance of the Hartford Line railroad infrastructure, including track signals, train dispatching, and security." [8,10]

How was the service funded and "sold" to decisionmakers and the public?
Initial feasibility study in 1994, second feasibility study in 2001 and part of a larger rail feasibility study in 2005 [1]. Project initiated by the State. Advertised as fast (110 mph) service between Springfield & New Haven as an economic development measure [4]. Revitalization and redevelopment, for area 45-minute ride from New Haven [5]. Improved employment access for areas between New Haven and Springfield [12]. Economic development of station areas [9,12]. Congestion on I-91 cited [12]. Dual-tracking to provide increased reliability over existing Amtrak service, including 17 daily trips rather than six [12]. Connectivity to existing rail services was also mentioned [12] (see image of schedule map, below).



MUSIC CITY STAR

Service (Route) Name	Music City Star		
Largest City and State	Nashville		Tennessee
Location: The Nashville Music City Star extends eastward out of a fast-growing urban center. It connects smaller communities along a heavily traveled corridor. Developed in response to a proposed abandonment by a rail company, the service is controversial due to lower-than-expected ridership but is helping to create town centers.	 LOCATION		 DRIVE-TIME (10mins)
Length (miles)	32	**Type of Service**	commuter
Population / Jobs (10-minute drive of stations)	231,721 / 223,301	**Population / Job Density (10-minute drive of stations)**	1,319 / 1,271
Average Station Spacing (miles)	4.6	**Average / Max. Speed (mph)**	39 / 59
Shared Trackage	Yes; leased from Nashville & Eastern Railroad Authority		
Operator Name	Regional Transportation Authority (RTA)		
Contact Information	Gabriel Burgess, Operations Supervisor		
Peak Period Fare (adult, one-way)	$2 - $5.25 (zone)	**Began Operations**	Sept. 18, 2006
Annual Trips (2017)	203,497	**Trips Five Years Ago (2013)**	252,220
Days Operating Weekday Hours of Operation	M-F 5:40am-5:55pm	**Headway (peak / off-peak)**	35 / 55 mins.

Main Takeaways

- Contracted service, with 30 year trackage rights
- Short-line host railroad amenable to commuter rail thanks to associated improvements/maintenance
- Frequency limited by lack of Positive Train Control (PTC)

[rendering, right] "Vintage State North is a mixed-use plan approved to build 192 apartments and 28 townhomes in Mt. Juliet near the train station being billed as a transit oriented development." (source: Andy Humbles, "Mt. Juliet train station to see upgrades amid development boom," Nashville Tennessean, published March 22, 2019.)

Service Name	Music City Star

Interview Summary

Start Up and Annual Maintenance Costs
The original cost of $41m for 32 miles of single track and six stations [27], using the less-desirable but available Nashville & Eastern R Company (NERC) short-line, which includes 10mph segments [51]. Track rehabilitated by transit authority [54]. Annual O&M costs of $4.0m, offset by $0.79m in fares [28]. The 2004 pre-construction estimate was for a $39.8m for construction, with an annual operating cost of $3.0m, based on 1,900 average weekday boardings. Actual boardings were and have been substantially lower--opening day ridership was only about 273 riders per day, reaching a peak of about 800 riders per day in 2012; 2018 ridership averages 818 daily boardings [31]. The Music City Star lacks positive train control, which would cost an additional ($20m). The operator has applied for a waiver to existing rules and cut service in the interim [30] as a result.

Details of Shared Track Agreement(s)
NERC is the host railroad. The Regional Transportation Authority of Middle Tennessee (RTA) arranged for 30 years of trackage rights on the corridor, starting in 2006 [54].

Ridership Demographics and Trip Purposes
Handful of special event trains [51]; such as sporting events [59]. Discounts/free rides for veterans and other groups (note: commonplace to all services).

Maintenance / Storage of Trains when not in Use
Rolling stock maintained under contract TSG; NERR maintains track [54]. Trains stored/maintained at Lebanon storage yard [27].

Governance / Ownership and Operators / Dispatching
Following abandonment by CSX in the 1980s, a joint powers authority was created between the state DOT, affected counties, and the Nashville & Eastern Railroad Authority (NERA). The state created NERC, a privately held corporation, to take over the short-line, and a special purpose authority (NERA) to manage funding the line. However, it was making limited use of the rail line and was amenable to the Music City Star proposal due to the associated improvements [55]. "RTA signed a complex and unique tri-party agreement with NERR and the Nashville Rail Corporation (NRC); NRC subcontracted to Transit Solutions Group (TSG), a subsidiary of NERR for operations & maintenance" [52,54]. The Regional Transportation Authority of Middle Tennessee (RTAMT) oversees the service, although direct management is provided through the Nashville Metropolitan Authority (NMA) [29]. NERC handles dispatching [57].

How was the Service Funded and "Sold" to Decisionmakers and the Public?
Sold as low-cost commuter rail, providing tourist access to the downtown. Planned as the initial line of a 'star' of commuter rail lines centered on Nashville billed as congestion mitigation/alternative to driving [58].

ADDITIONAL PEER STUDIES

In 2018 GoForward published a report discussing and summarizing 11 other similar peers to the then-studied Wake and Durham counties Major Investment Study in new transit infrastructure. The summary table is reproduced in part below to provide additional information on the peers discussed previously and additional systems. Systems have high ranges of startup (capital) costs per mile, as well as high variability in ongoing annual operating costs. Almost all of these systems share trackage with other operators. Annual ridership and train frequency information in this chart may differ for the peer systems discussed previously (*) as the information in Figure 13 is older than the peer descriptions.

Commuter Rail System	System Miles	Year of Opening	Number of Round Trips Per Day	Peak (Off-Peak) Headway	Number of Stations	System Capital Cost ($mil)	System Capital Cost / Mile ($mil)
A-Train (Denton, TX)	21	2011	30	22 min (40 – 60 min)	5	$308	$15
MetroRail (Austin, TX)	32	2010	18 to Austin / 20 Leander and Lakeline	30-40 min (1 hour)	9	$177	$6
SunRail* (Orlando, FL)	32	2014	18	30 min (12 hour)	12	$402	$13
Music City Star* (Nashville, TN)	33	2006	6	45 min (No Service)	6	$59	$2
Tri-Rail (Miami, FL)	71	1989	25	20-40 min (1 hour)	18	$773	$18
Virginia Railway Express (Washington, DC)	35 (Manassas Line) / 54	1992	8 (Manassas Line) / 8	30 min (Limited Off Peak)	10 (Manassas Line) / 13		
Trinity Railway Express (Dallas-Fort Worth, TX)	36	1996	32 trains to Dallas/31 trains to Fort Worth	30 min (1 hour)	10	$266	$11
Northstar (Minneapolis, MN)	40	2009	12	30 min (No Service)	7	$414	$10
COASTER (San Diego, CA)	41	1995	11 to San Diego/12 from San Diego	30-40 min (13 hour)	8		
FrontRunner* (Salt Lake City, UT)	89	2008	31	30 min (1 hour)	17	$823	$18
University of Colorado A Line (Denver, CO)	23	2016	72	15 min (30 min)	8	$1,273	$55

FIGURE 13. SUMMARY OF PEER STUDIES (WAKE MIS REPORT)

THIS GRAPHIC WAS ADAPTED FROM FIGURE 11 IN THE WAKE COUNTY MIS COMMUTER RAIL PEER REVIEW (NOVEMBER 20, 2018). NOT ALL FIELDS FROM THAT SUMMARY TABLE ARE INCLUDED. COSTS ARE IN 2018 DOLLARS UNLESS OTHERWISE SPECIFIED. AN ASTERISK (*) DENOTES A SYSTEM DISCUSSED PREVIOUSLY THAT MAY HAVE DIFFERENT AND MORE RECENT INFORMATION.

Annual Operating Cost (2016)	Operating Expenses per Vehicle Revenue Mile ($2016)	Average Weekday Riders	CBD Parking Price (Daily)	Funding	Shared with Freight and / or intercity rail?
$13	$19.79	2,006	Not Available	Regional Toll Revenue Funding Initiative and Local Sales Tax Revenue	Yes
$23	$77.34	2,883	Not Available	No federal funds	Yes
$31	$48.08	3,542	$15	FTA New Starts (50%)	Yes
$5	$25.59	1,005	$20	FTA New Starts (59%)	Yes
$90	$25.03	13,894	$25	FTA New Starts & Urban Area Formula	Yes
$70	$30.53	17,713	$21	Not Available	Yes
$28	$24.01	7,395	$15	FTA New Starts (39%)	Yes
$17	$30.99	2,534	$23	FTA New Starts (50%)	Yes
$17	$12.20	5,294	$17	Not Available	Yes
$45	$8.37	16,214	Not Available	FTA New Starts (80%) [Phase 1 only]	Yes
$47	$28.08	18,600	$17	Public-Private Partnership	No

PASSENGER RAIL SERVICE FEASIBILITY STUDY

INPUT FROM FOCUS GROUPS AND THE TSC

The Technical Steering Committee (TSC) met for a total of six times over the course of the study to provide leadership and guidance to the project team. Additionally, four focus group meetings were held to allow detailed interaction on the Fayetteville (South), Central, and Raleigh (North) sections of the two study corridors as well as a dedicated Economic Focus Group (May 19, 2020). The following summarizes the input received from the TSC over the course of these meetings.

MEETINGS OF THE TECHNICAL STEERING COMMITTEE

MO YR	
09 19	ORIENTATION. The project team worked with the TSC to explain their role and introduce the project to them, its schedule and its milestone deliverables. The TSC participated in an exercise to describe what they would consider to be success factors in this study; obstacles to passenger rail service; and the potential benefits.
11 19	ROUTE OVERVIEWS. A brief interactive survey was conducted to get the baseline opinions of the TSC on the potential for services between Raleigh and Fayetteville. An overview of the western and eastern route alternatives was outlined for the TSC.
02 20	PRELIMINARY DRAFT OF THE RIDERSHIP FORECASTS AND STATION / ROUTE-LEVEL OPERATIONAL ASSESSMENTS. The project team presented preliminary assessments of the challenges encountered along each route and at three station locations (Raleigh, Selma, and Fayetteville. This meeting determined the desirability to conduct area focus groups.
04 20	REVIEW OF THE UPDATED RIDERSHIP FORECASTS AND OPERATIONAL ASSESSMENTS (WITH COST ESTIMATES). As with meeting #3, the fourth TSC meeting focused on (refined) estimates of costs and ridership at stations. An overview of the focus group meetings was also provided at this TSC meeting.
05 19	REVIEW OF THE UPDATED RIDERSHIP FORECASTS. The primary focus of the fifth TSC meeting was reviewing the ridership forecasts, including an additional station on the Eastern Corridor, modifications to account for future roadway congestion, and explanations of the effects of the frequency of round-trip trains.
06 20	ECONOMIC IMPACTS OF PASSENGER RAIL AND POTENTIAL FOR FUTURE STUDY. The sixth and final TSC meeting focused on a "walk-through" of the complete draft report, economic impacts from both qualititative and quantitative persepctives, and a draft scope of work should a more detailed study be conducted based on the outcomss of this work.

NOTES FROM THE TECHNICAL STEERING COMMITTEE

Surveys of the TSC early in the project helped establish a baseline of opinion and where to place an emphasis in this study (some results summarized below).

STUDY SUCCESS IS...

- Talking to partners
- Noting Resource Requirements
- Fatal Flaws
- Considering Fort Bragg Ridership
- Next Steps

SERVICE OBSTACLES

- Right-of-Way
- Funding/Cost
- Railroad Agreements

SERVICE BENEFITS

- Reliability
- Economic
- Congestion / Emission Reductions

What travel time for rail would make 5% of people in your community switch to rail?

41% Same travel time as car

What's the biggest benefit to passenger rail in your community?

44% Provides a new, stable choice for commuters

Who would be most likely to use the proposed passenger rail service?

88% Daily commuters

The Fayetteville Station parking deck was becoming operational at the time of the second TSC meeting. It was noted that this action would potentially alleviate concerns about a lack of nearby parking (although many of the spaces have been reserved for other uses).

At the same meeting, the A&R railyard was identified as being under study and potentially a suitable location for future storage and maintenance facilities in the Fayetteville area.

The TSC noted another passenger rail study occurring to study service between Orange County and Selma.

The TSC identified the importance of considering travel times for the service as well as competing (e.g., automobile) alternative modes of travel in the corridors.

The TSC provided input that triggered a re-estimation of costs in the Eastern Corridor.

NOTES FROM FOUR FOCUS GROUPS

Prior work (about 7-8 years ago) had been done on designing a new section of track and siding for the Fayetteville Amtrak Station. The project had neared final design prior to being suspended.

Clayton (and other communities) have been involved in discussion of Orange-Selma passenger rail service connecting the region east-to-west. Preliminary locations for a station had been worked out as well.

Land in Dunn near downtown was considered ripe for development / redevelopment, although no formal discussions of this property in relationship to passenger rail service had occurred.

More than one participant noted the importance of including Fort Bragg and its market for passenger rail in the study, including adding a north Fayetteville (I-295) station to the proposed Eastern Route. Additional estimates for shuttle service to such a station were provided subsequently by FAST / City of Fayetteville and would add approximately $20,000 to $35,000 annually to the cost of operations.

The Economic Focus Group provided qualitative insights on potential development impacts from the proposed service, and helped shape the assumptions feeding the assessment.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

OPERATIONAL ASSESSMENT

An important part of assessing the two route scenarios was considering the relationship between existing and future service conditions, some of which are highly dependent on the serviceability of existing track infrastructure as well as new improvements like stations and associated amenities. This section reports on the operational conditions and concludes with recommended improvements to create the most viable passenger rail service scenarios and a springboard for estimating ridership in the next section.

HIGHLIGHTS FROM PRELIMINARY OPERATIONAL ASSESSMENT

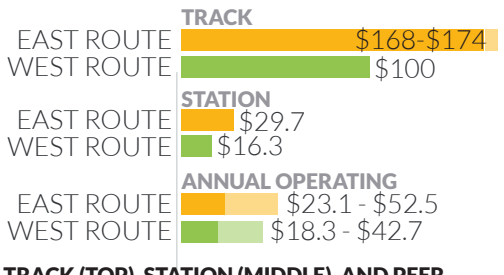
1 CAPITAL IMPROVEMENTS NEEDED. Both corridors will require significant investment in upgrading the track infrastructure and capacity in order to implement intercity passenger rail service between Raleigh and Fayetteville.

2 STATION DELAYS CAN BE REMEDIATED. Track improvements in Downtown Fayetteville and Selma can significantly reduce delays likely to be incurred by passenger trains when they are transitioning between lines.

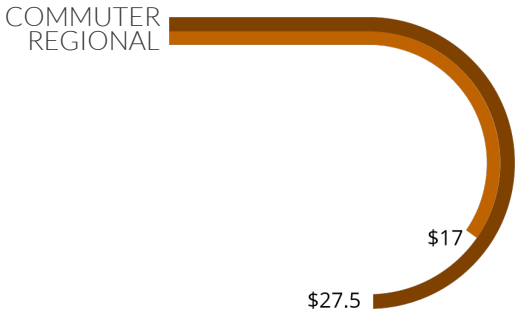
3 RIGHT-SIZING STATIONS. Based on Amtrak's Station Program and Planning Guidance, ridership projections at most of the proposed stations do not meet the criterion of the construction of a station building with restrooms and a waiting area. Stations with Quik-Track ticketing kiosks and covered shelters are recommended, reducing upfront costs until ridership increases drive demand for improved station facilities.

TOTAL OPERATIONAL IMPROVEMENTS STUDIED

THE TOTAL OPINION OF PROBABLE COSTS (PLANNING-LEVEL ASSESSMENT, WITHOUT LAND ACQUISITION AND INCLUDING CONTINGENCIES, IS SUMMARIZED BELOW. TRACK, STATION, AND PEER OPERATING COSTS AND ROLLING STOCK ACQUISITION ARE SHOWN SEPARATELY.



TRACK (TOP), STATION (MIDDLE), AND PEER OPERATING COSTS ($MIL)



TRAIN SET ACQUISITION COST: 2 OPTIONS ($MIL.)

ASSUMPTIONS
Operational Assessment

The assessment of the two study corridors (refer to Figure 14) necessarily made several assumptions. These assumptions are described in brief, below, while the subsequent pages outline operational assessments for the western and eastern corridors and three major station areas (Fayetteville, Selma, Raleigh).

The service type (commuter versus regional) was not determined, but it was assumed that at least one roundtrip between Raleigh and Fayetteville would occur each day utilizing push-pull operations. Hence, turning locomotives will not be required for each trip. The length of the trainsets was also unknown, and may vary depending on passenger demand. These two assumptions about service type and train locomotion hold true for every part of the assessment.

The average length of local and through freights utilizing the corridors vary. The freight operations along the Western Corridor appear to be local in nature with trains operating out of Raleigh and serving businesses along the Norfolk Southern (NS) and VF-Lines.

The freight operations along the Eastern Corridor appeared to be a combination of local and regional service. Along the H-Line, the freight operations are primarily local in nature, with local freight trains serving customers between Raleigh and the NS Selma Yard. Along the A-Line, the freight operations appear to be regional in nature, with the majority of trains operating between major yards along the Eastern Seaboard.

The Selma route follows the CSX A-Line, a main route along the Eastern seaboard and part of the CSX National Gateway Corridor. CSX will likely be concerned about new services on the A-Line unless they can be assured that existing / proposed infrastructure will prevent their operation from being negatively impacted and their operations can continue to grow.

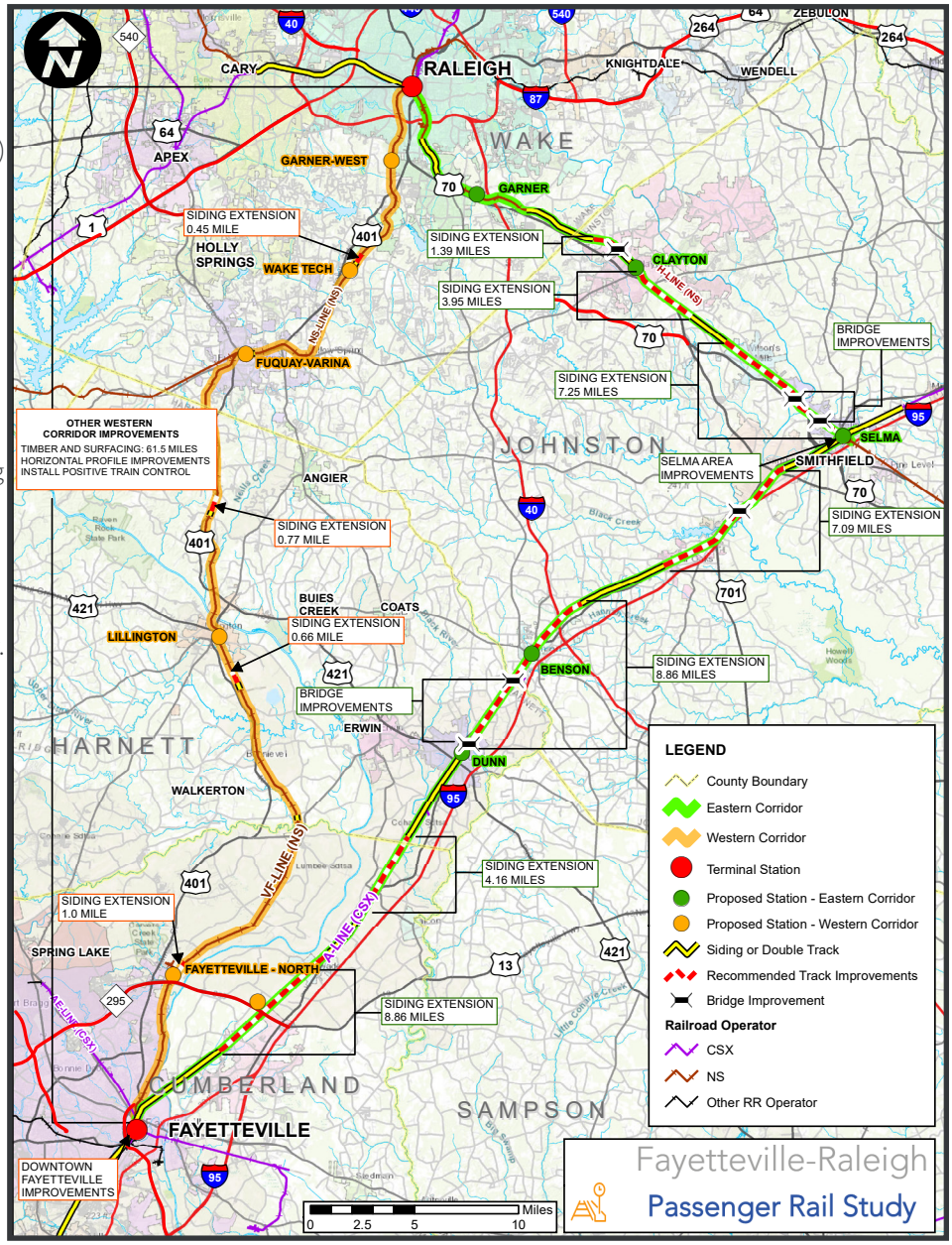


FIGURE 14. STUDY CORRIDORS, LINES, STATIONS, AND IMPROVEMENTS

WESTERN CORRIDOR OPERATIONAL OVERVIEW

The Western Corridor consists primarily of the NS VF-Line between Fayetteville and Fuquay-Varina and the Norfolk-Southern (NS) Line between Fuquay-Varina and Raleigh. Trains operating along this corridor will also use portions of the CSX AE and A-Lines to access the Fayetteville Amtrak Station and portions of the NS H-Line to access Raleigh Union Station.

Western Corridor Infrastructure

The corridor extends approximately 61.5 miles between the Fayetteville Amtrak Station and Raleigh Union Station. The Western Corridor is primarily single tracked with a total of five sidings ranging in length from approximately 1,127 feet to 3,200 feet. The sidings are spaced approximately 10 miles apart. The corridor is primarily FRA Class 2 track with a maximum authorized track speed of 25-miles per hour (mph) for freight and passenger trains. There are two, 10mph segments along the corridor: Cape Fear River Bridge in Lillington which is a non-moveable structure, and Hillsboro Street in Fayetteville where the railroad tracks run down the center of the street. There is no existing intercity passenger rail service along this corridor.

Raleigh-area Operational Concerns

Lack of Direct Access to Raleigh Union Station - There is not direct access to the station platform from the NS-Line. Currently, all access to the station platform is via the H-Line. Access to/from Raleigh Union Station would require a two-phase time-consuming forward/backing maneuver that would require the engineer to walk between the locomotive and cab-control car on multiple occasions.

Fayetteville-area Operational Concerns

Lack of Direct Access to the Fayetteville Amtrak Station - There is not direct access to the station platform via the VF-Line and AE-Line. The only access to the station platform is via the A-Line. Access to/from the Fayetteville Amtrak Station would require a three-phase, time consuming forward/backing maneuver that would require the engineer to walk between the locomotive and cab-control car on multiple occasions.
Limited Operating Speeds - The NS Timetable notes a maximum speed of 10mph along the VF-Line while trains are traveling down Hillsboro Street in downtown Fayetteville.

Other Operational Concerns

Overall Corridor Speed - North of Hillsboro Street in Fayetteville, the VF-Line has a maximum authorized speed of 25mph for freight and passenger trains. Maximum operating speeds along the NS-Line is also 25mph. There is also a 10mph restriction on the Cape Fear River Bridge in Lillington. All services evaluated in the Peer Review have an average start to finish speed of greater than 34mph.
Corridor Capacity - The corridor is primarily single-tracked with five sidings spaced approximately 10 miles apart ranging in length from 1,127 feet to 3,200 feet. The Western Corridor averages one-to-two freight trains per day (Raleigh to Fayetteville local). If freight trains operating along the corridor are longer than any of the sidings, they would not be able to fit into the sidings along the corridor. If trains need to pass each other, the shorter passenger trains would be required to occupy the sidings while the longer freight train passes, causing them to incur delays.

OPERATIONAL CONCERNS WITH BOTH ROUTES

SEVERAL CONCERNS PERTAIN TO BOTH ROUTE ALTERNATIVES. IN ADDITION TO THE BRIEF DESCRIPTIONS AT RIGHT, ADDITIONAL INFORMATION IS PROVIDED FOR THE FAYETTEVILLE, RALEIGH, AND SELMA STATION AREAS IN THE FOLLOWING PAGES.

EASTERN CORRIDOR OPERATIONAL OVERVIEW

The Eastern Corridor consists of the CSX A-Line between Fayetteville and Selma and the NS H-Line between Selma and Raleigh. The corridor extends approximately 75.5 miles between the Fayetteville Amtrak Station and Raleigh Union Station.

Eastern Corridor Infrastructure
The A-Line segment consists of a single main track with five double-tracked segments along its length to allow same and opposite direction passing. The length of the siding range from 2.45 miles to 10.9 miles. Additionally, the sidings are spaced an average of 4.5 miles apart. The H-line is primarily single-tracked with four sidings between Raleigh and Selma, ranging from 0.7 to 3.4 miles in length. The corridor is constructed to Federal Railroad Administration (FRA) Class 4 track standards with a maximum authorized track speed of 79 mph for passenger trains (Amtrak timetable speed) along the A-Line and H-Line. The lowest authorized speeds are 45 mph in Clayton (along the H-Line) and Dunn (along the A-Line) and 35 mph through downtown Fayetteville.

Raleigh-area Operational Concerns
None – Raleigh Union Station is designed to support intercity and commuter rail operations along the H-Line.

Selma-area Operational Concerns
Lack of Direct Access between the A and H-Lines - There is not a direct connector between the A and H-Lines for trains traveling between Fayetteville and Raleigh. Access between the lines currently require a three-phase time consuming forward/backing maneuver that would require the engineer to walk between the locomotive and cab-control car on multiple occasions.

Fayetteville-area Operational Concerns
None – The Fayetteville Amtrak Station is designed to support intercity rail operations along the A-Line.

OPERATIONAL CONCERNS WITH BOTH ROUTES

Northbound trains waiting on passengers to board will occupy Track 1, which provides access to the station, prior to their departure. Additionally, southbound passenger trains would need to occupy Track 1 while dropping passengers when they arrive from Raleigh. Passenger trains serving Fayetteville Station also prevents northbound CSX freight trains from accessing the Milan Yard lead track. Thus, if a northbound freight train needs to access the yard, it must continue north on Track 2 past Milan Yard and Control Point N. Milan onto the single-tracked section of the A-Line. The train must cross the single-track Cape Fear River Bridge and continue north until the last car or pushing locomotive clears the switch at CP North Milan. Once the switch is clear, the train will reverse direction and enter the Milan Yard lead track from the north.

NCDOT Rail Division noted that CSX may require dual platforms at Fayetteville Station if additional passenger service is implemented as a means to provide the railroad with the flexibility to have passenger trains utilize either track depending on freight operational needs. Connectivity to FAST buses will be via a short walk to the FAST Transit Center between Franklin Street and W. Russell Street. Both Raleigh and Fayetteville would require additional space for train storage between the morning departures and evening arrivals. The NCDOT Rail Division noted there is currently no capacity at the Capital Yard Maintenance Facility to store additional train sets. Likewise, there is currently not a location in the Fayetteville area currently identified for storing and servicing the train sets.

FAYETTEVILLE STATION AREA OPERATIONS

ASSUMPTIONS

Just as with the route operational summary, there are several assumptions that were made in the planning-scale assessment of the Fayetteville station area conditions. First, the service type (commuter versus regional) has not been determined. The Ridership and Revenue Study will evaluate demand for each service type. It is assumed that at least one roundtrip between Raleigh and Fayetteville occurs each day. Similarly, the locomotive and passenger equipment type has also not been determined at this point in the study. It is assumed that push-pull operations will be utilized. Hence, turning locomotives will not be required for each trip. The length of the trainsets is unknown at this point and may vary depending on passenger demand.

The average length of local and through freights utilizing the corridors vary. The freight operations along the Western Corridor appear to be local in nature with trains operating out of Raleigh and serving businesses along the Norfolk Southern (NS) and VF-Lines. The freight operations along the Eastern Corridor appear to be a combination of local and regional. Along the H-Line, the freight operations are primarily local in nature, with local freight trains serving customers between Raleigh and the NS Selma Yard. Along the A-Line, the freight operations appear to be regional in nature, with the majority of trains operating between major yards along the Eastern Seaboard.

Class One railroads are required by federal regulation to allow intercity passenger rail service. Freight railroads are not required by law to allow commuter rail service; therefore, agreements must be negotiated between the railroad owner and the operator of the proposed passenger service. Furthermore, the location of the Fayetteville-area train storage and maintenance facility has not been identified.

As noted previously, passenger connections to FAST buses will require a short walk to the FAST Transit Center between Franklin Street and West Russell Street.

TRACK INFRASTRUCTURE

The CSX A-Line has a dual-track configuration in the vicinity of the Fayetteville Station. The dual-track configuration extends from Control Point (CP) S. Hope Mills – mile post (MP) A218.6 to CP N. Milan – MP A207.6. Track 1 is the easternmost track and Track 2 is the westernmost track. Milan Yard is the primary CSX yard in the Fayetteville area. It is located approximately one mile north of the Fayetteville Amtrak Station along the east side of the A-Line.

Between Hay Street and Rankin Street, the A-Line is sandwiched between the north and southbound one-way pair section of Winslow Street. North of Hay Street, Hillsboro Street and the Airborne and Special Operations Museum occupy the land along the west side of the A-Line. A double crossover is located at A&R Crossing (MP A210.6) to allow trains to change between Track 1 and Track 2.

A&Y Junction (MP A209.6) is the crossing of the CSX A and AE-Lines and is located just north of the Fayetteville Amtrak Station. A connector track from the AE-Line parallels Track 1 the north of A&Y Junction and becomes the lead track to Milan Yard. A single crossover between Track 1 and the Milan Yard lead track is located just north of the Rowan Street overpass. For northbound local freight trains, the access to the Milan Yard lead track is only provided via Track 1.

The AE-Line intersects the NS VF-Line approximately 660-feet north west of A&Y Junction. The NS VF-Line extends from the AF-line and continues north down the center of Hillsboro Street for 2,500-feet before veering off along its own alignment. The station platform is served by Track 1 (refer to Figure 15).

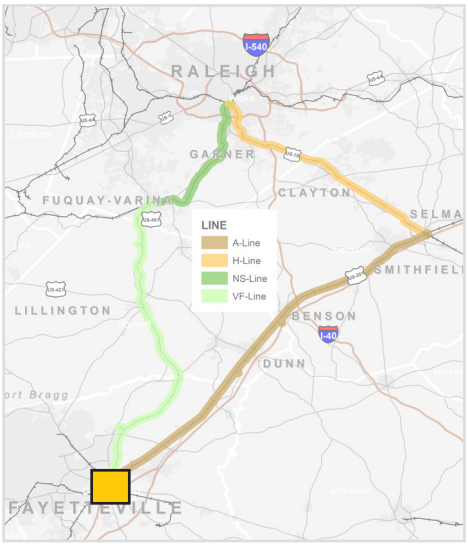


FIGURE 15. FAYETTEVILLE STATION AREA

ADDITIONAL OPERATIONAL CHALLENGES

Passenger trains will occupy Track 1 while passengers are getting on and off the trains during various times of the day. These trains serving the station would reduce the A-Line to a single-track main through downtown Fayetteville between MP A209.6 and MP A207.6. This operation also prevents northbound CSX freight trains from accessing the Milan Yard via the Milan Yard lead track. Thus, if a northbound freight train needs to access the yard it must continue north on Track 2 past Milan Yard and CP North Milan onto the single-track section of the A-Line. The train must cross the single-track Cape Fear River Bridge and continue north until the last car or pushing locomotive clears the switch at CP North Milan. Once the switch is clear, the train will reverse direction and enter the Milan Yard lead track from the north.

NCDOT Rail Division staff noted that CSX may require dual platforms at Fayetteville Station if additional passenger service is implemented as a means to provide the railroad with the flexibility to have passenger trains utilize either track depending on freight operational needs. The presence of Hillsboro Street and the Airborne and Special Operations Museum is a significant obstacle to enabling the installation of a second platform at Fayetteville Station or adding rail capacity.

Eastern Route Operational Concerns

The existing route is currently utilized by three daily Amtrak roundtrips; the Auto Train, Palmetto, and Silver Meteor. The Auto Train is the only one that does not stop at the Fayetteville Amtrak Station. Additional passenger service will require conflict resolution with freight service in this corridor.

Western Route Operational Concerns

Passenger trains to/from Raleigh via Fuquay-Varina and Lillington would access the Fayetteville Amtrak Station (and the A-Line) via the NS VF-Line and the CSX AE-Line at A&Y Junction.

Lack of a Direct Connection to the Fayetteville Amtrak Station - The only connection between the A-Line and the AE-Line is in the eastern quadrant of A&Y Junction. This configuration prevents passenger trains from directly traveling between the Fayetteville Amtrak Station and the VF-Line via the AE-Line. The following six-phase maneuver would be conducted in order for northbound trains to utilize the Western Corridor (the maneuver would be reversed for southbound trains accessing the Fayetteville Amtrak Station via the Western Corridor).

1. Northbound trains would travel north on Track 1 and utilize the crossover to access the Milan Yard lead track.
2. Once the last car (locomotive or cab control car) clears the switch, the train will need to travel south and access the AE-Line, east of the A&Y Junction. The engineer will need to leave the lead locomotive and walk to the cab control car to conduct the backing maneuver.
3. The train will then travel south (in reverse) along the Milan Yard lead track and enter the AE-Line.
4. Once the switch is cleared, the train will then need to travel north on the AE-Line. The engineer will have to leave the cab control car and walk to the lead locomotive.
5. Once the train is ready to progress north towards Raleigh, the train will need clearance from the CSX dispatcher to cross the A-Line.
6. Once the A-Line is cleared, the train will then veer from the AE-Line onto the NS VF-Line.

Limited Speeds along Hillsboro Street - The NS Timetable notes a maximum speed of 10mph along the VF-Line while trains are traveling down Hillsboro Street. North of Hillsboro Street, the VF-Line has a freight maximum speed of 25mph.


FAST Transit Center

RALEIGH STATION AREA OPERATIONS

ASSUMPTIONS

As with the Fayetteville station area review, the Raleigh Station Area review made several assumptions to facilitate the preliminary planning analysis of operations. The first is again that the service type (commuter versus regional) has not been determined. It is assumed that at least one roundtrip between Raleigh and Fayetteville occurs each day. Similarly, the locomotive and passenger equipment type has not been determined at this point in the study, but it is assumed that push-pull operations will be utilized. Hence, turning locomotives will not be required for each trip. The length of the passenger trainsets is unknown at this point and may vary depending on passenger demand.

The average length of local and through freight trainsets utilizing the corridors vary. The freight operations along the Western Corridor appear to be local in nature with trains operating out of Raleigh and serving businesses along the Norfolk Southern (NS) and VF-Lines. The freight operations along the Eastern Corridor appear to be a combination of local and regional. Along the H-Line, the freight operations are primarily local in nature, with local freight trains serving customers between Raleigh and the NS Selma Yard. Along the A-Line, the freight operations appear to be regional in nature with the majority of trains operating between major yards along the Eastern Seaboard.

Class One railroads are required by federal regulation to allow intercity passenger rail service. Freight railroads are not required to allow commuter rail service; therefore, agreements must be negotiated between the railroad owner and the operator of the proposed passenger service. It should be noted that Raleigh Union Station is currently served by GoRaleigh Transit bus service. A new bus terminal was recently approved for development next to the station.

TRACK INFRASTRUCTURE

The track infrastructure surrounding Raleigh Union Station is referred to as the Boylan Wye. The single-track NS-Line runs along the northwest leg of the Wye and continues north to NS' Glenwood Yard north of Downtown Raleigh. The CSX S-Line enters Boylan Wye from the north as a track paralleling the NS-Line before turning westerly, forming the west leg of the wye and merging with the NS H-Line as a multi-track section heading towards Cary. The NS H-Line enters Boylan Wye from the southeast and continues in a westerly direction, forming the southern leg of the Boylan Wye and continuing westward towards Cary and Durham as a dual track line with the S-Line. A connector track from the H-Line extends from CP Hunt (MP H81.3) forming the eastern leg of the wye connecting to the NS-Line and the S-Line just north of the Morgan Street overpass (CP Southern Junction MP NS 232.4). The NS-Line crosses the H-Line at CP Boylan (MP 80.9).

The combined NS H-Line/CSX A-Line extends west of Raleigh in a four-track configuration. The two northernmost tracks serve as the two main tracks, while the two southern tracks serve as the NS Prison Yard. A connector track extends east from the NS-Line at CP Boylan and ties into the Prison Yard Lead, which then merges into the H-Line just south of the southernmost station track. Currently, two intercity passenger station tracks serve Raleigh Union Station's center island platform. The station includes a dedicated space for a future passenger platform and track that lies between the station building/concourse and the northernmost station track. W. Hargett Street crosses over the NS Line, S-Line, and East Leg of the wye at-grade just north of the station. The South Boylan Avenue overpass crosses over the NS-Line, H-Line, and the S-Line, just east of CP Boylan. West Cabarrus Street crosses the H-Line and the east leg of the Wye at grade, just east of CP Hunt (Figure 16).

NCDOT Rail Division staff noted the current configuration of the Capital Yard Maintenance Facility would not allow for the storage of additional passenger train sets between morning and afternoon operations. A storage location for the new train sets will need to be identified and evaluated for suitability.

Lack of Direct Connection to Raleigh Union Station - There is not direct access to the station platform from the NS-Line. The only access to the platform is via the H-Line. Trains from the NS-Line would have to execute the following maneuver in order to access the Raleigh Union Station platforms. This maneuver would be reversed in the evening.

1. Northbound AM trains would use the connector track between the NS-Line and the Prison Yard Lead to enter the H-Line at CP Hunt.
2. The train would continue east-bound until the last car clears the interlocking at CP Hunt.
3. Once the last car has cleared the switch, the train reverses into the station platform.

Storage and Maintenance of Train Sets - A location for storing and/or maintaining trains designated for the Raleigh to Fayetteville service has not been identified, and the NCDOT Rail Division noted that the capacity for storing additional train cars has been exhausted.

Prior to the construction of the Charlotte Locomotive and Railcar Maintenance Facility, NCDOT's Charlotte-area maintenance "facility" consisted of a single, approximately 630'-long siding adjacent to the Tryon Street Station. The facility included modular buildings for parts and equipment storage, and a place for the train crew to sign-in, receive briefings, and keep personal items. Fueling operations also occurred at the site via mobile fuel trucks. Major maintenance operations require a dedicated, larger, more well-equipped space.

ADDITIONAL OPERATIONAL CHALLENGES

Eastern Route Operational Concerns
None – Raleigh Union Station is currently configured for intercity passenger and future commuter train access directly from the H-Line.

Western Route Operational Concerns
Low Authorized Track Speeds - Along the Western Route, the authorized track speed is 25mph to Cape Fear River Bridge (33 miles) in Lillington.

SELMA STATION AREA OPERATIONS

ASSUMPTIONS

As noted previously for the other operational assessments of stations, the service type (commuter versus regional) has not been determined, with the ridership/revenue forecasts in this and subsequent studies playing a major role in the evaluation of each service type. It is assumed that at least one roundtrip between Raleigh and Fayetteville occurs each day of operation. Also as noted, the locomotive and passenger equipment type has not been determined at this point in the study; for the purposes of this study push-pull operations were assumed negating the need for turning locomotives or maneuvers. The length of the trainsets is unknown at this point and may vary depending on passenger demand.

The average length of local and through freights utilizing the corridors vary. The freight train operations along the Western Corridor appear to be local in nature with trains operating out of Raleigh and serving businesses along the Norfolk Southern (NS) and VF-Lines. The freight operations along the Eastern Corridor appear to be a combination of local and regional. Along the H-Line, the freight operations are primarily local in nature, with local freight trains serving customers between Raleigh and the NS Selma Yard. Along the A-Line, the freight operations appear to be regional in nature, with the majority of trains operating between major yards along the Eastern Seaboard.

The Selma Amtrak Station (Selma Station) will serve as the passenger station for the Smithfield-Selma area. It is noted that the area with the highest concentration of employment in the area is farther south towards Smithfield. As previously noted, Class One railroads are required by federal regulation to allow intercity passenger rail service, while freight railroads are not required by law to allow commuter rail service. Therefore, agreements must be negotiated between the railroad owner and the operator of the proposed passenger service. Trains traveling between Raleigh and Fayetteville will transition between the H and the A-Lines in Selma.

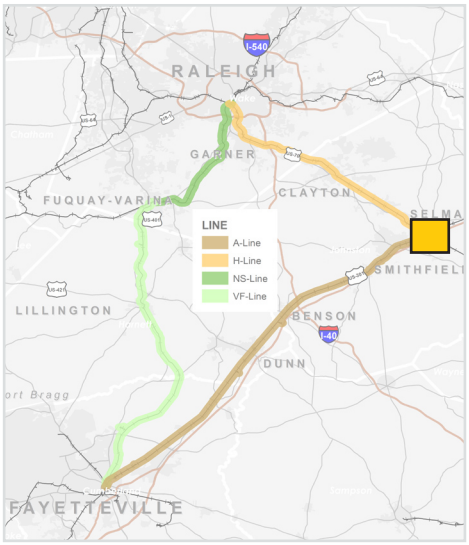
TRACK INFRASTRUCTURE

The single-track NS H-Line runs east to west. The dual track CSX A-Line runs north to south. This dual track section of the A-Line runs from CP N. Smithfield (MP A164.4) to CP S. Micro (MP A157.9). A double crossover is located at CP N. Selma (MP A160.0). The two lines cross at Selma Interlocking (NS MP H109.4/CSX MP A161.0).

Connector tracks are located in the northwest and northeast quadrants Selma Interlocking. Yard tracks and the loop track serving the Bailey Feed Mill is located in the southeast quadrant of the interlocking and are unavailable for passenger train use. There is currently no connector track in the southwest quadrant; the Selma Housing Authority property occupies the southwest quadrant. The Selma Amtrak Station is located in the northwest quadrant and has three platforms: H-Line, A-Line, and northwest quadrant. The NS Selma Yard is located along the H-Line approximately 3,300 feet east of the Selma Interlocking (Figure 16).

NEXT PAGE: OPERATIONAL SUMMARY

THE TABLES IN FIGURE 17 SUMMARIZE ALL OF THE ROUTE AND STATION AREA OPERATIONAL ISSUES EXAMINED AND DESCRIBED IN THIS SECTION.



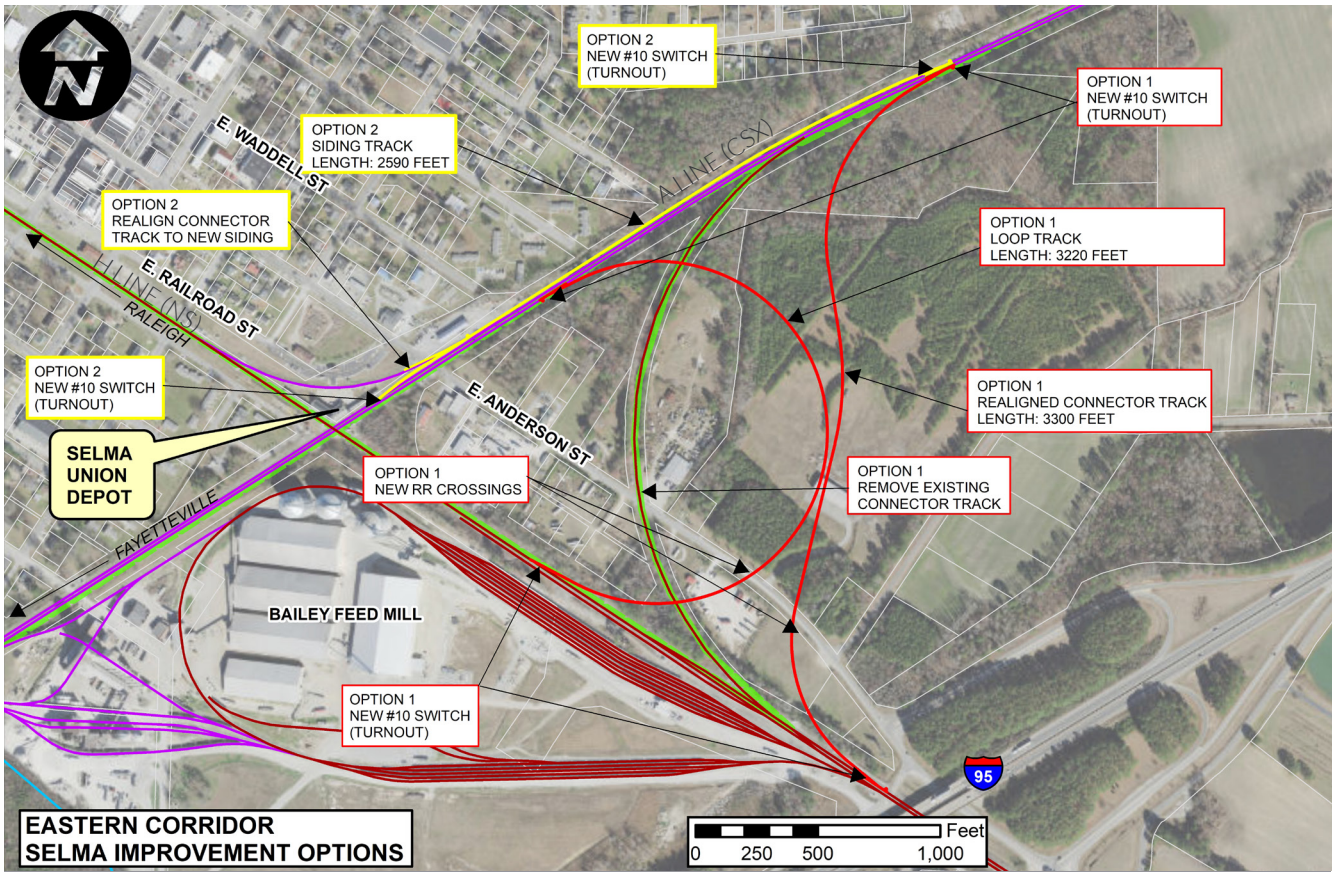


FIGURE 16. SELMA AREA RAIL INFRASTRUCTURE IMPROVEMENTS

ROUTE OPERATIONS SUMMARY

	WEST	EAST	• Major Concern (likely mitigation) / • Moderate Concern / • No Concern / • Not Applicable
Station Accessibility			
Raleigh Union Station	●	●	A two-phase maneuver would be required for passenger trains using the Western Route to access and depart the Raleigh Union Station. This maneuver would require the engineer to walk between the locomotive and the cab-control car multiple times.
Fayetteville Station	●	●	A time-consuming three-phase maneuver would be required for passenger trains using the Western Route to access and depart the Fayetteville Amtrak Station. This maneuver would require the engineer to walk between the locomotive and the cab-control car multiple times.
Corridor Capacity			
Raleigh Union Station	●	●	Trains conducting the two-phase maneuver to access/depart Raleigh Union Station will impact operations at Boylan Wye as the passenger train would have to maneuver up and down two legs of the wye, limiting the ability of other trains to operate in this area.
Fayetteville Station	●	●	At the Fayetteville Amtrak Station, the A-Line has a dual track configuration. AM and PM passenger trains will need to occupy Track 1, reducing A-Line to one through track. Limited opportunities to add a third track or additional platform due to parallel streets along both sides of the A-Line through downtown.
Mainline Track Infra-structure	●	●	The Western Corridor is primarily single track. Sidings are average 2,000 feet in length and are spaced an average of 10 miles apart. The Western Corridor averages 1 – 2 freight trains per day (Raleigh to Fayetteville local). If freight trains are longer than the sidings, they would not be able to utilize the sidings along the corridor. This would require passenger trains to sit in the sidings while allowing freight trains to pass, causing them to incur delays. The Eastern Corridor has adequate capacity to support current freight and passenger operations. Existing sidings are long enough to accommodate all trains utilizing the corridor. However, if additional passenger trains operations are implemented, the additional trains will likely conflict with existing freight and intercity passenger rail service, requiring the addition of sidings or double-tracking existing segments.
Operational Speeds	●	●	Maximum authorized speed along the Western Corridor is 25mph. Additionally, 10mph maximum speeds are required along Hillsboro Street in downtown Fayetteville and at the Cape Fear River Bridge north of Lillington. All services evaluated in the Peer Review have an average operating speed of greater than 34mph.The maximum authorized passenger train speed along the Eastern Corridor is 79mph.
Storage and Maintenance Facility			
Raleigh and Fayetteville Station Areas	●	●	A location for storing and/or maintaining trains designated for the Raleigh to Fayetteville service has not been identified. The NCDOT Rail Division noted that there is currently no capacity at the Capital Yard Locomotive and Railcar Maintenance Facility to store additional locomotives or rail cars. Storage sites will need to be identified at both stations and evaluated for suitability. The size and function of the facility will be dictated by the operations plan for the service, the amount of equipment to be stored, and the level of maintenance to be conducted.
Passenger Parking			
Raleigh Union Station	●	●	There are existing and planned parking decks in the vicinity of Raleigh Union Station, which should provide adequate parking for patrons.
Fayetteville Station	●	●	A new parking deck, still coming on-line as of this writing, will help somewhat with parking at the Fayetteville Amtrak Station. The spaces are allowed to be reserved at this point, which may restrict parking at the deck in the future.
A-Line/H-Line Transition (Selma)	●	●	There is not a direct connector between the A and H-Lines for trains traveling between Fayetteville and Raleigh. Access between the lines would require a three-phase, time consuming, forward/backing maneuver that would require the engineer to walk between the locomotive and cab-control car on multiple occasions. The maneuver will also require crossing the A-Line along the H-Line. Additional delays may be incurred while waiting to cross and enter the A-Line due to the higher train volumes along the A-Line.

FIGURE 17. ROUTE AND STATION-AREA OPERATIONS SUMMARY (THIS PAGE AND NEXT)

STATION OPERATIONS SUMMARY

		WEST	EAST	• Major Concern (likely mitigation) / • Moderate Concern / • No Concern / • Not Applicable
FAYETTEVILLE	Station Access	•	•	A complicated three phase maneuver would be required for passenger trains using the Western Route to access and depart the Fayetteville Amtrak Station. This maneuver would require the engineer to walk between the locomotive and the cab-control car multiple times.
	Multi-modal Connectivity	•	•	The FAST Transit Center is located one block south of the Fayetteville Amtrak Station. In the current configuration, rail passengers would have to cross both tracks, walk down Hillsboro Street, and cross Hay and Franklin Streets to make connections at the Transit Center.
	Capacity Impacts	•	•	At the Fayetteville Station, the A-Line has a dual track configuration. Passenger trains occupying Track 1 reduce the A-Line to one through track. Limited opportunities to add a third track or dual platform due to streets paralleling the A-Line on both sides in downtown.
	Operational Speeds	•	•	Western route must travel down center of Hillsboro Street for approximately 2,500 feet from north of the AE-Line transition at 10mph. North of Hillsboro Street, the authorized track speed is 25mph to Cape Fear River Bridge (27 miles). All services evaluated in the Peer Review have an average operating speed of greater than 34mph.
	Station Parking	•	•	A new parking deck will support parking behind the station area.
RALEIGH	Station Access	•	•	A two - phase maneuver would be required for passenger trains using the Western Corridor to access and depart the Raleigh Union Station., requiring the engineer to transition between the locomotive and the cab-control car multiple times, incurring delays.
	Multi-modal Connectivity	•	•	The station is directly served by existing GoRaleigh Transit bus service. A new bus terminal was recently approved for development next to the station.
	Capacity Impacts	•	•	The current and proposed track configuration eliminates the need for trains serving the station to occupying the H-Line main tracks. Thus, there are no foreseen major capacity-related impacts in the vicinity of Raleigh Union Station.
	Operational Speeds	•	•	Along the Western Route, the authorized track speed is 25mph to Cape Fear River Bridge (33 miles). All peers studied have an average operating speed of greater than 34mph.
	Station Parking	•	•	There is existing and planned parking decks in the vicinity of Raleigh Union Station which should provide adequate parking for patrons.
SELMA	Station Access	•	•	The Selma Amtrak Station has three platforms, H-Line, A-Line, and along the connector track in the NW quadrant. Passenger trains will be able to access station platforms regardless of the A-Line/H-Line transition method chosen.
	Multi-modal Connectivity	•	•	If the H-Line platform is utilized, it is possible that trains serving the platform could foul the A-Line (block the tracks or impact signals requiring trains to stop), requiring operational changes for trains utilizing the A-Line to reduce delays.
	Capacity Impacts	•	•	The complex maneuver to transition between the A and H-Lines would require multiple stops and starts to serve the Selma Amtrak Station.
	Operational Speeds	•	•	Transitioning between the A-Line and the H-Line would require a complicated and time consuming two or three phase maneuver. This maneuver would require the engineer to walk between the locomotive and the cab-control car on multiple occasions, adding to the time required to conduct the maneuver.
	Station Parking	•	•	Parking is available at the station and potentially on an adjacent parcel.

OPINION OF PROBABLE COST

In order to provide a reasonable service scenario, improvements to tracks on both routes and station improvements - including in some cases constructing a new station - are described in this section of the operations chapter. Note that land acquisition costs are not included, since land acquisition costs vary greatly even within the same general station area. The assumptions below are followed by opinions of probable costs for (first) track and second station-area improvements.

ASSUMPTIONS AND PREVAILING CONDITIONS

WESTERN CORRIDOR

The NS VF-Line and NS-Lines are single-tracked with a total of five sidings ranging in length from approximately 1,127 feet to 3,200 feet spaced approximately 10 miles apart.

The corridor is primarily FRA Class 2 track with a maximum authorized track speed of 25mph for freight and 30mph for passenger trains. Class 3 track, which allows for a maximum passenger train speed of 60 mph, is proposed.

An average of 1-2 freight trains operate along the Western Corridor each day. Train volumes are not expected to increase along either segment of the Western Corridor, and it is assumed that current or future freight trains will be no longer than one mile in length.

Undesirable delays will be incurred during the transition between the VF-Line, AE-Line, and A-Line in Downtown Fayetteville without infrastructure improvements to address the multi-phase transition to access the Fayetteville Amtrak Station.

EASTERN CORRIDOR

The CSX A-Line segment of the Eastern Corridor extends 48.7 miles from the Selma Station to the Fayetteville Station. This section includes 23.6 miles of double track, comprised of six sidings from 2.4 to 10.9 miles in length, with the latter extending beyond Fayetteville into Hope Mills. The sidings are spaced on average 4.5-miles apart. The line supports approximately 30 freight trains per day and six Amtrak trains (3 round trips) per day. CSX expects an increase in intermodal train volumes due to the opening of the Carolina Connector intermodal facility in Rocky Mount.

The Norfolk Southern (NS) H-Line portion of the Eastern Corridor from Raleigh to Selma is primarily single-track. There are four existing sidings ranging from 0.7 to 3.4 miles in length, and train volumes average 8 – 12 trains per day including four Amtrak trains (two round trips; *source: 2009 Norfolk Southern Piedmont Division timetable*). Train volumes are not anticipated to increase considerably along the section of the H-Line between Raleigh and Selma, and it is assumed there is enough capacity to accommodate an initial implementation of passenger service between Raleigh and Fayetteville. Other capacity improvements may need to be implemented to accommodate additional round trips.

Additionally, it is anticipated that the Durham-Wake Commuter Rail service will likely be implemented prior to the Raleigh-Fayetteville service. Thus, capacity improvements to the H-Line would likely be completed as part of Durham-Wake Commuter Rail service implementation.

The A-Line and H-Line currently have track geometry to support maximum passenger train speeds of 79-mph and Positive Train Control (PTC) is currently operable on the entire Eastern Corridor.

Transitioning between the A-Line and the H-Line in Selma will incur unacceptable delays without infrastructure improvements to simplify the multi-phase maneuver required for trains to travel between the two lines.

WESTERN CORRIDOR TRACK IMPROVEMENTS

Based on expected train volumes and existing capacity, track improvements are recommended throughout both corridors. Additional studies including Rail Traffic Control (RTC) modeling will be required at a later phase to refine infrastructure improvement recommendations.

Timber and Surfacing (T&S). T&S consists of upgrading the track infrastructure; replacing and upgrading ties, installing higher strength track, and improving the vertical profile and superelevation to accommodate higher track speeds. The T&S improvements should enable the majority of the corridor to accommodate 60-mph track speeds. The corridor will continue to contain segments where 60-mph track speeds will not be attained without horizontal alignment modifications. All track will be upgraded from 115-lb to 136-lb rail with timber ties.

Siding Extensions. Four of the five existing sidings will be extended to one mile in length in order to enable the sidings to accommodate all expected freight trains and allow passenger trains to pass. New siding track will consist of 136-lb rail and timber ties.

Signals and Communications. Positive Train Control (PTC): there is currently no PTC along a segment of the Western Corridor, so PTC will need to be implemented along the entire corridor.

SIDING LOCATION	LENGTH (MI.)	NOTES
McCullers	0.46	
Kipling	0.78	*(1) The existing siding at Kelly Springfield automotive is used for storing railcars to and from the tire plant. New siding proposed.*
Setner	0.70	
Kelly Springfield [1]	1.0	

Fayetteville-area Improvements (VF-Line/AE-Line/A-Line Transition). Fort Bragg Lead Connector Track will need to be constructed to simplify access to the Fayetteville Amtrak station from the Western Corridor. As late as 2015 improvements were proposed under STIP Project P-4901 (Fort Bragg Lead Connector Track) including 1,310-foot connector track in the western quadrant of the AE-Line/A-Line interlocking; 120-foot single track bridge over Cross Creek; and two new interlockings along the AE and A-Lines. The connector track will allow trains along the western corridor to directly access the A-Line into Fayetteville Amtrak Station. A reverse move will still be required when arriving and departing the Fayetteville Amtrak Station if an additional platform is not constructed.

COST CATEGORY	OPINION OF PROBABLE COSTS
NS & VF-Line Siding Extensions, Timber & Surfacing, and Signals	$93,082,000
Fayetteville Area Improvements (Ft. Bragg Lead Connector Track)	$7,826,000
TOTAL ESTIMATED COST(MILS.)	**$100.9**

EASTERN CORRIDOR TRACK IMPROVEMENTS

Track and Structures and Siding Extensions. Along the A-Line siding extensions are proposed to eliminate the majority of the single-track segments. Additionally, siding extensions are recommended, which will make the H-Line completely double-tracked from west of Clayton to Selma. Siding extensions will consist of 136-lb rail with concrete ties. New double crossovers will be installed at the current end of each siding to improve seamless passing maneuvers. The table below summarizes the siding extensions.

SIDING LOCATION	LENGTH (MI.)	LINE / OPERATOR	NOTES
Wake - Clayton (1)	1.4	H (NS)	*(1) Includes widened bridge over Old US 70 (MM H95.2)*
Clayton to Powhatan	3.9	H (NS)	*(2) Includes new parallel structure over the Neuse River (MM H106.5) and widened bridge over Mill Creek (MM H108.1)*
Wilsons Mills to Selma (2)	7.3	H (NS)	
S. Beard - S. Godwin	7.1	A (CSX)	*Includes widening of Mingo Swamp (MM A181.33) and Stoney Creek (MMA185.76) Bridges*
Kay - N. Wade	4.2	A (CSX)	
N. Dunn - Alaska (3)	8.9	A (CSX)	*(3) Neuse River Bridge (278-feet) is not recommended for double-tracking. Will result in a short single-track segment with two new interlockings.*
N. Smithfield - Four Oaks (4)	7.6	A (CSX)	

Crossing Improvements. There are six single-track bridges carrying the A-Line over rivers and streams. Only bridges shorter than 250 feet in length along the A-Line will be double-tracked; Mingo Swamp [60 feet] and Stoney Creek [35 feet]. Along the H-Line, three bridges will be widening or have a double-track added; Old US 70 (51-feet), Neuse River (306-feet), and Mill Creek (72-feet). Additionally, 48 at-grade crossings (42 public and six private) will need to be modified (gates, flashers, bells, and roadway panels) due to siding extensions. PTC will need to be updated as the sidings are extended, the line is converted to double track, and new interlockings (automated switches and signals) are added. The current ends of each siding will be converted to new double crossovers and be designated as new interlockings.

Selma-area Improvements (H-Line/A-Line Transition). Two options were evaluated to improve the efficiency of the H-Line/A-Line transition in Selma.

Option 1 – Loop Track (Design Speed of 10mph). Construct a new 3,220-foot long loop track in northeast quadrant of Selma Interlocking; realigned 3,300-foot long connector track long new location; two new at-grade crossings of Anderson Street; and removal of existing connector track in northeast quadrant of Selma Interlocking. This loop option would not require any reversing movements. Realigned connector track would facilitate existing transition between the A-Line (north of Selma) and the H-Line (east of Selma).

Option 2 – Siding. New 2,590-foot long siding along A-Line in the northwest quadrant of Selma Interlocking; existing connector track would be modified to tie into the siding instead of the western-most track of the A-Line. The siding would provide direct access to the curved platform along the north side of Selma Union Station. Trains would park in the siding, ensuring the mainline tracks are not blocked on either line as the engineer transitions between opposite ends of the train. This converts the current three-phase maneuver to a two-phase maneuver to transition between the A and H-Lines.

COST CATEGORY	OPINION OF PROBABLE COSTS	
	OPTION 1 (LOOP)	OPTION 2 (SIDING)
A-Line Siding Extensions, Signals, and Structures	$164,076,000	
Selma Area Improvements	$10,769,000	$4,670,000
TOTAL ESTIMATED COST(MILS.)	**$174.8**	**$168.7**

EQUIPMENT AND STATION AREA IMPROVEMENTS

Operating equipment on both ends of the train is required due to lengthy backing maneuvers. These maneuvers would require either a cab-control car or an additional locomotive. As previously noted, the service frequency has not been determined, so it is assumed that one train set will be acquired for this phase and be utilized for multiple, daily round trips. Since the passenger service type (commuter v. regional intercity) has not be determined both commuter and regional intercity passenger equipment is considered.

Equipment. Proposed trainset configuration will enable trains to operate in either direction. For commuter service: one locomotive, two bi-level coach cars, and one coach-cab car (occupancy per car:127 - 142). For intercity service: one locomotive , three coach cars, and one locomotive (occupancy per car: 55 – 65). NCDOT Piedmont passenger trains operate in a similar configuration using intercity passenger equipment.

EQUIPMENT CATEGORY	OPINION OF PROBABLE COSTS*	
	COMMUTER	REGIONAL
Locomotive (Siemens Charger)	$7mil.	$14mil.
Coaches and Cab	$10mil.	$13.5mil.
TOTAL ESTIMATED COST(MILS.)	**$17**	**$27.5**

**Equipment cost estimates provided by NCDOT Rail Division and contingency numbers are assumed to be included in these costs.*

Stations. For station costs, it was assumed that GoTriangle Transit Durham-Wake Commuter Rail will extend service to Clayton as part of its Phase 1 implementation. It is also assumed commuter service will be implemented prior to initiation of Raleigh-Fayetteville Passenger Rail service. Commuter stations locations east of Raleigh have not been finalized but are assumed to be at Raleigh – South (vicinity of I-40); Downtown Garner; Garner – East (near the Auburn-Knightdale Road); and Clayton (Near NC 42). Raleigh to Fayetteville trains will serve the Garner-East and Clayton Stations proposed as part of the GoTriangle Transit Wake-Durham Commuter Rail service.

Fayetteville Amtrak Station: A second platform is proposed at the Fayetteville Station to provide flexibility dispatching trains along the double-tracked section of the A-Line through Fayetteville. As noted, detailed location and site assessment studies have not been conducted and actual property acquisition costs have not been calculated. The Amtrak *Station Program and Planning Guide* was used to develop station component recommendations from ridership projections (see Figure 18 for description of station types; Figure 19 for summary).

STATION CATEGORY	PROJECTED ANNUAL RIDERSHIP	Amtrak Station Program and Planning Guide Notes
Category 1: Large	400,000+	*Stations serve the centers and edges of large urban areas, and are highly integrated with supporting public transportation systems. These stations are typically the heart of urban and regional multi-modal transportation networks, are staffed to provide ticketing and support services, and often include significant retail space or transit oriented development surrounding the station. Terminal stations are often Category 1.*
Category 2: Medium	100,000 to 400,000	*Stations are staffed and serve a wide variety of communities, and also have significant variability in rail service type and program function. Category 2 Stations are primarily oriented to State Corridor service, or major destinations along Amtrak's Long Distance services, and have ticket offices and minimal staff.*
Category 3: Caretaker	20,000 to 100,000	*Stations are not staffed by agents, but include an interior waiting facility, with restrooms, that is opened, closed, and maintained by staff. Ticketing provided through self-service Quik-Track ticketing.*
Category 4: Shelter	Less than 20,000	*Stations are not staffed and include only a shelter and/or platform canopy to protect passengers from the weather. Ticketing provided through self-service Quik-Track ticketing.*

FIGURE 18. DEFINITION OF STATION CATEGORIES (source: Amtrak *Station Program and Planning Guide*)

SUMMARY OF STATION AREA IMPROVEMENTS

STATION LOCATION	AMTRAK STATION CATEGORY	OPINION OF PROBABLE COST (MILS.)[1]	NOTES
Fayetteville-Center	3	*$10.1*[3]	*Existing Station – Second platform recommended. Dual platform provides CSX with flexibility in dispatching trains. Grade separated connection allows safe circulation for patrons between platforms and station building.*
Raleigh	2		*Existing Station – No modifications recommended*
EASTERN CORRIDOR STATION IMPROVEMENTS (Total: $16.3 million)			
Dunn	4	*$3.1*[4]	*New Station - Shelter and platform recommended*
Benson	4	*$3.1*[4]	*New Station - Shelter and platform recommended*
Selma	3		*Existing Station – No modifications recommended*
Clayton	4	*Built by others*	*New Station - Shelter and platform recommended. Station will be co-located with GoTriangle Wake-Durham Commuter Service Clayton Station.*
Garner-East	3/4[2]	*Built by others*	*New Station - Shelter and platform recommended*
WESTERN CORRIDOR STATION IMPROVEMENTS (Total: $29.7 million)			
Fayetteville – North	4	*$3.1*[4]	*New Station - Shelter and platform recommended*
Lillington	4	*$3.1*[4]	*New Station - Shelter and platform recommended*
Fuquay-Varina	3	*$7.2*[5]	*New Station - Station with interior waiting and restrooms recommended. Platform, station building, site access, and parking.*
Wake Tech/NC540	3 /4[2]	*$3.1*[4]	*New Station - Shelter and platform recommended*
Garner West	3 /4[2]	*$3.1*[4]	*New Station - Shelter and platform recommended*

FIGURE 19. SUMMARY OF OPINION OF PROBABLE COSTS FOR STATIONS

NOTES FOR FIGURE 19

[1] Estimated costs are based on active or recently completed station projects of similar scale.

[2] Station boarding estimates meet criterion for Category 3 station. Station would likely act as more of a commuter-style station due to location, thus Category 4 Station is recommended.

[3] Kannapolis, NC Amtrak Station modifications are of similar scope and scale.

[4] FTA Capital Cost Database (www.transit.dot.gov/capital-cost-database) – Reference Minneapolis NorthStar Commuter Rail. Estimate may not include actual property acquisition costs.

[5] Cost estimate based off NCDOT 2020-2029 STIP Project #P-5701 (New Hillsborough Train Station) cost estimate. NCDOT noted cost is being revised and will be updated based off updated design.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

PRELIMINARY RIDERSHIP FORECASTS

In order to better understand the viability of the proposed service and potential differences along the two route alternatives, a high-level forecast of ridership estimates was produced. These estimates made a number of assumptions about the service, improvements discussed in the operational assessment previously, and future population, employment, and travel patterns.

KEY TAKEAWAYS

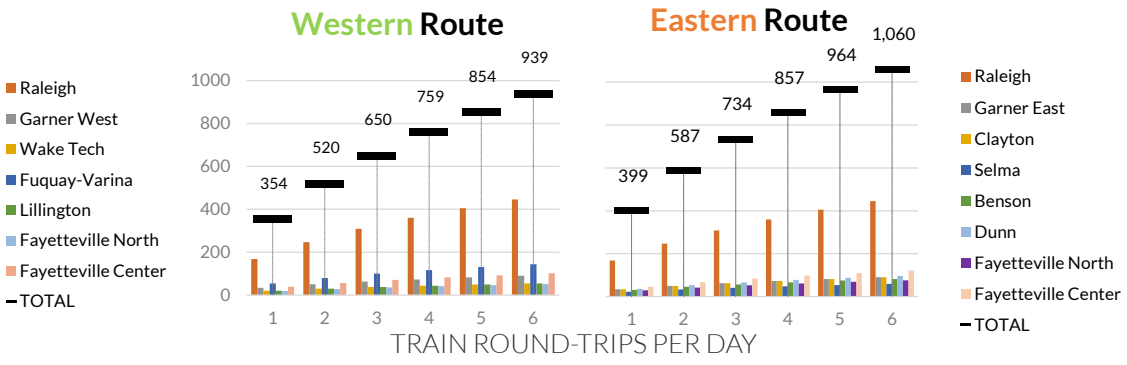
1 To forecast station-level boarding counts, the research team first applied an existing direct demand model of boarding estimates for commuter rail in the corridors based on Transit Cooperative Research Program (TCRP) Report 16 and a 2006 update. However, generalizing these models to the current corridors is problematic, as the TCRP study was based on older data from more-established, highly connected rail services. Based on feedback from project stakeholders, the envisioned concept was a passenger rail service similar to state-supported Amtrak. Therefore, a new model based on nationwide experiences of Amtrak services was developed and applied to generate boarding forecasts.

2 Driving will generally remain a dominant choice for trip-making unless a superior alternative in time, comfort, or cost is provided. A transit system must offer an advantage over the automobile in some way to be selected as an alternative. Few American transit systems can offer an actual time advantage over the automobile, even in congested conditions. But thanks to wireless and internet services, longer travel times are less important than they used to be as attention previously spent driving can now be spent working (or sleeping). A transit service that is both comfortable and comparable to automobile travel can be a very attractive alternative.

3 Employment within a 10-minute drive of the station, number of weekly trains, walkability, and population density within 20 minutes of the station had positive effects on boardings. The ridership model chosen is most sensitive to the number of trains (frequency) in service, but anticipated congestion levels also play a role in the ridership forecasts.

DAILY RIDERSHIP FORECASTS

TOTAL BOARDINGS BY STATION, ASSUMING A SERVICE OF ONE OR MORE ROUNDTRIPS EACH DAY IN 2035. THE FIGURES WERE DEVELOPED FROM A SAMPLE OF 507 AMTRAK STATIONS NATIONWIDE, WHICH PROVED TO BE THE BEST MODEL AFTER SEVERAL OTHERS WERE CONSTRUCTED AND TESTED.



FORECASTING ASSUMPTIONS

For this study parking was assumed to be present at all stations; Raleigh and Fayetteville stations were presumed to be transportation centers. Travel times between points were estimated by the research team as shown in Figure 20. A large 'window' of non-operation at mid-day was assumed, suggesting an effective four-hour headway. The number of stations in the network was set to be five; connectivity with a future Raleigh-Durham commuter rail was not assumed in the forecasting model. The number of zero-car households within two miles was assumed to be constant at 8% of the total. Population and employment totals for a 2035 horizon year were modeled using 2040 socio-economic data from the North Carolina Statewide Travel Model (NCSTM). The metropolitan region was considered to consist of Wake, Cumberland, Johnston, Harnett, and Hoke Counties. Figure 20 shows how the improvements proposed in this study result in travel times assumed between each station in each direction for both studied routes; dwell times at stations are assumed to last for 30 seconds.

Station	Total Run	Station Run	Arrive	Depart	Station	Total Run	Station Run	Arrive	Depart
Northbound Western Corridor					Southbound Western Corridor				
Fayetteville	0:01:53			0:00:00	Raleigh	0:00:00			0:00:00
Fayetteville North	0:19:29	0:17:36	0:19:29	0:19:59	Garner - West	0:04:53	0:04:53	0:04:53	0:05:23
Lillington	0:48:23	0:28:54	0:48:53	0:49:23	Wake Tech	0:11:24	0:06:31	0:11:54	0:12:24
Fuquay-Varina	1:04:06	0:15:43	1:05:06	1:05:36	Fuquay-Varina	0:21:41	0:10:17	0:22:41	0:23:11
Wake Tech	1:14:25	0:10:19	1:15:55	1:16:25	Lillington	0:36:42	0:15:01	0:38:12	0:38:42
Garner - West	1:20:55	0:06:30	1:22:55	1:23:25	Fayetteville North	1:05:40	0:28:58	1:07:40	1:08:10
Raleigh	1:25:50	0:04:55	1:28:20		Fayetteville	1:24:32	0:18:52	1:27:02	

Station	Total Run	Station Run	Arrive	Depart	Station	Total Run	Station Run	Arrive	Depart
Southbound Eastern Corridor					Southbound Eastern Corridor				
Fayetteville	0:00:00			0:00:00	Raleigh				0:00:00
Fayetteville North	0:09:15	0:09:15	0:09:15	0:09:45	Garner	0:08:40	0:08:40	0:08:40	0:09:10
Dunn	0:25:08	0:15:53	0:25:38	0:26:08	Clayton	0:16:57	0:08:17	0:17:27	0:17:57
Benson	0:30:31	0:05:23	0:31:31	0:32:01	Selma Station	0:29:04	0:12:07	0:30:04	0:30:34
Selma Station	0:51:21	0:20:50	0:52:51	0:53:21	Benson	0:50:10	0:21:06	0:51:40	0:52:10
Clayton	1:03:34	0:12:13	1:05:34	1:06:04	Dunn	0:55:30	0:05:20	0:57:30	0:58:00
Garner	1:11:52	0:08:18	1:14:22	1:14:52	Fayetteville North	1:11:16	0:15:46	1:13:46	1:14:16
Raleigh	1:21:10	0:09:18	1:24:10		Fayetteville	1:20:31	0:09:15	1:23:31	

FIGURE 20. ROUTE TRAVEL TIME ASSUMPTIONS.

The research team developed several boarding forecast models. The model assumptions and outcomes are discussed briefly in the following pages.

AMTRAK POPULATION DIRECT DEMAND MODELS

Because of the limitations of the TCRP 16-based model and data, the consulting team developed new direct demand models using data from existing Amtrak routes. This approach used a cross-sectional research design to construct direct demand models that incorporate built environment and transportation system data to determine which variables effectively predict ridership. Data from the Decennial Census, the American Community Survey, and the Longitudinal Employer-Household Dynamics (LEHD) program were used to calculate density, diversity, and design variables. Following published literature, the project team measured built environment characteristics at different distances around each station for each variable. To prevent endogeneity (double-counting) between buffer totals, larger buffers are broken into 'donuts' around the central buffer.

The statistical modeling approach used was an incremental additive approach, specifying a model with no variables initially and then iteratively adding new variables, then re-testing the model using all previous variables. During each iteration, the variable that most improved the model's explanatory power was added or removed. The Amtrak population model is superior to the TCRP model in the number / relevancy of samples, variables tested, regression specification, significance of relationships, and overall explanatory power of the model (R-square). The greater number of variables provide better measures of the actual drivers of ridership, rather than on variables that are merely correlates.

Amtrak Population-NC Model. Given that the outcome variable for the model is boarding counts, the project team obtained boarding counts (annual) for all Amtrak stations in North Carolina, South Carolina, and Virginia (14 stations). Due to the small sample size, only a limited number of variables were feasible to be tested. Based on inputs from the literature, population and employment within a half-mile were expected to be the most significant predictors. Each proved independently, but not jointly, significant. For the 14 stations sampled, using population as a predictor variable generated the results with the most explanatory power.

Amtrak Population-National Model. The project team obtained boarding counts (annual) for 507 Amtrak stations to develop a model based on a national data set. Predictor variables included both built environment and transportation system characteristics. In total, 38 variables were collected, calculated, and analyzed for statistical significance. Station area characteristics in the forecast model are described by the '7D" variables outlined by Reid Ewing and other practitioners on the Metro Analytics research team (Figure 21). Each variable may explain a part of the choice of using the station and service. This model proved to be the most rigorous of those created, and was chosen to provide the boarding forecasts used in this study.

Model testing helped explain some, but not all, of the relationships between variables. Employment within a 10-minute drive-time of the station, number of weekly trains, Walkscore and population density within 20 minutes of the station had the expected positive effect on boardings. The number of Amtrak lines at the station and employment density within a 10-to-20-minute drive-time had a counterintuitive negative effect.

AMTRAK POPULATION / NATIONAL MODEL VARIABLES TESTED

AT 10-MINUTE, 20-MINUTE, AND 30-MINUTE 'DONUT' DRIVE-TIME ISOCHRONES:

- POPULATION & POPULATION DENSITY
- EMPLOYMENT & EMPLOYMENT DENSITY 'DONUTS'
- ACTIVITY DENSITY (POPULATION+ EMPLOYMENT
- JOB-POPULATION BALANCE
- THREE- AND FOUR-WAY INTERSECTIONS PER ACRE; PERCENT FOUR-WAY INTERSECTIONS

ALSO:

LOCATION IN A METROPOLITAN AREA, MICROPOLITAN AREA OR NON-METRO AREA WALKSCORE COUNT OF WEEKLY TRAINS, NUMBER OF AMTRAK ROUTES SERVING THE STATION PRESENCE OF PARKING BUS, LIGHT RAIL, METRO (SUBWAY/ELEVATED), AND COMMUTER RAIL CONNECTIONS KILOMETERS TO NEAREST AMTRAK STATION ACRES OF 'HINTERLAND' NEAR EACH STATION STATUS AS A TERMINAL STATION

7D VARIABLE	DESCRIPTION OF APPLICATION IN MODEL
DENSITY	Density is a spatial measure of the amount of population and jobs. The model was calibrated using the most recently available data for population and employment, as provided by ESRI though ArcGIS online. Using ArcGIS online made it possible to collect data in terms of drive time accessibility, in three ten minute increments: 10, 20, and 30 minutes. Also modeled was activity density, which is the sum of population density and employment density. The most recently available public data sources were the 2017 American Community Survey (ACS) and the 2017 Longitudinal Employer-Household Dynamics (LEHD). Future year estimates of population and employment were based on the information contained in the NC Statewide Travel Demand Model.
DIVERSITY	Diversity measures pertain to the number of different land uses in a given area and the degree to which these are balanced in land area, floor area, or employment. Diversity refers to the mix of uses. The project team modeled this as the jobs to population ratio, calculated as: 1- [ABS(employment-0.2*population)/(employment+0.2*population)].
DESIGN	Design refers to 'Urban Design', which uses street network characteristics average block size, proportion of four-way intersections, and number of intersections per square mile. Following published peer reviewed literature, the project team operationalized this using Walk Score and intersection density within a half-mile of stations; data for the number of four-way intersections and the share of four-way intersections was collected.
DESTINATION ACCESSIBILITY	Destination accessibility measures the ease of access to trip attractions. It may be regional or local. This analysis relies on the analysis of population and employment density accessible within a 10-, 20-, and 30-minute drive-time to each station to represent accessibility.
DISTANCE TO TRANSIT	Distance to transit is usually measured as an average of the shortest street routes from the residences or workplaces to the nearest rail station. Analysis of existing Amtrak service suggests that while neither route distance nor mean speeds strongly correlate with ridership, the number of trains per day is relevant. There is tremendous variability for trains that come only once a day, suggesting other factors play a significant role.
DEMAND MANAGEMENT	Demand management represents additional (financial) costs of travel. It tends to be measured in terms of tolls, fares, and (especially) parking prices. At this time, no demand management variables (tolls, congestion pricing, parking) have been included in this model. Parking is assumed to be free or priced low enough to be a non-factor in determining mode choice.
DEMOGRAPHICS	Demographics refer to socioeconomic characteristics of persons or households. The model does not currently include any demographic variables because matching variable definitions between the Census and the NCSTM travel model proved infeasible.

FIGURE 21. DESCRIPTION OF "7D" MODEL VARIABLES AND APPLICATION IN AMTRAK MODEL.

DIRECT DEMAND MODELS

DIRECT DEMAND MODELING WAS FIRST ENVISIONED BY THE RAND CORPORATION IN THE LATE 1960'S, AND HAS SINCE BECOME AN ESTABLISHED METHOD FOR DEVELOPING SKETCH PLANNING-LEVEL ESTIMATES OF RAIL RIDERSHIP. IN GENERAL, DIRECT DEMAND MODELS USE STATION-AREA CHARACTERISTICS FROM OTHER SERVICES AND TRANSFERS THE RELATIONSHIPS BETWEEN THOSE STATIONS TO THE PROPOSED STATION AREAS. DENSITY OF POPULATION AND EMPLOYMENT; DIVERSITY OF NEARBY LAND USES; DESIGN / ACCESSIBILITY; DISTANCE TO TRANSIT; AND MANAGEMENT OF DEMAND (TOLLS, FARES) CAN PLAY A PART IN A "7-D" MODEL.

FORECASTING OUTCOMES

BOARDING FORECASTS

The Amtrak Population-National model for this study was applied by multiplying the coefficients by the values for each variable for each station, summed and both sides exponentiated then divided by 365 to get average daily ridership. Model outcomes assume that Walk Scores will remain constant over time. The two models can also be used to test scenarios. The models disagree which corridor would generate more ridership. The Amtrak-based model is more sensitive to land use, while the update to the TCRP model is more sensitive to travel time.

The results are not perfectly comparable (Figure 22), as each model was provided with different 'training' data. The Amtrak-based national model draws on data from over 500 Amtrak stations, but does not include variables to control for travel times. The Amtrak model is intended for a service comparable to an extension of the Piedmont Amtrak service, but other variables impact ridership as explained below.

Frequency of Service. While capacity on the train for passengers is not important given the baseline forecasts and proposed train sets, additional trains per day increase both convenience and reliability for passengers. Research indicates that each additional train has a diminished impact on the number of riders: going from one to two trains per day results in an important increase in ridership; going from two trains to three trains per day is less important. The impact of train frequency is captured in Figure 22, and is based on research reviewed by Todd Litman of the Victoria Transport Policy Institute (2019) who found an elasticity of service frequency-to-ridership of 0.5 (an elasticity of 0.5 means that ridership changes at half of the same percentage as service frequency - doubling frequency increases ridership by 50%). Others have reported higher values, but the types of service and locations make those studies less applicable.

Traffic Congestion. Over time, roadway congestion along highway corridors between Fayetteville and Raleigh will increase, thus increasing automobile travel times. Based on an assessment of both the Triangle Regional and NC Statewide travel demand models, the west corridor (US 401) can expect to see a 21% increase in congestion, while alternative eastern routes (NC 50, US 70, I-40) an average of 7% congestion increase through 2040 (the closest model year to the 2035 horizon year used in this analysis). Using low (0.10) and high (0.30) elasticities the total impact to ridership is modest, between 2% and 6%. Figure 22 uses a mid-point average of these low- and high-elasticity values for congestion to report forecasted boardings by station, route, and number of train roundtrips per day.

BOUNDING THE FORECASTS

Future forecasts of transit ridership are inherently uncertain for many reasons, both from the assumptions being used failing to come to fruition or "exogenous" reasons like the price of fuel changing or cultural preferences for lifestyles and travel choices. Most of these variations are captured in the 7D and elasticity adjustments, but an additional variation of 3.9% was used in the forecast "bounding" exercise based on Amtrak North Carolina station ridership variations between 2016 and 2018 (three years).

The reality lies within the extreme bounds represented by the range in the factors chosen by the analyst. Therefore, it is advisable to consider higher and lower bounds to account for this uncertainty, with the intention that a single forecast value is accompanied by a range that the forecast will likely fall within. Figure 23 illustrates graphically the range in forecast variation for the Western Corridor (similar bounds would apply to the Eastern Corridor), including assumptions about the impacts of frequency of service, typical observed ridership variation (annual - daily variation is approximately 15%), and automobile congestion.

Eastern Corridor	Trains per Day					
Station	1	2	3	4	5	6
RALEIGH	168	247	309	360	405	446
GARNER EAST	34	50	62	73	82	90
CLAYTON	34	50	62	73	82	90
SELMA	22	33	41	48	54	59
BENSON	31	45	57	66	74	82
DUNN	36	53	66	77	87	96
FAYETTEVILLE NORTH	29	42	53	62	69	76
FAYETTEVILLE CENTER	46	67	84	98	110	121
TOTAL BOARDINGS	**399**	**587**	**734**	**857**	**964**	**1,060**

FIGURE 22. AMTRAK MODEL BOARDING FORECASTS (2035) USING FREQUENCY ELASTICITY OF 0.5 AND A MIDPOINT CONGESTION SENSITIVITY VALUE (4% INCREASE)

Western Corridor	Trains per Day					
Station	1	2	3	4	5	6
RALEIGH	168	247	309	360	405	446
GARNER WEST	34	50	62	73	82	90
WAKE TECH CAMPUS	20	30	37	43	49	54
FUQUAY-VARINA	54	80	100	116	131	144
LILLINGTON	20	30	37	43	49	54
FAYETTEVILLE NORTH	19	28	35	41	46	51
FAYETTEVILLE CENTER	38	56	70	82	92	102
TOTAL BOARDINGS	**354**	**520**	**650**	**759**	**854**	**939**

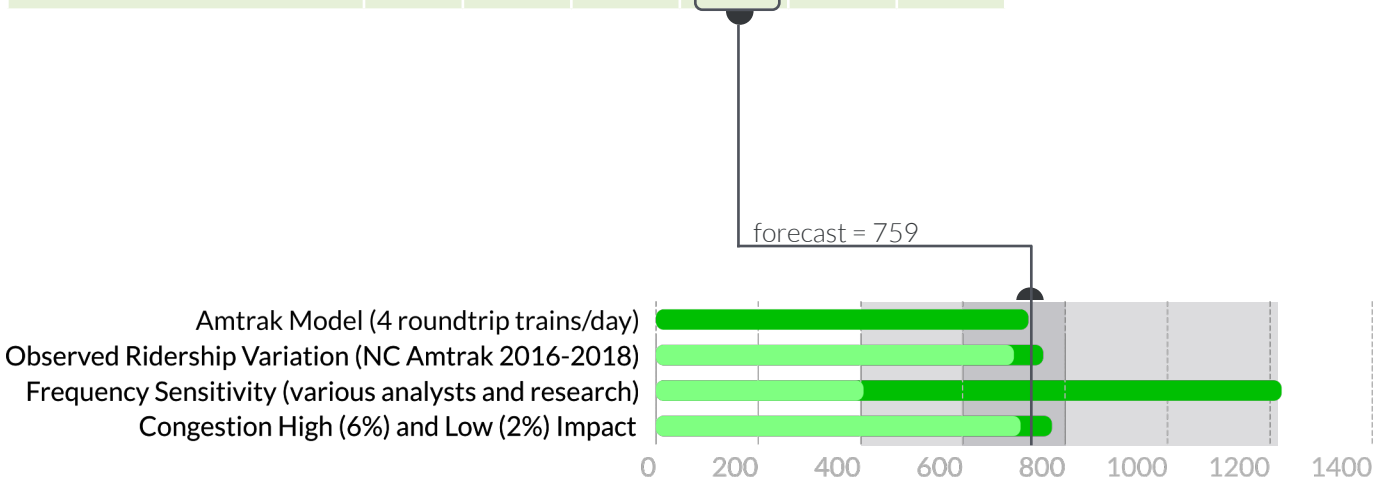


FIGURE 23. FORECAST VARIATION IN WEST CORRIDOR RIDERSHIP (FOUR TRAINS /DAY)

Since the research considered an array of forecasting assumptions, it was possible to graphically represent the variation in the corridor forecasts (in this case, for the Western Corridor at four trains per day). Variation from different sources of potential error are represented by the dark green ("optimistic") bars, and light green ("pessimistic") bars. The gray-shaded boxes laid over the top of both graphs illustrate confidence bands for the forecast (approximately 600 to 800 riders per day for the smaller, darker band, and 400 to 1,200 for the larger, lighter-gray band) of four trains per day in the Western Corridor. A similar study of the Eastern Corridor would show a very similar range shifted slightly to the right to account for the higher "base" ridership forecast.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

ECONOMIC ASSESSMENT

The final section of the project report relies upon both operational improvements and the resulting ridership forecasts to produce a summary of the impacts to the communities in the two rail corridors. Qualitative and quantitative results are described, particularly the inputs of a focus group conducted on May 19, 2020.

ECONOMIC FOCUS GROUP PARTICIPANTS

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J. Scott Lane, Metro Analytics
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KEY TAKEAWAYS

1

The Economic Focus Group held on May 19, 2020 stated that the passenger rail service could provide economic benefits to several key communities along both the Eastern and Western Corridors in several respects.

- The proposed passenger rail service would serve to provide relief to congested highways, thus providing a quality-of-life benefit.
- The proposed passenger rail service could spark Transit-Oriented Development (TOD) near the corridors and proposed stations, potentially jump-starting stagnant growth in areas that haven't seen the same relatively high rates of growth as central cities. This TOD could provide local employment opportunities, new business opportunities, and provide nearby residents retail and commercial service opportunities.
- The proposed passenger rail service would better connect the Region to those who might not have reliable transportation, providing job, health, and education opportunities to citizens and aid commutes to major employers like Ft. Bragg, Goodyear, Food Lion, and others.
- The Eastern Corridor could open up the region for possible connection to Wilmington and points east further expanding opportunities for growth.

2

The estimated benefits from the proposed service are unlikely to offset costs if the current economic context and trends remain the same. The economic payoff from the Raleigh-Fayetteville service could be significantly enhanced if the proposed rail investment were integral to a wider service/industry business-cluster economic development strategy.

ECONOMIC IMPACT ASSUMPTIONS

ASSUMPTIONS ABOUT POTENTIAL BENEFITS

The objectives of this study are to create a clearer understanding of the existing and future conditions to support intercity passenger rail service between Fayetteville and Raleigh. Connecting these areas could benefit travelers in multiple ways.

- Increase the reliability of personal travel by offering another option to the congested US 401 and I-40 corridors.
- Increase mobility choices for citizens that may have unreliable or no access to a private automobile.
- Increase capacity between two of the largest cities in North Carolina along a corridor that is rapidly developing both residentially and commercially.
- Provide additional mobility for residents along the studied routes, including Fort Bragg (which flies personnel into RDU now), and Wake Harnett, Cumberland and Johnston counties.

ASSUMPTIONS ABOUT CORRIDORS

The Western Corridor extends primarily 61.5 miles between the Fayetteville Amtrak Station and Raleigh Union Station. It consists primarily of the NS VF-line between Fayetteville and Fuquay-Varina and the Norfolk-Southern (NS) line between Fuquay-Varina and Raleigh. Trains operating along this corridor will also use portions of the CSX AE and A-Lines to access the Fayetteville Amtrak Station and portions of the NS H-Line to access Raleigh Union Station. The 75.5-mile-long Eastern Corridor consists of the CSX A-Line between Fayetteville and Selma and the NS H-Line between Selma and Raleigh. Improvements in these two corridors made travel times (in 2035) relatively comparable to automobile travel, about 1:20 to 1:40 minutes.

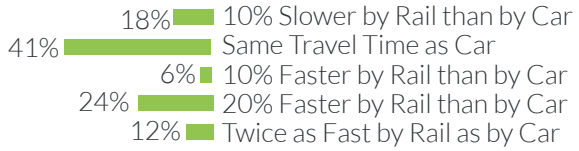
INPUT FROM THE ECONOMIC FOCUS GROUP

The evaluation of this line focuses on four primary purposes, economic feasibility, design and concept, fatal flaw assessment, and future actions. In addition to supporting or amplifying the outcomes of these earlier tasks, the economic impact assessment in this section also summarizes proceedings of and present the findings of the Economic Focus Group teleconference held on May 19th, 2020.

While the corridors of the Raleigh-Fayetteville Passenger Rail Study begin and end in the cities of Raleigh and Fayetteville, several smaller communities would be served by in the proposed Western and Eastern corridors. During the Economic Focus Group, participants discussed issues related to each of those communities. Communities that were discussed along the Western Corridor include from south to north, Fayetteville, Lillington, Fuquay-Varina, Garner, and Raleigh. Communities that were discussed along the Eastern Corridor include from south to north, Fayetteville, Dunn, Benson, Smithfield, Selma, Clayton, Garner, and Raleigh.

The following pages summarize the highlights of the Economic Focus Group teleconference and comments received.

On November 21, 2019 the Technical Steering Committee was asked, "*What travel time for passenger rail do you think would make 5% (1 out of 20) travelers to the furthest point from your community (or the community closest to you) switch over to rail?*"



THE MAY 19, 2020 ECONOMIC FOCUS GROUP

QUALITATIVE ASSESSMENT

Fayetteville
As the southern termini for the passenger rail service, it is part of both the Western and Eastern Corridors. It is located approximately 50 miles southwest of Raleigh. The existing Fayetteville Amtrak Station would serve the Fayetteville community along with an additional proposed station located along the Western Corridor at the north side of Fayetteville.

During the Economic Focus Group meeting there were several comments regarding the Fayetteville area. One key theme was the proposed corridors proximity to major employers. Major employers in Fayetteville include Fort Bragg, Goodyear, and others. Participants also noted with the development of a passenger rail service, the Fayetteville area may pick up new residential development near the Western Corridor and in turn attract knowledge workers to the area. It was also noted that it would be a huge win for the regional economy to keep knowledge-based workers and give them access to both ends of the region. While it is hard to estimate quantities, it's more of a retention issue. There is a need to integrate where riders work and live. Participants believe the corrido could accommodate 10,000 or more homes with rail impacts ranging from 10%-20%. It was also mentioned by participants that the new corridor would mean an increase to the areas tax base because it would then be a Tier 1 community, and that a passenger rail service would also provide additional options for commuting. Currently, there are many residents who must work in Fayetteville because there are no other commute options to get to the rest of the Region.

While much of the discussion focused on the Western Corridor in Fayetteville, it was noted that the Eastern Corridor has value as well. As congestion on I-95 will continue to grow, a passenger rail service through this area may provide an additional option and possible relief to the congestion on the highway. The Eastern Corridor also provides a potential for regional connectivity as well. It could provide connections to Wilmington and reestablish it as a regional center.

Lillington
Lillington lies along the proposed Western Corridor and is located centrally between Fayetteville and Raleigh along the proposed Western Corridor. It was noted that Harnett County was growing, and that the passenger rail service through this area may provide an opportunity for residents to live in the area and find work outside the immediate area.

Garner
Garner is located just south of Raleigh. It lies along the path of both the Western and Eastern Corridors. No comments were directly made regarding the Garner area during the Economic Focus Group meeting, but one commenter expressed that the residents of Southeast Raleigh (adjacent to Garner's northern boundary) would benefit significantly from any potential economic improvement.

Dunn
Dunn lies along the proposed Eastern Corridor and is located approximately 23 miles northeast of Fayetteville and 33 miles south of Raleigh. It is designated as a community that would have a proposed station along the proposed Eastern Corridor. Participants in the Economic Focus Group noted that growth in Dunn is currently stagnant. However, the proposed Eastern Corridor could potentially jump-start growth in the area. The passenger rail line would provide increased connectivity to existing employers such as the Food Lion Distribution Center and Harnett Health. It would also provide increased connectivity to new households. Participants also noted that the proposed Eastern Corridor would provide relief to commuters in the area by providing options to avoid long rides in highway traffic around the Region. It also would provide commuters an option to leave the car at home when going to Raleigh for work or events. Participants also noted that it would help improve the Dunn area for long-distance commuters who would like a quieter lifestyle.

Clayton

Clayton is located southeast of Raleigh along the proposed Eastern Corridor and is approximately 47 miles northeast of Fayetteville and 14 miles southeast of Raleigh. It is designated as a community that would have a proposed station along the proposed Eastern Corridor.

Participants of the Economic Focus Group noted that this would be the end-of-the-line for proposed commuter rail line being studied by GO Triangle. Choosing the Eastern Corridor would provide redevelopment opportunities and improve the utilization of parking lots and other undeveloped areas in Clayton. In addition, it was noted that Clayton is home to a branch campus of Johnston Community College. The proposed passenger rail line could open up health and education opportunities to those without vehicles. It was also noted by the Economic Focus Group that growth trends for Clayton show population growing to 25,000 and then to 45,000 in 20 years according to current projections.

Raleigh

As the northern terminus for the passenger rail service, Raleigh is part of both the Western and Eastern Corridors. It is located approximately 50 miles northeast of Fayetteville. The existing Raleigh Union Station would serve the Raleigh community, including large concentrations of employment and residential development in and near downtown.

Participants of the Economic Focus Group noted that Raleigh could accommodate many inbound commuters. It was also noted that inbound commuters via the proposed passenger rail line would not need to worry about parking, especially downtown. In addition, it was noted that the proposed passenger rail service would improve the economic viability for southeast Raleigh area. There is a need for more jobs that pay a higher wage in that area specifically. The proposed service would also bring in more people and help to realize further opportunities for the area. There is also a sense that because of the impact of the COVID-19 pandemic that timelines for projects are being pushed further and further out. The proposed passenger rail service might, however, accelerate the revitalization of southeast Raleigh as it would spread opportunity and bring residents from outside the area into the area to work. This could bolster small businesses, encourage people to shop in southeast Raleigh, and ultimately generate interest for new businesses in the area.

Opportunities for Community Impact

Other areas discussed by the Economic Focus group during the session included both residential and commercial opportunities that the proposed passenger rail line may have for the Region.

Residential-Oriented Community Opportunities. Several topics of discussion revolved around the impacts to the region regarding residential housing incldluing the need to attract to and retain people in neighborhoods along the proposed rail service corridors, including "knowledge-worker" households. Also, of importance to the focus group was the need to attract a diverse spectrum of residents across all incomes. With the continued growth and advancement of people in technology, it was also identified by the focus group that there was a need to be competitive with other national hubs and academic arenas. The focus group also noted that the introduction of a passenger rail service to these communities may bridge a proximity gap between job opportunity and range of lifestyle options, thus improving quality of life.

Commercial-Oriented Community Opportunities. The focus group noted that the area does not necessarily need a specific new type of business, but identified higher-wage manufacturing as a general need for the area, but not necessarily a "knowledge-worker." The focus group also determined that the proposed passenger rail service could spark interest in Transit-Oriented Development (TOD) in 5 years or so, however planning for 20 years out would be too far in the future for developers to think about. However, community planners could put appropriate policy and zoning in place to preserve areas of TOD.

Another perceived opportunity by the focus group was additional retail and consumer establishments built around the station area would provide those within a 10-20-minute drive radius additional available services. The increased density would also provide opportunities for new kinds of retail. Finally, the Economic Focus Group felt that the proposed passenger rail service might attract new tech-related employers to the Fayetteville area that might go someplace else. It could allow the Fayetteville area to leverage Raleigh educational opportunities with a better connection by utilizing the passenger rail service.

QUANTIFIABLE ASSESSMENT

Under present and forecast conditions, the quantifiable undiscounted transportation performance benefits of the rail service would be approximately $28 - $85 million. These benefits include $17-8 - $55.6 million in automobile driving-cost savings and $39.6 - $123.9 million in safety/environmental savings, offset by additional travel time costs $ 30.3 - $94.6 million in additional travel time (due to the additional distance of going to a rail station and longer linear routes). It is possible that these time-costs could be reduced if amenities were available to enable commuters to work while en-route, and it could be understood how many of the passenger hours could be applied as productive working time. If travel time is simply understood as commuting time (comparable to driving time) it is unlikely that any of the alignments would yield overall transportation performance benefits at the system level when safety and vehicle operating savings are balanced against the additional travel time.

However, depending on station locations, development strategies and other factors discussed in the focus group, it is plausible that as many as 13,000 upper-middle class households could be attracted to the Region (essentially representing a 1% increase in households in each of the above-described focus areas beyond what would otherwise occur) yielding a $25.3- $78 million cumulative increase in regional GDP.

As described previously, in addition to transportation performance, the project can contribute to the regional economy by attracting households and businesses. In this way, the economic payoff from the Raleigh-Fayetteville service could be significantly enhanced if the proposed rail investment were integral to a wider service/industry business-cluster economic development strategy. Achieving the $78 million (higher end) GDP impact enabling the returns to exceed the costs would require attracting businesses and households near the upper end of the likely $25.3 million to $78 million range.

Creating a rail scenario within the context of an economic development strategy intentionally focusing business/household recruitment on station nodes would be integral to validating this potential return. Such a strategy would entail detailing station area locations and access to them throughout a preferred corridor. Access might be bundled with other specific amenities in business improvement districts, homeowner's associations or other mechanisms to leverage the amenity of inter-city non-driving connections.

Quantifiable benefits and impacts were assessed using the Transportation Regional Economic Development Information System (TREDIS), comparing transportation costs and associated conditions to the regional economy with a build in comparison to a no-build baseline. The per-trip costs are compared over a 20-year operation period and a four-year construction period. The user benefits are presented in an undiscounted form (discounting would reduce the benefits if applied in a grant setting, depending on the discount rate applied and more detailed scenario planning). The benefits and impacts shown in Figure 23 are presented from the regional perspective (counting net gains to the region even if attracted from elsewhere in the state or nation). All benefits are shown as gross benefits (not net present values) and compared to gross costs (as estimated by the scenario developed in the current study).

Regardless of the level of potential business attraction with an annual operating cost of between $30 million and $38 million per year (based on peer services, an operating cost of $500,000 per mile was used), the project would be expected to draw far more from the regional economy than it could return, unless the maximum business attraction results could be achieved with well over 90% of the operating costs borne by subsidies from outside of the region. The findings shown in Figure 24 demonstrate that transportation benefits alone are unlikely to generate returns comparable to the costs of the investment without a concerted household/business attraction strategy to leverage the amenity to attract significant new households and businesses, coupled with local, state, and federal subsidies.

Cost or Benefit Amount	Description of Economic Effect
$17.8-$55.6 MILLION	Driving Cost Savings
$49.6-$123.9 MILLION	Safety/Environmental Savings
$30.3 - $95.6 MILLION	Additional Travel Time (Rail Route is Longer than Car)
$37-$84 MILLION	**TOTAL USER BENEFIT**
$25.3- $78 MILLION	GDP From Household/ Business Attraction
$62 - $161 MILLION	**TOTAL ECONOMIC RETURN**
$129 - $175 MILLION	Total Capital Cost
$600 - $770 MILLION	Total Operating Cost
$667 - $783 MILLION	**TOTAL CUMULATIVE ECONOMIC COST**

FIGURE 24. VALUE OF ECONOMIC IMPACTS FROM PROPOSED RAIL SERVICE (CURRENT DOLLARS)

CONCLUSIONS FROM ECONOMIC IMPACT ASSESSMENT

Several keys findings and themes were determined during the Economic Focus Group held on May 19th, 2020. It's important to note that this assessment is not a revenue or user-cost study, but an economic assessment of the rail service and some downstream impacts.

Some of those key findings and themes can be generalized as follows.

- The proposed passenger rail service could provide economic benefits to several communities along both the Eastern and Western Corridors.
- The proposed passenger rail service would serve to provide relief to congested highways, thus providing a quality of life benefit.
- The proposed passenger rail service could spark Transit-Oriented Development (TOD) near the corridors and proposed stations. This TOD could provide local employment opportunities, new business opportunities, and provide nearby residents retail and commercial service opportunities.
- The proposed passenger rail service would serve to better connect the region and open travel in the region to those who might not have reliable transportation. It could provide job, health, and education opportunities citizens of the region as well, connecting the region to medical and academic facilities throughout the region. It could help workers commute to major employers, such as Ft. Bragg, Goodyear, Food Lion and others in the area.
- There are plenty of areas for residential housing opportunities and future development along both the Eastern and Western Corridors.
- The Eastern Corridor could open up the region for possible connection to Wilmington and points east further expanding opportunities for growth.
- The proposed passenger rail service could potentially jump-start areas of stagnant or declining growth along the corridors.
- The quantified benefits, while not offsetting costs in the short term after the service opens, are very high-level and could be substantially higher with more aggressive policies fostering transit-oriented development and accessibility to station areas. Regardless, substantial subsidies will be required to finance the operations.

PASSENGER RAIL SERVICE FEASIBILITY STUDY

APPENDIX A. FUTURE WORK

This appendix contains a suggested scope of work for completing the next phase of work to develop the passenger rail service into an implementation-oriented process.

KEY POINTS

1 Administration. This project should be led or co-led by NCDOT to help facilitate discussions with private rail companies and Amtrak and provide technical review of items included in the Phase II scope of services. Peer reviews in the preliminary study strongly suggested that railroad cooperation was a critical element in initiating passenger rail service along privately owned rail infrastructure.

2 Schedule and Budget. The proposed scope of services, including adequate time for scheduling reviews and meetings with affected parties, is approximately 18 months from the Notice to Proceed. The total cost is likely to approach $250,000 - $300,000, in part due to the degree of engagement, meetings, and so forth that may be incorporated into the project.

3 One Corridor. A second phase would likely focus on one of the two corridors studied in Phase I. The level of detail envisioned here could be accomplished for two corridors, but with an 80% or more escalation in budget. In some cases, specific references are made to one corridor that wouldn't apply to the other corridor or line that makes up the corridor.

While it is understood that very few commuter transit services are profitable (few generate internal revenue exceeding their capital and operating outlays) – most have a positive wider return on investment in terms of overall societal benefits. For example, even unprofitable transit services can (and usually do) prevent auto crashes, emissions, mileage, fuel use, congestion or may attract and retain critical workers and businesses to an area. The economic analysis of the current study has found that the magnitude of these wider returns for the proposed Raleigh-Fayetteville service(s) are questionable and depend on a level of development planning that is not yet in place.

The following Scope of Services is therefore considered in two sequential exercises: determine the proper, single corridor to pursue in detail (Task 0) and subsequently conduct a design service analysis to tighten costs and produce a conceptual design for the proposed service, specific station locations, and set the stage for moving towards project funding, design, and environmental planning / permitting.

SCOPE OF SERVICES

TASK 0 – SINGLE CORRIDOR DETERMINATION

Objective – Determine which corridor to pursue

The choice of which corridor to pursue wasn't a part of this study and it wasn't definitively identified, partly because differentiators like length, travel time, cost to improve, station considerations, track condition, and freight volumes now and later were all different tradeoffs for the two corridors. It was suggested at the final TSC meeting (June 11, 2020) that a path for making a determination should consider the following.

1. Community Support. An uncomfortable truth is that the technically "best" corridor isn't always the one that has the best technical evaluation, but rather the one that gets the most support early. If private rail companies, communities affected, or other stakeholders emerge to support a corridor, then that momentum should be a strong consideration. Expand the economic benefits study in this project to include operating costs and revenues/subsidies, and have community meetings to determine the level of support first - then pursue the rest of the scope identifed in the following pages.
2. Financial Support. Studies and new transportation services have costs. Identifying which partners are willing to contribute to those costs - studies, station area acquisition/development, transit-supportive land development policies - would go far to determine the potential for creating project champions in a corridor.
3. Consider Connectivity. The study should also specify if additional service would be provided to stations beyond Raleigh and Fayetteville (e.g., Wilmington). This decision point may influence the selection of the corridor, although both are currently considered viable.
4. Market / Economic Visioning Study. An economic visioning study would (1) provide a more specific and defensible understanding of the role for commuter rail in accessibility-based economic development for the served communities, (2) provide a more detailed set of assumptions regarding development levels, complementary strategies and locations for future services, and (3) provide a more specific and defensible business case for proceeding with any commuter rail option based on the support (community and financial aspects) listed previously.

It is recommended these three objectives are met before significant further investment is made into engineering solutions for a Raleigh-Fayetteville service.

TASK 1 – PROJECT COORDINATION

Objective – Provide project management and coordination for the study

While still a technically-oriented study, the individual communities should be allowed to provide focus groups with a degree of freedom to invite the public as they see fit in Phase II. A Steering Committee also provides an opportunity to include a broad range of participants.

1A. Coordination. The consultant will participate in regular project team coordination meetings / conference calls, at a minimum, once a month to report on project progress, discuss near-term work, and to seek guidance and feedback on major milestones. Agendas should be prepared for project team meetings. The consultant will be expected to prepare all materials and presentations; distribute meeting summaries as appropriate; and prepare written, monthly progress reports and invoice for the work quarterly.

1B. Steering. A Technical Steering Committee (TSC) will again be created to provide stakeholder engagement. The consultant should meaningfully engage the TSC by holding regular interval meetings to seek stakeholder technical expertise on reviews, concepts and analysis, and input on major milestones of the project. The TSC will consist of representatives from CAMPO, FAMPO, NC DOT Rail Division, NC DOT Transportation Planning Division, Wake County, Cumberland County, Harnett County, Johnston County, Mid-Carolina RPO, Upper Coastal Plain RPO and municipal governments along the corridors. Staff from Norfolk Southern, CSX Transportation, Amtrak, and NCRR will be invited to participate in the Technical Steering Committee as well.

Deliverables. (1) Meet seven (7) times with the TSC, prepare/revise agendas with two-week period; (2) conduct ten (10) stakeholder interviews and summaries; and (3) prepare monthly progress reports and quarterly invoices.

TASK 2 – EXPLORE USE/OWNERSHIP AGREEMENTS WITH CSXT, NORFOLK-SOUTHERN, AND/OR NCRR

Objective – Determine what types of ownership/use agreements host railroads have previously entertained and would be willing to entertain.

2A. Summarize Use / Ownership Agreements. Peer reviews suggested that passenger rail start-ups have engaged in a wide variety of arrangements with host railroads including outright purchase, purchase of a strip on the edge of the corridor, and purchase and lease-back (via trackage rights). Other examples might include time-of-day lease and/or Amtrak operations. It should be assumed that the host railroads will have no reason to entertain such arrangements without either financial compensation or infrastructure improvements.

2B. Track Charges. As part (b) of this task, review with the proposed host railroad (CSXT, NS, NCRR) the proposed track charges suggested as necessary for operations of the Fayetteville to Raleigh passenger rail service and their feasibility. This information is necessary to elevate the discussion of use agreements.

2C. Amtrak Operation. Explore the feasibility of extending the Piedmont service to Fayetteville, as well as the feasibility of rerouting other Amtrak services (Silver Meteor, Silver Star, or Palmetto) currently running along the CSX A-Line between Richmond, Virginia and Savannah, Georgia. Obtain data for most/all state-sponsored Amtrak routes regarding the use of host railroads using Amtrak passenger service rate. Obtain data regarding the operation capacity on those lines, as well as the on-time performance of state-sponsored Amtrak. For Amtrak service, dispatching will still be controlled by the host railroad, and freight train priority can generate substantial delay and unreliability that would undermine the viability of passenger service. Estimate the amount of capacity necessary to reduce delays to a level comparable for peers.

Deliverable. Summarize Use / Ownership Agreements, including potential conflicts and impacts to service scenarios (integrated into Tasks 3 – 5).

TASK 3 – OBTAIN DETAILED DATA ON VERTICAL-HORIZONAL CURVATURE OF TRACK

Objective – As an input to better costing/operations planning obtain more-detailed data

3A. Remote Data. While acquiring data directly from rail companies should be explored, alternatives should be assumed that may include obtaining data from FRA, Amtrak, or purchased through third-party providers. The data is a necessary input to determine the feasibility of future corridor upgrades including any updated timetables and track charts. For the eastern corridor, data on previous corridor upgrades may prove useful. Aerial photography and LIDAR data acquired by the Consultant would be used to create 15% design plans for the improvements recommended for each corridor.

3B. Survey Data. Conduct a survey of the proposed rail lines to gather current information on track conditions, curvature/geometry, and intersection treatments. The western corridor particularly has geometric concerns that would translate into a need for more detailed costs including right-of-way acquisition costs for modifying horizontal curvature. While conducting a high-rail review of the corridor(s) is preferred, challenges exist in coordinating for scheduled track time for a high-rail exercise along 70-miles of track, particularly the CSX A-Line that carries large volumes of freight traffic. The proposals should address this concern in light of the value received compared to alternative approaches that include field visits to select sites along each corridor. Note that this approach would still require coordination with NS, NCRR, or CSX to request permission to access their right-of-way, and possibly to request flagging support depending on the nature of the site investigation.

Deliverable. Detailed characterization using text, photographs, and mapping of track (mainline and siding) by milepost, including condition, curvature, and crossing facilities/conditions.

TASK 4 – PRELIMINARY OPERATIONS PLAN

Objective – Estimate rolling stock needed, cost of rolling stock, and operations costs; impacts from other, proposed services

4A. Rolling Stock. In an integrated process with Task 6B (rail operation modeling), determine the rolling stock necessary for 2-4 daily roundtrips (assess how the number of trips may influence or impact extension of existing services or connections with services that interface with the proposed service). Make reasonable estimates of the cost of rolling stock, assuming each trainset to consist of an engine and two passenger cars. Based on hours of service required, make estimates of operational costs based on a survey of peer systems.

4B. Impacts from Other, Proposed Services. Improvements or modifications to passenger rail services south of Richmond to South Carolina and Florida (via Fayetteville) are likely. Future Southeast High-Speed Rail (SEHSR) might be routed either through Rocky Mount or Norlina (via the S-Line) but will likely pass through Raleigh. In either case, there will be implications for track usage at the Boylan Wye/Raleigh Union Station. Clayton-Durham passenger rail service is also being explored now and would stop at Raleigh's Union Station; it is likely that more scenarios will be developed in the future. Finally, identifying freight-related conflicts in more detail will help feed information to the discussion on service agreements. Scenarios to be conceptually explored should include impacts of re-routing all passenger rail to the Norlina route and reserving the more eastern track.

4C. Infrastructure Improvements. Create a list and cost for each infrastructure improvement and summarize in an infrastructure improvement schematic diagram. A 15% design will be completed in this subtask. This information will likely get revised in Task 7 as well.

Deliverables. (1) Description of operations including scheduling reflective of dwell times and acceleration / deceleration periods; (2) initial estimate of costs for rolling stock and operations; (3) descriptions of proposed services and existing services currently and at the proposed opening of the Fayetteville-Raleigh service; (4) descriptions of proposed track and crossing improvements; and (5) a 15% corridor design.

TASK 5 – MAINTENANCE SHED LOCATION & NECESSARY AMENITIES

Objective – Determine where rolling stock is stored and maintained

5A. Outline Issues. It is anticipated that the primary flow of traffic will be towards Raleigh in the morning, strongly suggesting that trains will need to be stored in Fayetteville. If the operations plan does not suggest continuous operation during operations hours, storage will also be required near Raleigh Union Station. The Capital yard currently lacks capacity; explore feasibility of expanding the Capital yard or established a siding to 'park' trains between the inbound and outbound trip. For overnight storage, a maintenance shed to both clean and maintain the rolling stock will be necessary. Document how this is accomplished for the Piedmont train and estimate the costs per train for cleaning and maintenance. Determine amenities—heated, cooled, running water, sewerage, storage, etc.

5B. Evaluation of Options. Evaluate multiple scenarios that may include (1) mid-day maintenance / servicing at a an expanded Raleigh Capital Yard (if feasible) and storage siding in Fayetteville; and (2) overnight maintenance/servicing in Fayetteville at a new facility with mid-day storage in Raleigh at a siding or expanded Capital Yard. The outcomes of this evaluation should include:

- Conceptual layouts in order to identify locations in close proximity to proposed service corridor where the siding and/or facility can be located; and
- High-level environmental screening and preliminary right-of-way costs to compare evaluate feasibility of locations.

Deliverables. (1) Description of storage / maintenance issues; and (2) identification of locations and conceptual layouts necessary to ensure adequate area is available for maintenance and storage of the train sets identified in Task 4.

TASK 6 – TRANSPORTATION SIMULATION & MODELING

Objective – Develop and evaluate travel demand forecasts for passenger rail

6A. Demand Modeling. The Consultant during the proposal stage should identify how to model the full extent of the corridor(s) studied. Using some combination of the CAMPO, FAMPO, and North Carolina Statewide travel demand model, develop a travel demand model which covers the entire study area as one entity. It may be feasible to expand both models to subdivide the territory between the two models, and then arrange for a common forecast year (ideally 2035) for both models to provide data inputs for the travel demand model. The following are approach elements.

- Where feasible, subdivide large TAZs into smaller zones and appropriately apportion the share of new growth to match the supply of buildable land and local zoning restrictions.
- Ensure that the modeled passenger rail service is responsive to both travel time on parallel corridors and to transit connections to future passenger rail and BRT projects planned and/or in operation at the time of the study.
- Create and report on scenarios with and without widening along any congested corridors.

6B. Rail Traffic Controller (RTC) Modeling / Simulation. There are a number of packages that are commonly used to develop simulations of rail service. Regardless, the approach and technical software should accommodate the following elements and will have to be coordinated with the existing rail companies that have operations in the corridor(s).

- Acceleration / Speed charting
- Minimum travel run speeds by service scenario
- Scheduling / Minimum headway descriptions
- Impact of passenger and freight interactions
- Assessment of different levels of crossing treatments and PTC

Deliverables. (1) Description of modeling methodology; (2) development and execution of model "runs" that describe ridership and roadway volumes; and (3) The reporting should include detailed information on scheduling impacts from alternative service scenarios as well as associated fare revenue / rate of return figures, recognizing local, state, and federal subsidies to the service.

TASK 7 – DOCUMENTATION AND REPORTING

Objective – Create a detailed technical document that tightens anticipated costs for developing a passenger rail service and steps required for implementation

7A. Documentation. The outcome should be a report and appendices (draft and final incorporating reviews) in MS-Word™ format along with original format images (e.g., ESRI map package(s)). An executive summary suitable for distribution to a lay audience followed by sections that describe the following are part of the report:

- Executive Summary
- Corridor Description (existing)
- Service Description (scenarios)
- Trackage / Crossing Improvements and Costs
- Station Area Descriptions and Costs
- Rolling Stock Description and Costs
- Summary of Modeling Methodology and Outcomes (including ridership forecasting for each scenario)
- Conceptual Design (15%)
- Next Steps towards Implementation

7B. Reporting. The Consultant will report to the MPO boards twice (four meetings) and conduct a final TSC meeting at the draft report stage to review the document and inform the TSC the preferred way and schedule for receiving comments. Comments received will be summarized, presented to the project management team, and used to craft the final draft document.

Deliverables. (1) Development of Draft Report; (2) Conduct four (4) presentations; (3) incorporate staff and other stakeholder comments into a summary for review and the final report document; and (4) delivery of original format documentation, maps, and image files to Client.

ACRONYMS & TERMS

AADT (Average Annual Daily Traffic) is a term describing traffic counts of vehicles that have been adjusted to account for seasonal and other variations
BRT (Bus Rapid Transit) Is a phrase used to describe a high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations
CAMPO Capital Area Metropolitan Planning Organization
CRT (Commuter Rail Transit) A type of passenger rail service designed to carry people into cities for primarily work purposes; the term has come to be more closely aligned with "regional rail" in the U.S.
FAMPO Fayetteville Area Metropolitan Planning Organization
FRA Federal Railroad Administration
NCDOT North Carolina Department of Transportation
NTI National Transit Institute
Placetype A term used to describe a major land use category in some land use databases, often associated with characteristics like density, land consumption, utility demand, etc.
Push-Pull Operation A type of train locomotion that can move a train set in either direction along a track.
PTC (Positive Train Control) A phrase used to describe a suite of measures related to systems and technologies designed to automatically stop a train before certain accidents related to human error occur, notably with respect to train derailments and train-auto collisions
RTC (Rail Traffic Controller) Refers here to a type of rail operations modeling to tightly define scenarios for multiple service conditions
Timber and Surfacing (T&S) is the replacement of foundation, ties, ballast and other track elements
TCRP (Transit Cooperative Research Program) is a research body focused on studying public transport issues
TOD (Transit-Oriented Development) is a term used to describe land uses, development patterns, densities, and design factors that support public transportation modes and service
Track Charges refer to monetary compensation made by or on behalf of a rail service operator to track owners
TAZ (Traffic Analysis Zone) is a unit of geography that contains housing, employment, and other data used to forecast vehicular and transit volumes, often serving as a definitive source for future forecasts of population and employment
TREDIS (Transportation Regional Economic Development Information System) models economic impacts
TRM (Triangle Regional Model) refers to a computer model that covers the Triangle Region including CAMPO and DCHC metropolitan planning organization planning areas

SOURCES **(for peer studies)**

Basic Information on Service
National Transit Database (ridership)
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The project portal served as a storehouse for draft materials, meeting agendas / summaries, and other information generated over the course of the Fayetteville-Raleigh Passenger Rail Feasibility Study.