



Western North Carolina Passenger Rail Feasibility Study

December 2023

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Executive Summary

The Western North Carolina (WNC) Passenger Rail Feasibility Study (the study) provides conceptual level capital costs, operating costs, and a range of ridership and revenue associated with a new intercity passenger service connecting Asheville, N.C. with passenger rail services in Salisbury, N.C. The Asheville-to-Salisbury service would operate along the Norfolk Southern (NS) AS-Line for approximately 139 miles as shown in Figure 1.

Although passenger rail service has not served western North Carolina since 1975, the area itself still attracts millions of visitors each year—many from cities that are currently served by existing state-supported and long-distance intercity passenger rail services. The service described in this study would connect western North Carolina communities with communities between Charlotte and Raleigh, as well as future connections to communities in North Carolina and the Northeast. Intercity passenger rail service can connect rural, suburban, and urban centers and enhance peoples' access to jobs, healthcare, education, and tourism destinations. Local interest in establishing passenger rail service to western North Carolina has been championed by the Western North Carolina Rail Committee and its predecessor committee for more than 25 years.

I am asked frequently, as Mayor of Marion, when passenger trains will return to Marion and western North Carolina. People are eager to ride a train to Asheville, to Raleigh, to New York City for the weekend! People are also eager to ride the train past Andrews Geyser and through the storied seven tunnels through the Old Fort Loops as they head west. Western North Carolina will be a major destination once passenger rail service is restored!

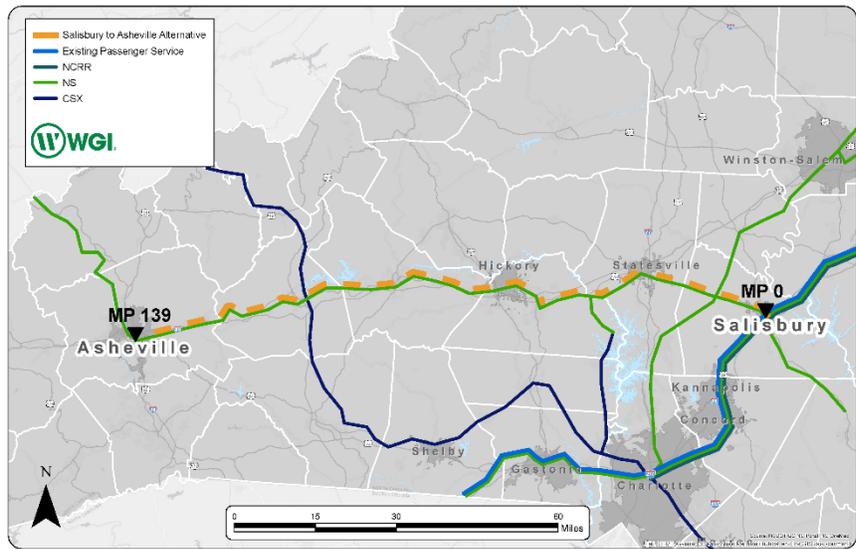
– Steve Little, Mayor
Town of Marion
Co-Chair
Western North Carolina Rail Committee

The WNC Rail Committee continues to advocate for the return of passenger trains to the region and its membership represents communities from Salisbury to Murphy. [We] supported the Rail Division's upgrading of stations along the route in Salisbury, Statesville, Morganton, Marion and Old Fort and now stand ready to advocate for the next step in the restoration of passenger service to Asheville. The Committee is encouraged by AMTRAK's stated goal of launching passenger rail to Asheville by 2035 and is lining up federal and state leaders, most of whom are already on board, to make this a reality.

– Ray Rapp
Co-Chair
Western North Carolina Rail Committee

Nationwide interest in passenger rail service has increased, in part, due to the passage of the Infrastructure Investment and Jobs Act (commonly known as, and hereinafter referred to as, the Bipartisan Infrastructure Law (BIL)), and the Amtrak Connects US Corridor Vision. Intercity passenger rail ridership in North Carolina set all-time highs in 2022 and is on pace to exceed that record ridership in 2023.

Figure 1. Western North Carolina Rail Corridor



This available funding and significant interest in the project represent a good opportunity to expand passenger rail to western North Carolina. The following document explores the service characteristics, costs, and some of the necessary next steps to develop the WNC passenger service.

Summary of Conceptual Capital Costs

Item Description	Cost (2023 Dollars)
Track Infrastructure, Rail Signals and PTC	\$369M ¹
Stations	\$81M ^{1,2}
Equipment (3 Train Sets)	\$160M ¹
Maintenance Facility	\$55M ¹
Total WNC Capital Costs	\$665M

¹The conceptual costs shown include 10% project administration costs, 10% for engineering, 5% for mobilization, bonds, and insurance, and 35% for contingencies.

²Station costs include those for the Asheville Biltmore Village site location, Salisbury, and intermediate locations. Additional costs associated with a station location option in the River Arts District are described in the report.



Service Characteristics and Assumptions

- Connects Western North Carolina with train services in Salisbury
- Three round trips per day on the corridor
- Conceptual travel times range from 3 hours and 25 minutes to 3 hours and 48 minutes. Final schedule times will be determined based on service and intermediate stopping patterns
- Ridership modeling shows approximately 100,000 annual local trips in 2045
- Ridership modeling shows up to 290,000 additional Western North Carolina trips connecting to the *Piedmont and Carolinian* trains
- Ridership modeling shows up to 160,000 additional Western North Carolina trips connecting to future Southeast Corridor / S-Line trains

Summary of Conceptual Operating Costs

Item Description	Cost (2023 Dollars)
Track Signal and Maintenance	\$2.3M ¹
Net Operating Costs	\$2.7M - \$7.4M ¹
Total Annual Costs	\$5M – 9.7M¹

¹Operating and maintenance costs are based on NCDOT's experience and analysis of the *Piedmont* and *Carolinian* services, operated by Amtrak.

Next Steps

The information in this feasibility report is conceptual, but can be used to initiate conversations between key stakeholders to consider including passenger rail services and its associated station and rail infrastructure improvements. Initial steps that can be taken by local communities include the following:

- Metropolitan Planning Organizations (MPOs), Rural Planning Organizations (RPOs), and communities can include the intercity passenger service and potential station locations in their respective comprehensive transportation plans.
- MPOs and RPOs can use the information in this report to submit projects to NCDOT's Strategic Transportation Investments (STI) prioritization process for funding consideration.

NCDOT has submitted this corridor for consideration by the Federal Railroad Administration (FRA) for its Corridor Identification and Development Program (CID). If selected, the program will provide federal funding to develop a service development plan and prepare environmental documentation for the project. The service development plan will include freight railroad coordination and more detailed discussions on passenger rail operations, benefits, and costs. The FRA is anticipated to notify NCDOT on the CID Program in late 2023. NCDOT will notify stakeholders once FRA's selections are known. The program requires matching funds, which could be a combination of state funds and local funds from interested municipalities.

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1. Introduction

1.1 Project Description

The Western North Carolina Passenger Rail Feasibility Study (the study) provides conceptual level capital costs, operating costs, and a range of ridership and revenue associated with a new intercity passenger service connecting Asheville, N.C. to stations served by existing passenger rail services. This service could potentially be provided by trains between Raleigh and Asheville or through connections with passenger rail services in Salisbury. The Asheville-to-Salisbury service would operate along the Norfolk Southern (NS) AS-Line for approximately 139 miles, as illustrated in Figure 2. The analysis associated with the study assumes three round trips per day will be provided between Asheville and Salisbury, providing travel options in the morning, midday, and late afternoon. In Salisbury, riders could connect to stations currently served by the *Piedmont* and *Carolinian* state-supported intercity services or stations along or accessed by the Raleigh to Richmond portion (S-Line) of the Southeast Corridor. Current intercity passenger rail services in North Carolina are shown in Figure 3. Future passenger rail services are being pursued through the Federal Railroad Administration’s Corridor Identification and Development (CID) program. Figure 4 shows these potential services. The CID program is discussed in more detail in Section 8.

Figure 2. Western NC Passenger Rail Corridor

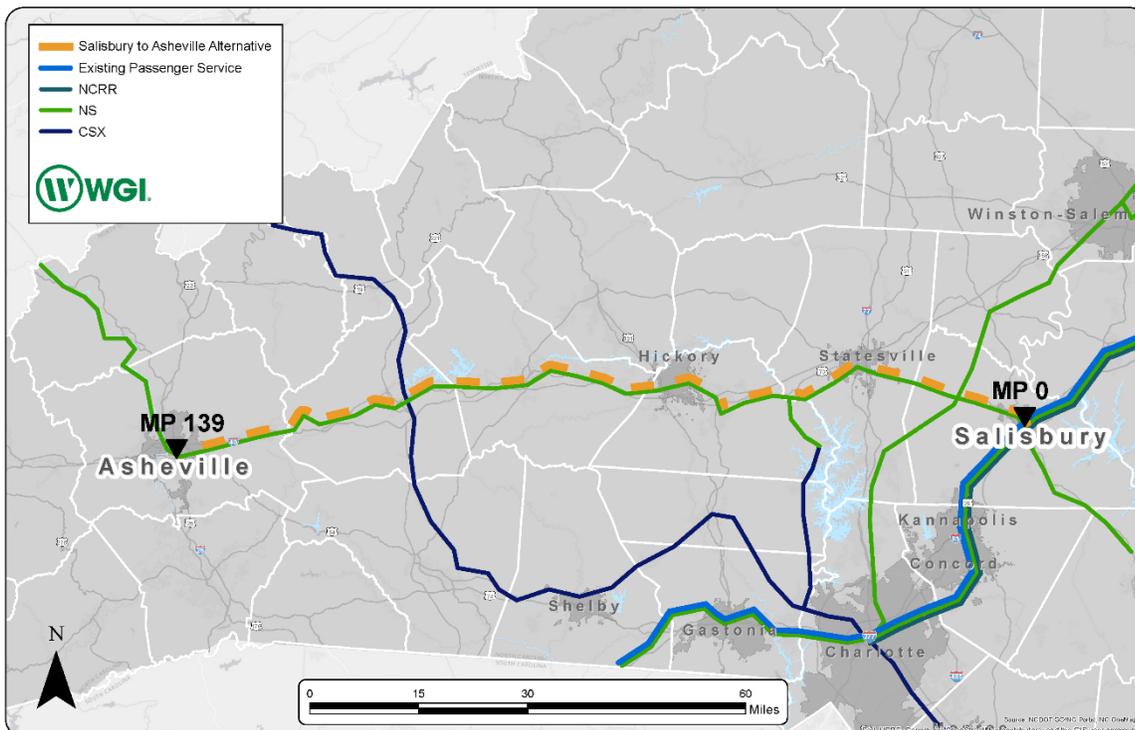


Figure 3. Existing North Carolina Intercity Passenger Rail Services

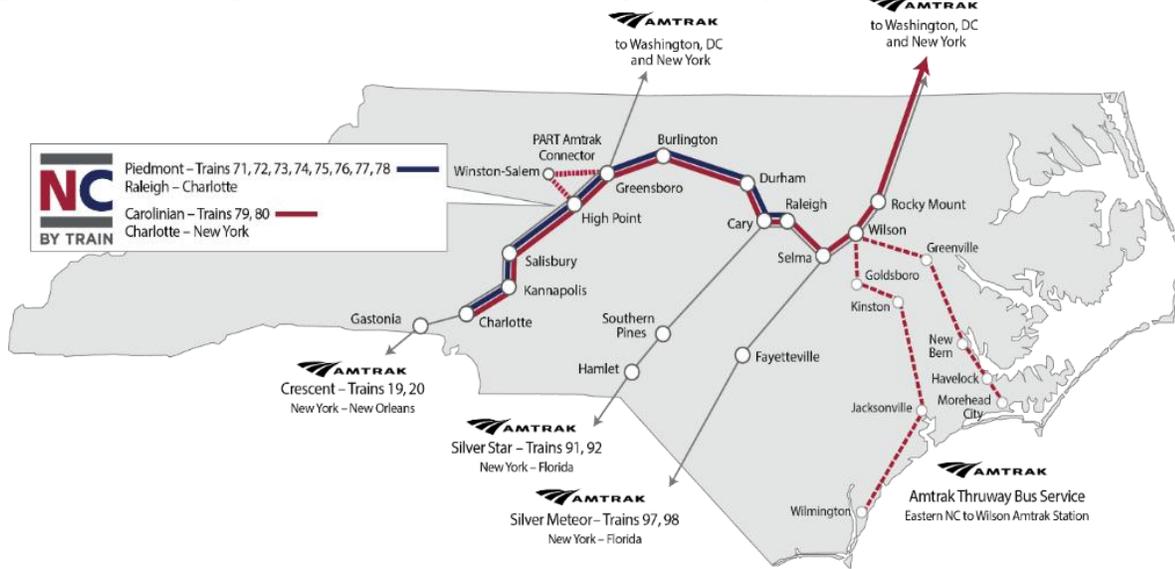
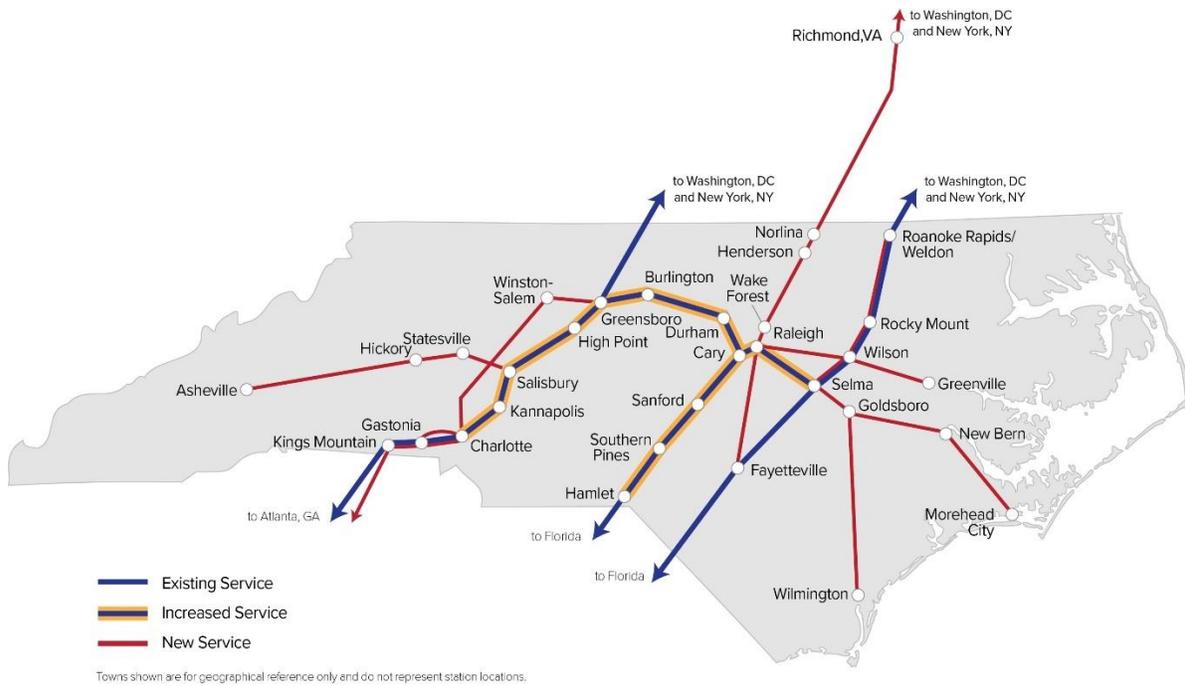


Figure 4. Potential Passenger Rail Services being considered for CID



1.2 Study Scope and Limitations

The objective of this study was to identify the conceptual capital and operating costs, and ridership and revenue associated with initiating proposed passenger rail services between Salisbury and Asheville. It does not represent a decision by the State of North Carolina, Amtrak, or any other entity to grant or budget funds to initiate passenger service between Salisbury and Asheville. The estimates provided by this study can be used to pursue funding through NCDOT's STI prioritization process as well as other state, local and federal sources, including federal discretionary grants funded by the Bipartisan Infrastructure Law. The infrastructure recommendations and modeling were made based on a review of infrastructure conditions and industry trends, but do not include detailed input from freight railroads. The estimates and infrastructure assumptions were prepared using information gathered through field visits, previous studies, and general assumptions on freight volumes and potential passenger schedules. As the corridor project develops, additional coordination will be needed with host freight railroads to obtain more detailed input, refine the infrastructure needed, and develop agreements to facilitate service. This study builds on previous efforts but is not a complete corridor development plan or a benefit/cost analysis.

1.3 Background

The history of rail operations in Western North Carolina dates to the late 19th century, when North Carolina chartered the Western North Carolina Railroad. Regular passenger rail service to Asheville and the surrounding areas of Western North Carolina was discontinued in 1975 by Southern Railway. The line is now owned and operated by Norfolk Southern Railway. Although passenger rail service has not served Western North Carolina for many years, the area itself still attracts millions of visitors each year—many from cities that are currently served by existing state-supported and long-distance Amtrak services. Increased interest in passenger rail service has been generated through the Amtrak Connects US Corridor Vision and the passage of the Bipartisan Infrastructure Law. Related advance appropriations provide historic levels of funding for the Federal Railroad Administration's Federal-State Partnership for Intercity Passenger Rail discretionary grant program. This available funding and significant interest in the project represent a good opportunity to expand passenger rail to western North Carolina.

In North Carolina, interest in establishing passenger rail service to Western North Carolina has been championed by the Western North Carolina Rail Committee and its predecessor for over 25 years. In addition, the service is included in the North Carolina Comprehensive State Rail Plan and the Southeast Regional Rail Plan. Summaries of past studies are included below.



Western North Carolina Rail Passenger Study - Intrastate Rail Plan – January 1997

The Western North Carolina Rail Passenger Study was conducted in 1997 for the NCDOT Rail Division. Five separate alternatives were studied, including connections to Asheville from Raleigh, Charlotte, and Greensboro. The preferred alternative, Raleigh-to-Asheville via Salisbury, was determined to serve the largest number of riders without the need for transfers to reach Asheville and had the greatest potential for future ridership growth and system utilization.

Western North Carolina Passenger Rail Study - March 2001

This study was conducted by the NCDOT Rail Division at the request of the North Carolina General Assembly. The study considered four alternatives. Of these, the study determined that the most cost-effective and successful opportunity for passenger rail service to Western North Carolina is a train that operates between Asheville and Salisbury and provides connections to a long-distance train, such as the Carolinian, or a proposed New York-Atlanta service. Both daily and four-day-per week service were proposed.

Study of Passenger Train Service Between Salisbury and Asheville – February 2002

This study was conducted for NCDOT and Norfolk Southern and looked at the proposed operation of two daily Amtrak passenger train round trips between Salisbury and Asheville, while minimizing interference with NS's freight train operations. The study identified railroad track capacity needs, estimated the cost of construction of required improvements, and proposed Salisbury-Asheville passenger train schedules to minimize freight or passenger train interference. Recommendations included site-specific construction projects and proposed intermediate station stops along the corridor. The study mentioned below was done in parallel with this study, and complimentary in nature, with the study below being completed in coordination with Norfolk Southern.

Report on Western North Carolina Rail Operations and Station Right-of-Way Acquisition – April 2002

This study was conducted by NCDOT and NS to determine the impacts of the proposed passenger trains on the operations of NS's freight trains, identifying track capacity required to mitigate the impact of passenger trains, and estimating costs for the physical improvements. Station site assumptions matched the February 2002 Study of Passenger Train Service between Salisbury and Asheville and added additional detail to the project development. Study recommendations included specific construction projects such as installing power turnouts, extensions and/or rehabilitations of sidings, track and bridge upgrades, and upgrades to crossing warning predictors at the highway-railroad at-grade crossings along the corridor.

NCDOT Comprehensive State Rail Plan – August 2015

As stated in the Comprehensive State Rail Plan (CSRP), "*...the goals and objectives for the Plan is to support the mission and goals of the North Carolina Department of Transportation (NCDOT) and the*



NCDOT Rail Division. "The NCDOT Rail Division's mission is the "...safe and efficient movement of people and goods on North Carolina's railroads through freight, passenger and safety programs, supporting job creation and economic growth." The CSRP includes discussion of existing freight and passenger movements, railroad infrastructure, and economic trends statewide. It also includes the plans and goals for extensions of existing passenger service, such as service from Salisbury to Asheville.

Southeast Regional Rail Plan – December 2020

The Southeast Regional Rail Plan was completed in December 2020 to develop a long-term regional passenger rail vision for the Southeast. The Southeast Regional Rail Plan was developed by member states of the Southeast Corridor Commission and the Federal Railroad Administration (FRA). The Southeast Corridor Commission includes Florida, Georgia, South Carolina, North Carolina, Tennessee, Virginia, and Washington D.C. The plan outlines the potential for high performance passenger rail and creates a 40-year vision for intercity connections in the region. The plan includes a connection between Asheville and the high-performance corridor identified between Atlanta and Washington D.C.

1.4 Study Area Description

The proposed passenger rail corridor spans approximately 139 miles between Salisbury and Asheville. Asheville is in the Western Piedmont and Mountain region of North Carolina, which consists of mountain ranges and steep slopes. This area is significantly more rural compared to the central and eastern portions of the Piedmont region, which includes the Triad,



Outdoor attractions such as Pisgah National Forest, Fontana Dam, and Nantahala National Forest are draws for visitors to Western North Carolina.

Charlotte, and Raleigh. The western portion of North Carolina is heavily forested and boasts state and national parks, as well as other public lands such as the Pisgah National Forest and the Nantahala National Forest. Tourism is a major part of the local economy in Western North Carolina. Along with the national forests, the region also contains a large portion of the Great Smoky Mountains National Park as well as several lakes and dams such as Lake Lure and Fontana Dam. Each year, Western North



Carolina welcomes millions of visitors for camping, hiking, whitewater rafting, and other recreational activities.

Just east of Black Mountain is a 13-mile section of railroad, aptly referred to as the *Old Fort Loops*, that twists, winds, and curls its way through tunnels and over bridges up the Eastern Continental Divide and through the Blue Ridge Mountains. These loops were necessary to spread the vertical change of the Blue Ridge escarpment out over the railroad track length, thus minimizing the grade of the railroad. Even with the loops, the railroad still has an average grade of approximately 2% over these 13 miles.

The two endpoints of the proposed passenger rail corridor—Salisbury and Asheville—are passenger destinations in the western part of the state for various reasons. Salisbury is about 45 miles northeast of Charlotte and will serve as a connection to stations between Charlotte and Raleigh along the *Piedmont* and

Carolinian corridors. Due to its proximity to the Charlotte metropolitan area, Salisbury's

population has steadily increased. Salisbury is noted for its historic preservation, with five local historic districts and 10 national register historic districts. Asheville is the largest city in Western North Carolina, and the state's 12th most populous city. Asheville is known for its vibrant arts scene and historic architecture. The city is home to a growing number of educational and medical facilities as well as more than 9,000 businesses that help make it a major tourism destination.

A train makes its way over mountainous terrain via the Old Fort Loops.



1.4.1 Socioeconomic Characteristics

The corridor for the proposed Salisbury-to-Asheville passenger rail service runs through six counties: Rowan, Iredell, Catawba, Burke, McDowell, and Buncombe. Researchers used the average distance traveled (15 miles one way) to access North Carolina's state-supported intercity passenger rail services, to determine the likely service area for the proposed corridor. The area encompassed by a 15-mile buffer area around the proposed corridor is home to nearly 1.33 million residents. Accounting for overlapping geographies within the existing Raleigh-to-Charlotte corridor, adding the Western North Carolina Passenger Rail service would extend service to an additional 1.27 million North Carolina

residents, which is approximately 12% of the state population. Some demographic data points for this population are presented in Table 1-1. For comparison, the same data points are provided for a similar area around the existing rail service between Raleigh and Charlotte.

Table 1-1. Corridor Demographic Data (15-mile buffer)

	Salisbury to Asheville	Raleigh to Charlotte	N.C. Statewide
Total Population	1,331,800	4,552,400	10,699,000
Average Median Household Income¹	\$56,131	\$72,145	\$56,642
Percent below Statewide Median Household Income	61.5%	36.6%	
Percent Zero-car Household	4.9%	4.9%	5.6%
Percent Minority	19.6%	42.3%	37.4%
Percent with Disability	15.3%	10.2%	13.4%
Percent over 65 years of age	18.9%	13.5%	16.3%

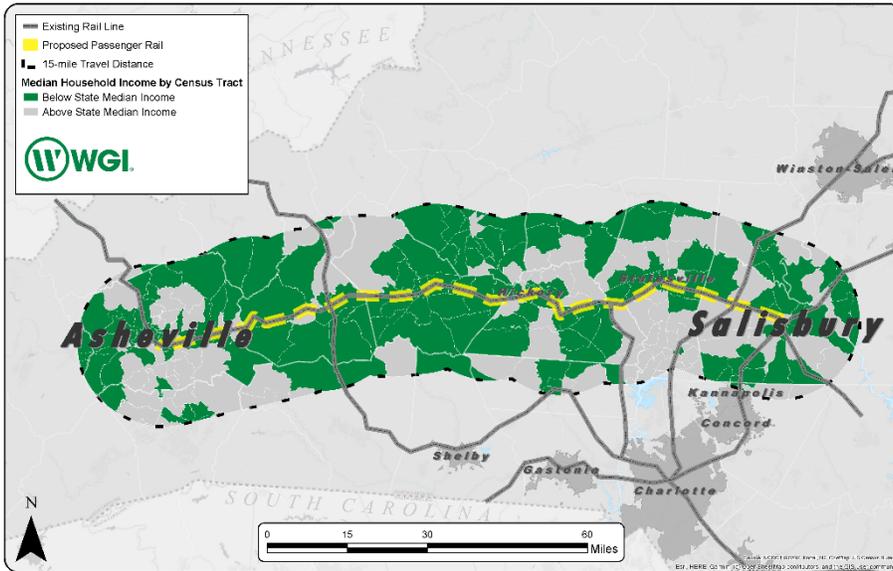
Source: US Census Bureau, American Community Survey 5-year Estimates (2016-2020), Tables B01001, B16004, B25044, B03002, B18101; US Census Bureau 2020 Decennial Census.

¹For each rail corridor, census tract median incomes were averaged to achieve an average regional median income for the 15-mile corridor buffer. The Statewide median income comes directly from Census-provided data.



The data show that the population to be served by the proposed Western North Carolina passenger rail service has lower income than the population in the Raleigh-to-Charlotte corridor. Figure 5 and Figure 6 illustrate the median income of corridor census tracts relative to the statewide median income.

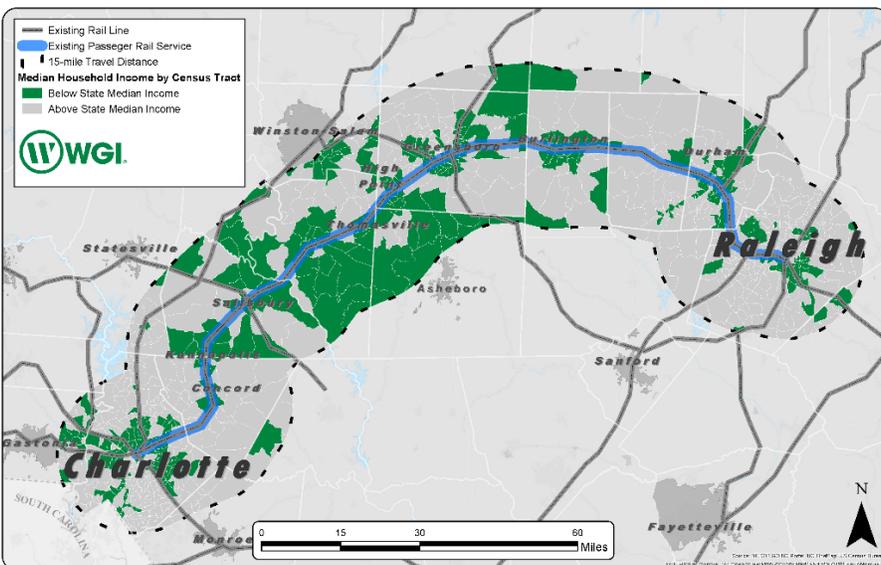
Figure 5. Median Household Income compared to Statewide Median Household Income: Salisbury to Asheville



In the Salisbury-to-Asheville corridor, 61.5 percent of the census tracts have a lower median income than the statewide median, as compared to 36.6 percent of the census tracts in the Raleigh-to-Charlotte corridor.

The population within the Salisbury-to-Asheville corridor is also home to a population with a higher proportion of residents over the age of 65 and a higher proportion of disabled residents than in the Charlotte-to-Raleigh corridor.

Figure 6. Median Household Income compared to Statewide Median Household Income: Raleigh to Charlotte



As noted in the *Comprehensive State Rail Plan* (NCDOT, 2015), access to passenger rail service provides increased accessibility and mobility for passengers, particularly those with limited available transportation options. Low-income and elderly riders benefit from rail and other transportation alternatives compared to using individual vehicles to get to work, school, errands, medical care

and recreational activities. With the passenger rail services, transportation disadvantaged populations



are able to access locations outside of the cities and towns where they live, which benefits them by increasing their access to employment, educational, medical, and recreational opportunities. The Western North Carolina Passenger Rail Corridor would be a car-free connection to major metropolitan areas throughout the state, such as Charlotte, Greensboro, and Raleigh. It also would connect urban and rural Western North Carolina to rail routes on the East Coast.

The addition of passenger rail service would also benefit the state’s growing population of young professionals. This group has reversed the trend of suburban living and instead prefers living in towns and cities to access restaurants, shopping and other entertainment in downtown areas, according to the “Survey: Millennials Willing to Relocate for Better Transportation Options” (Streetblog USA, 2014). It was also noted in the Rail Plan that the Millennial generation (people born between 1982 and 2003) value access to a variety of transportation options while simultaneously aspiring to be less reliant on automobiles. More than half (54 percent) would consider moving to another area if it had better options to get around.

In North Carolina, which is one of the fastest growing states in the nation, having the option of multiple modes of transportation has become increasingly important. The addition of a transportation option in this region provides the ability to reach job opportunities that might otherwise be inaccessible and widens the pool of job seekers for employers. Regional jobs associated with the operations and maintenance of the trains and infrastructure would be created. If fostered by local authorities, station areas have the potential to spur economic development with increased density and a mix of residential and commercial uses. Investment in infrastructure such as passenger rail is critical to shaping the future of the state’s economy.

1.4.2 Proposed Station Locations

As noted in the *Comprehensive State Rail Plan* (NCDOT, 2015), station-area projects have contributed to quality-of-life improvements across the state. Localities and NCDOT have invested significant state and federal funds in passenger rail station improvements over the past decade. Revitalized stations can serve as a catalyst for private development in the adjacent properties, and investing in station area improvements will provide better passenger access to more of the state.

*Historic Marion, NC
Station*



Specifically for the proposed Western North Carolina service, the stations in Salisbury and Asheville will serve as the end point locations. As noted in the *Comprehensive State Rail Plan* (NCDOT, 2015), some initial station planning has occurred between Salisbury and Asheville. Several historic station buildings along the Salisbury-to-Asheville route, including Conover, Marion, Morganton, Old Fort, and Statesville have already been renovated and are housing other interim compatible uses. Potential station sites



*Historic
Morganton, NC
Station*

were identified in past studies for Asheville, Valdese, and Black Mountain. During the development of this study, Hickory also expressed interest in a station location. After the 2002 study, NCDOT worked with a local task force to identify potential station locations. Following that process, NCDOT and Asheville purchased land near Biltmore Village for a potential future passenger rail station. The Biltmore Village location is

contemplated in capital cost estimates for the study; during the development of the study, a request was made to consider a location closer to the River Arts District.

No specific site selections are included in this study, but the conceptual cost estimates include up to seven intermediate stations. The additional infrastructure that would be needed to travel to the River Arts District location rather than the Biltmore Village location would cost approximately \$5 million beyond what is presented in the cost table. More detailed service development planning is needed to determine the stopping patterns associated with train frequencies. Potential variance of stopping patterns for different train frequencies can help provide access to more intermediate stations and communities. Varying stopping patterns at intermediate stations will be considered against the overall trip time as the service plan for the project develops. Detailed service development planning, site selection, and environmental studies in accordance with the National Environmental Policy Act are needed to determine final station locations.

1.5 Road Network / Travel Time

There are three major interstate highways that help people move in and out of the region: Interstate 40 which travels east-west across the state, Interstate 77 which travels north-south through the west-central portion of the state, and Interstate 26 which travels north-south through the mountains. Also, Interstate 85 travels north-south through the eastern portion of the region. There are also other major highways, such as U.S. 421, that traverse throughout the western part of the state. The Blue Ridge

Parkway, a 469-mile National Scenic Byway, runs through the region, starting in Virginia and ending at the Great Smoky Mountains National Park.

A typical 130-mile drive between downtown Salisbury and downtown Asheville takes approximately 2 hours and 15 minutes. The driving journey between Charlotte and Asheville is assumed to take 2 \ hours and 10 minutes and the journey from Raleigh to Asheville along I-40 is assumed to be 3 hours and 50 minutes. These travel times do not include a stop at a fuel station or rest area. Auto travelers in Asheville and Raleigh would need to add 15% to 20% more to their estimated journey time to account for delays associated with peak hours; this concept is called the 'travel time index' and reflects the ratio of travel time during peak hours versus free-flow speeds. (Texas A&M Transportation Institute, 2023). Travel time indices vary from 1.15 in Greensboro and Raleigh to 1.2 in Charlotte. The index was used to increase the estimated time 2 hours, 35 minutes from Charlotte to Asheville and 4 hours, 25 minutes between Raleigh and Asheville.

The addition of passenger rail service to Western North Carolina would provide another connection for residents to access a more extensive travel network, which may be more affordable, provide more amenities, and be more accessible than current options.

1.6 Other Modes of Transportation

Apart from personal car travel, there are limited existing travel options between Asheville and the Charlotte to Raleigh corridor: To connect to Asheville from the Charlotte to Raleigh corridor, travelers could take a bus from origins along the corridor to Asheville. Although travel times depend on the specific origins and destinations, existing Greyhound bus routes between Raleigh and Asheville, Greensboro and Asheville, and Charlotte and Asheville are described below.

- The bus route between Raleigh and Asheville generally follows I-40 and has a scheduled travel time of six hours and 20 minutes.
- The bus route between Greensboro and Asheville generally follows I-40 and has a scheduled travel time of four hours and 40 minutes. The bus route does not currently stop in Salisbury and would have to be modified to provide the service. Relative highway distances were used to prorate the travel time for comparison purposes. The estimated bus trip time between Salisbury and Asheville is approximately three hours and 30 minutes. Riders of NCDOT's existing passenger rail services between Charlotte and Raleigh could transfer to this existing bus service in Greensboro to get to Asheville.
- The bus route between Charlotte and Asheville generally follows US 74 and has a scheduled travel time of two hours and 55 minutes.

These routes are described to provide a relative travel time comparison to the passenger rail service contemplated in this feasibility study, not to evaluate existing or future potential bus services.



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2. Train Performance and Estimated Run Times

Three daily frequencies or roundtrips between Salisbury and Asheville were analyzed for this feasibility study. It is possible that NCDOT would begin any proposed service with a lower number of frequencies and grow to a third round-trip as the service becomes established and the utilization increases. This analysis is preliminary and will need to be refined with more detailed information on freight trains along the corridor in future studies.

To determine the run-time for the proposed service, NCDOT used Berkely Simulation Software Rail Traffic Controller (RTC) modeling software. This software allows for large system scale 'dispatching' of trains, both freight and passenger, singly or in a mixed-use scenario. Multiple factors were considered within this model, including a maximum authorized speed of 79 mph, terrain/steepness of grade, radius of curves, stoppage times for passengers to board and unload, number of trains, and the interoperability with other trains during travel. This type of model is utilized to establish run times, develop operating plans, diagnose bottlenecks, evaluate various capital improvement scenarios, and assess the impact of adding new trains to a network. For this study, only the individual train performance aspect of the software was used to determine expected approximate run times.



The proposed corridor between Salisbury and Asheville consists of approximately 139 miles of existing single main track with unsignalized passing sidings. This study evaluated two different types of service: a limited stop option which would run between Salisbury and Asheville with up to four intermediate stops, and a local option which would include stops at up to six intermediate stations along the



Terrain maps show how the track twists through the mountains.

corridor. Multiple scenarios were evaluated, with different sets of intermediate stations and stopping patterns which would potentially allow more than six locations to be served. However, decisions regarding selection of specific station locations and stopping patterns were not determined. These decisions will be made as a part of future, more detailed service development planning. The train performance analyses done with the RTC indicated that the travel time for these two options would range from 3 hours, 25 minutes to 3 hours, 48 minutes. A significant portion of this travel time would be for traversing the Old Fort Loops, a series of switch-back loops traversing a steep grade on the existing track. An additional eight to nine minutes of travel time would be needed to reach the River Arts District station location rather than the Biltmore Village station location in addition to the base travel times reported here.

Table 2-1 presents travel time comparisons among modes for the journey to Asheville from both Charlotte and Raleigh. Train and bus trips allow for all passengers to relax or be productive during the journey, instead of having a driver devote attention to safe automobile operation.



Table 2-1. Travel Time Comparison by Mode

	Train	Automobile	Bus
Charlotte to Asheville	4 hrs., 26 min. ¹	2 hrs., 10 min. – 2 hrs., 30 min. ³	2 hrs., 55 min.
Salisbury to Asheville	3 hrs., 35 mins. – 3 hrs., 48 mins. ²	2 hrs., 15 min. – 2 hrs., 35 mins. ³	3 hrs., 30 min. ⁴
Raleigh to Asheville	6 hrs., 47 min. ¹	3 hrs., 50 min. – 4 hrs., 25 min. ³	6 hrs., 20 min.

¹Includes a minimum of 30 minutes to allow for transfers between trains at Salisbury. Train schedules would be adjusted to maximize the utility of the connections between Asheville trains and trains on the Piedmont corridor.

²A range is provided to reflect different potential stopping patterns.

³The second estimate includes a 15% increase in travel time associated with 'travel time index' of 1.15 (Texas A&M Transportation Institute, 2023).

⁴This travel time is pro-rated from a Greensboro to Asheville route that does not pass through Salisbury using the ratio of highway mileage between Salisbury and Asheville to Greensboro to Asheville. There is not currently a direct intercity bus that travels between Asheville and Salisbury. Bus trips between these cities must transfer in Greensboro or Charlotte.



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3. Ridership

NCDOT developed a statewide intercity passenger rail ridership estimate model to predict ridership on Salisbury to Asheville corridor and other existing and planned corridors throughout the state. The probability distribution model predicts the average daily ridership by station pairs and is sensitive to train frequency, scheduled travel time, delay, fare, as well as population and employment characteristics around each station. The ridership estimates for this rail feasibility intercity model are based upon NCDOT datasets on ridership and train service characteristics for the *Piedmont* and *Carolinian* services between June 2009 and January 2020 (to exclude service disruptions during the COVID-19 state of emergency/pandemic).

The train travel times between stations along the Asheville-to-Salisbury route and to stations between Charlotte and Raleigh were used to estimate local riders on the Western North Carolina corridor, and riders who would be

expected to transfer to stations along the *Piedmont* and *Carolinian* routes between Charlotte and Raleigh. Thirty additional minutes were included in travel times for riders to transfer to the *Piedmont* and *Carolinian* services in Salisbury.

Passengers board an Amtrak train.



Based on this statewide model, the 2045 target ridership is approximately 100,000 local trips between Salisbury and Asheville, 290,000 connecting trips with one trip end on the Salisbury-to-Asheville corridor and one station between Charlotte and Raleigh, and 160,000 connecting trips to destinations north of Raleigh that will be facilitated once the Raleigh to Richmond portion (S-Line) of the Southeast Corridor is completed (See Figure 7). These destinations include, but are not limited to, stations in North Carolina north of Raleigh, Petersburg, Richmond, Washington, DC, and points served by the Northeast Corridor. Completion of the S-Line will provide more frequencies to points north of Raleigh, opening additional connections and interstate tourism opportunities; thus, generating more potential Western North Carolina corridor riders. Some decrease in actual ridership compared to modeled



ridership may result from the required transfer associated with connecting trips at Salisbury. To be conservative, a range of 50% to 100% of connecting trips is included in ridership, revenue, and passenger-mile estimates in this study. The mileage of each was applied to calculate projected passenger-miles for the service. For planning purposes, a projected yield of approximately \$0.17 per passenger mile (the current yield for the *Piedmont* service) was applied to the passenger-miles to estimate revenue. A \$0.17 yield results in a potential \$24 fare (reflecting current 2023 pricing assumptions) to travel the distance from Asheville to Salisbury. The ticket price and revenue assumptions made here are preliminary and may change prior to service implementation. Table 4-1 presents the conceptual ridership, passenger-miles, and revenue of the service.

The ridership model includes connecting trips to locations between Charlotte and Raleigh and connecting trips to destinations north of Raleigh once the Raleigh-to-Richmond segment of the Southeast Corridor (along the S-Line) is completed (see Figures 3 and 7). Development of the Western North Carolina service will also provide connectivity to future corridors developed through the Corridor Identification and Development Program (see Figure 4).

Figure 7. Piedmont / Carolinian and S-Line Network

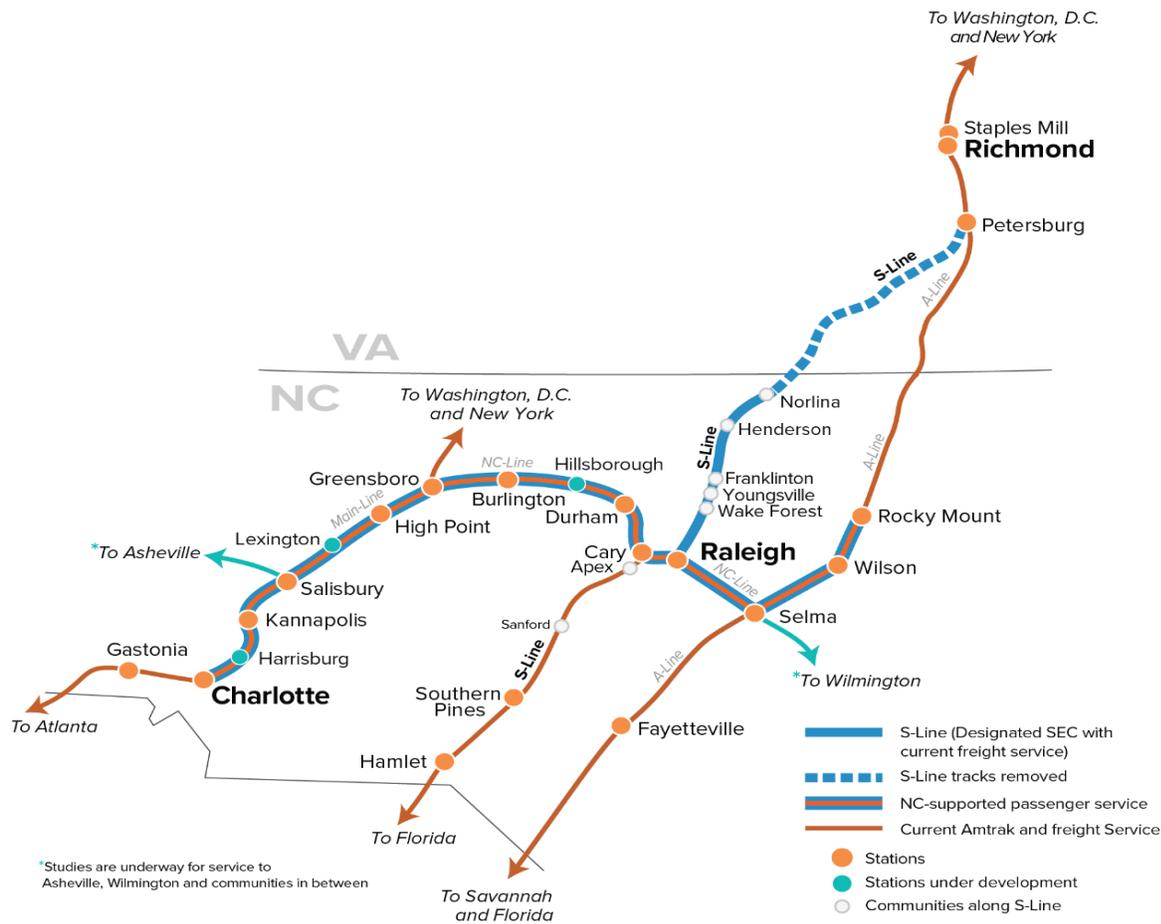


Table 4-1. Conceptual Ridership, Passenger-miles, and Revenue

	Ridership (riders per year in thousands)	Passenger-miles (passenger- miles per year in millions)¹	Potential Annual Revenue (2023\$ in millions)²
Local Trips	100	5.6	\$1
Connecting Trips between WNC and Piedmont stations	145 – 290	22 – 44	\$4 - \$7.6
Connecting Trips between WNC and S-Line stations north of Raleigh	78 – 160	35 – 70	\$1.2 – \$2.3
Total	328 – 550	63 - 120	\$6.2 - \$10.9

¹Passenger-miles are presented for the entire trip length, including portions of the trip on the Piedmont or S-Line corridor.

²Revenue is presented only for the portion of the trip that is on the Western North Carolina Rail corridor so that the revenue can be compared with the conceptual operating cost of that corridor. The balance of the revenue would be assigned to Piedmont, Carolinian, or S-Line trains.

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4. Operational and Track Maintenance Costs

Conceptual annual operating and maintenance costs were calculated by applying unit costs associated with the *Piedmont* service to the corridor length and number of trains anticipated on the Western North Carolina corridor. Operating costs are based on costs per train-mile developed from recent operating costs for the *Piedmont* service. Operating costs of \$44.7 per train-mile were applied to the new WNC service characteristics. Track signal and maintenance costs were derived from costs per mile of incremental maintenance payments associated with track and signal improvements made to the Greensboro to Raleigh section of the Piedmont Corridor. Finally, net operating costs are the difference between the annual operating costs and annual train revenue. Conceptual annual financial results are detailed in Table 5-1.

Table 4-1. Conceptual Annual Financial Results

Item Description	Value (2023 Dollars)
Track and Signal Maintenance	\$2.3M
Operating Costs	\$13.6M
Ticket Revenue	\$6.2M - \$10.9M
Net Operating Costs	\$2.7M – \$7.4M
Total Annual Net Operating and Maintenance Costs	\$5.0M - \$9.7M



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5. Conceptual Infrastructure and Equipment Needs

5.1 Track, Signal, and Crossing Infrastructure

To add three daily round trip passenger trains to the Salisbury to Asheville line, infrastructure improvements have been assumed to augment current capacity used by operations of NS freight trains, as well as increasing authorized speed to historically achievable levels. Because most of the current line between Salisbury and Asheville consists of single-track

Crews complete track construction activities



with unsignalized passing sidings, siding upgrades and one additional siding are proposed. In addition, upgrades to accommodate higher authorized track speed, new signals, and implementation of Positive Train Control (PTC) were budgeted in this study.

An analysis of existing infrastructure was completed for track classification relative to supporting passenger trains up to the maximum of 79 mph proposed for this service. Existing track classifications in North Carolina range on a scale of 1 to 4, with Class 1 supporting the slowest moving trains and Class 4 supporting faster moving trains. Each classification also has different restrictions on the maximum track speed for freight movement versus passenger train movement. In general, a higher classification will also result in a smoother travel experience. Some of the AS-Line is currently maintained to FRA Class 2; to achieve the desired speed and ride quality, investment should be made to achieve Class 4 for the entire corridor. These costs are included in the cost estimate.

Costs associated with upgrading highway-rail at-grade crossings and associated signals are also included in the estimate. There are 121 public highway-rail at-grade crossings, 56 private rail at-grade crossings, and 78 existing grade-separated crossings along the route. Generally, the costs are

associated with improving the existing at-grade crossings and replacing the signal devices and systems rather than proposing grade separations. A mix of active and passive crossing signals and infrastructure are present and will be replaced or upgraded. In addition, devices are proposed at nine crossings along the project that don't have any current signals. Subsequent analyses may evaluate the potential for closure or grade separation of some crossings.

Beyond general improvements to the track along the length of the corridor, site specific improvements are proposed. The proposed improvements are predominantly upgrading, lengthening, and adding new sidings to ensure the fluid movement of both freight and passenger trains throughout the corridor. These specific improvements are included with an approximate milepost map in the Appendix. In addition, the entire rail corridor will be signalized. The physical location of improvements to be made in this study were based on historic freight activity and the locations of existing freight sidings along the corridor. In-depth railroad coordination for the line may reveal additional or alternate locations for conflicts among trains. The purpose of this analysis was to arrive at a reasonable cost estimate for upgrades, rather than the specific location of improvements to address conflicts among passenger or freight trains.

In addition to the signalization of control points, the corridor must be upgraded to include positive train control (PTC) to allow for passenger service. A positive train control (PTC) system is designed to prevent train-to-train collisions, control train speeds to eliminate over-speed derailments, prevent incursions into established work zones, and prevent the movement of trains through switches left in the wrong position. Twenty-five miles on the Salisbury end of the corridor have PTC installed. PTC needs to be installed on the remaining 114 miles of the corridor. PTC costs are based on a cost per mile of \$225,000 per mile in 2019 dollars (\$263,000 per mile in 2023 dollars) included for Norfolk Southern in a report titled *Sensor System Benefits and Costs in Positive Train Control, Bridges and Others* (North Dakota State University, 2019).

5.2 Stations

The two endpoints of the proposed passenger rail corridor are Salisbury and Asheville. Approximately 45 miles northeast of Charlotte, Salisbury has an existing station and will serve as a connection to trains serving stations between Charlotte and Raleigh along the *Piedmont* and *Carolinian* corridors. The station is already set up to accommodate a future additional platform and station track extending from the Norfolk Southern AS-Line. This cost estimate includes construction of the new station track and platform.



In Asheville, NCDOT and Asheville own land near Biltmore Village which may be used for a potential future passenger rail station. The land is between Garfield Street and the railroad corridor. A platform, station track, and layover track would need to be constructed, in addition to a station building.

*NCDOT Property
at Biltmore Village
in Asheville, NC*



During the development of the study, a request was made for NCDOT to consider building the station in an alternate location near the River Arts District closer to Asheville's downtown. Similar station infrastructure would be needed for the River Arts District Station, and additional right of way



or use of railroad right of way would be required. Approximately \$5 million in additional costs are estimated to provide the station at the River Arts District rather than at Biltmore Village.

Previous studies have identified potential intermediate stops between Asheville and Salisbury. Depending on the study referenced, those stops have included Black Mountain, Old Fort, Marion, Morganton, Valdese, Hickory / Conover, and Statesville. In some cases, station buildings are present and have been renovated in preparation for future passenger services. In some communities, station buildings need to be constructed. Estimates include costs to provide platforms, canopies, and buildings, where needed, at each intermediate station. Separate station tracks are not budgeted at any of these intermediate stations. Traditionally, NCDOT has partnered with communities to pursue grants to help with construction, but through agreements, towns and cities help fund ongoing operations and maintenance of station buildings. An allowance associated with improvements at seven potential intermediate stops has been included in the cost estimate, although additional planning is needed to optimize service development planning and stopping patterns.

5.3 Equipment and Maintenance Facility

NCDOT developed a conceptual equipment and maintenance facility estimate based on two types of passenger equipment that have been recently demonstrated to meet the FRA Buy America statute: Venture trainsets manufactured by Siemens, substantially like the Amtrak Airo™, and FLIRT (Fast Light



*Marketing photos
for Siemens
Venture trains.*



Intercity and Regional Train) trainsets manufactured by Stadler. Venture trains, manufactured by Siemens, have been selected by Amtrak to replace much of its fleet for regional and state-supported routes. FLIRT (Fast Light Intercity and Regional Train) trains, produced by Swiss company Stadler Rail, can reach speeds of 124 miles per hour. FLIRT sets are an alternative to Venture trains for lower volume, regional train operations. Because Amtrak has selected Venture trainsets to replace their fleet, using Venture trainsets may provide the most interoperability with other corridors and routes, but using trainsets that interoperate may provide more capacity than is needed early in the development of the Western North Carolina service.

Equipment costs in this report are based on Venture trainsets and associated maintenance facility for estimating purposes. Daily operation of three roundtrips between Salisbury and Asheville can be accomplished with two active trainsets. In addition to the two active trainsets, an additional trainset is required to provide spare capacity to facilitate equipment maintenance rotation and provide reliability of operations. Accordingly, the estimates included in this report are based on the costs for three trainsets. Equipment costs were derived from Amtrak's costs for their Airo™ contract with Siemens, as gathered from Amtrak's *Consolidated Financial Statements – Years Ended September 30, 2022, and 2021*. An additional evaluation will be needed to make any final decisions on equipment needs.

A service and maintenance facility will be necessary to support the proposed passenger rail operations. The facility will need to be located near one end of the corridor, in Asheville or Salisbury. This facility will cover basic day-to-day cleaning and service operations, as well as minor mechanical repairs.

Locations for a maintenance facility would need to be relatively contiguous with existing rail lines and large enough to accommodate a minimum of three trainsets. At the concept level, it is anticipated a maintenance facility for the Venture trainsets would require a 10-acre site. A maintenance facility for FLIRTs would require a site of 22 acres. A larger site is predicted for FLIRTs because of the lack of interoperability with other parts of the Amtrak fleet. A smaller site is predicted for Venture trainsets because of existing and planned maintenance facilities elsewhere. Larger land areas may be needed to ensure appropriately shaped sites can be utilized. More detailed site selection, layout, and design will be needed as plans for the service develop. Cost estimates for the maintenance facility are based on unit costs associated with conceptual estimates for upgrades to NCDOT's Charlotte Passenger Rail Facility (CPRF).



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6. Capital Cost Estimate

Capital costs for the improvements described in Section 5 are summarized below. All costs are conceptual and are subject to change pending freight railroad coordination.

Table 6-1. Conceptual Capital Costs

Item Description	Cost (2023 Dollars)
Track Infrastructure and Class of Track Improvements	\$119M ¹
Grade Crossing and Grade Crossing Signal Upgrades	\$169M ¹
Rail Signal Infrastructure (excluding PTC)	\$35M ¹
Positive Train Control (PTC)	\$45M ¹
Stations	\$81M ^{1, 2}
Equipment (3 Train Sets)	\$160M ¹
Maintenance Facility	\$55M ¹
Total WNC Capital Costs	\$665M

¹The conceptual costs shown include 10% project administration costs, 10% for engineering, 5% for mobilization, bonds, and insurance, and 35% for contingencies.

²Station costs include those for the Biltmore Village site alternative, Salisbury, and seven intermediate locations. Additional costs associated with a station alternative in the River Arts District are described in the report.



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7. Next Steps and Funding

The information provided in this feasibility report is conceptual and can be used to initiate conversations between NCDOT, MPOs, RPOs, NS, Amtrak, and other key stakeholders on design requirements and the pursuit of funding to reestablish passenger rail between Salisbury and Asheville.

Municipalities and their respective MPOs or RPOs will need to work together and consider including passenger rail services and their associated station and rail infrastructure improvements in the region's comprehensive transportation plans (CTP), metropolitan transportation plans (MTP), and long-range transportation plans (LRTP). MPOs and RPOs can use the information in this report to submit the project for funding consideration through the NCDOT STI prioritization process which allocates available project funding based on data-driven scoring and local input. If the project scores well enough to receive state transportation funds in STI, it will be included in the State Transportation Improvement Program (STIP). MPOs and RPOs have considered submitting the project into STI during the submission window that opened in July 2023.

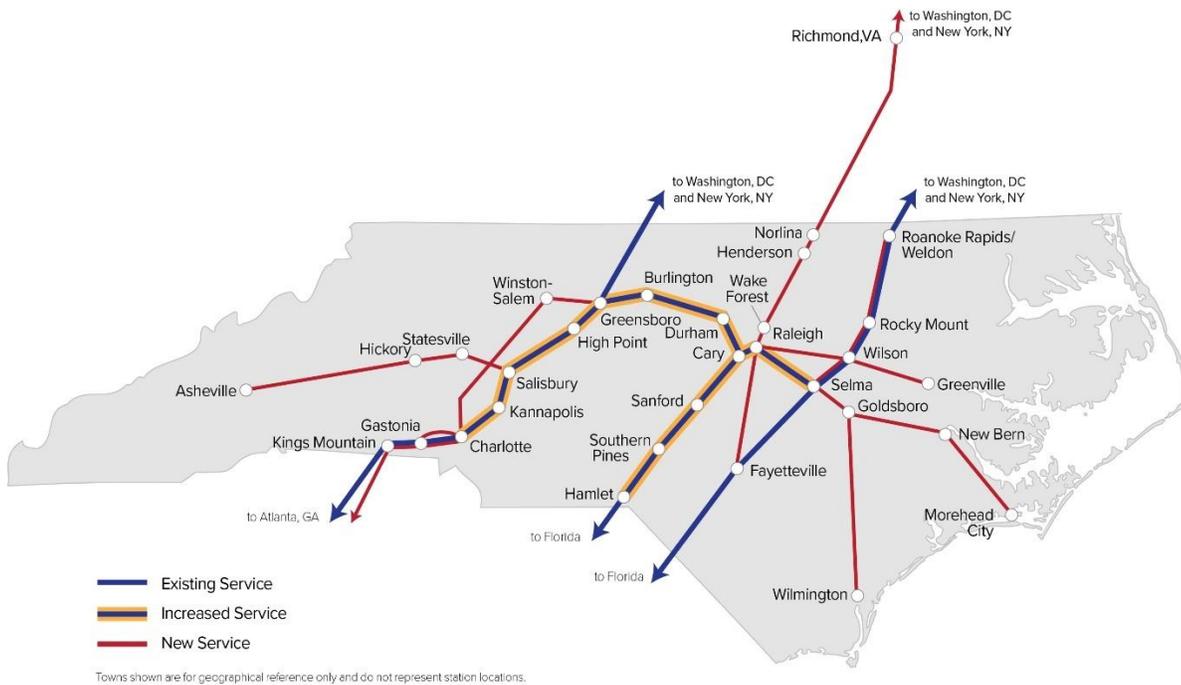
State funds secured through the STI process may also be used as leverage or match to pursue a federal competitive discretionary grant. This will significantly reduce the burden on state funds for development. A federal grant will help offset up to 80% of the costs associated with the project. Based on current federal funding authorities, the most appropriate federal grant program is the FRA's Federal State Partnership for Intercity Passenger Rail, which is a competitive, discretionary grant program for passenger rail. When it is time to submit an application for this program, letters of support from communities along the corridor will be needed.

To obtain federal funds for further study and development of the corridor and to better position the corridor for a potential future federal grant, NCDOT recently submitted an application to FRA for the Asheville-to-Salisbury corridor to be included in the newly created Corridor Identification and Development Program (CID). Figure 7 shows the corridors that NCDOT submitted to FRA for consideration. The CID program was created by the 2021 Bipartisan Infrastructure Law which directed FRA to "...build a foundation for a long-term rail program" related to intercity passenger rail services. This corridor was submitted by NCDOT to the CID program through FRA's Spring 2023 submittal process. If selected into CID, the program will fund 90 percent of the costs to develop a service development plan for the project. A service development plan is a high-level business, operating and capital plan with the objectives of demonstrating operational and financial feasibility and the value of the proposed service. The service development plan would build on the work associated with this feasibility study. The service development plan would also include railroad coordination to ensure the recommended infrastructure is sufficient for safe and efficient passenger and freight movement. The



more detailed analyses will provide information needed to more fully describe transportation benefits and costs associated with the service. Following the service development plan, the CID program would fund 80 percent of the costs to prepare environmental documentation in compliance with National Environmental Policy Act (NEPA). Corridor projects that have a service development plan and NEPA completed through the CID program are put into a project pipeline with statutory preference for the Federal State Partnership for Intercity Passenger Rail Program. The FRA anticipates announcing corridors selected for the CID Program in late 2023.

Figure 8. Future Passenger Rail Network for CID



8. Stakeholder Coordination

The NCDOT Rail Division began the coordination outreach process by notifying NS, Amtrak, and the North Carolina Railroad Company (NCR) of initiation of the feasibility study. Letters were sent to these stakeholders in May and June 2022. In those letters, NCDOT noted they would share the draft report with the railroads for their review and comments. As noted previously, additional more intensive railroad coordination is needed as planning for this passenger corridor proceeds.

NCDOT also met and coordinated with MPOs, RPOs, and the Western North Carolina Rail Committee during the development of this study. Meetings or calls that were held are listed below. In general, NCDOT presented information on the status of passenger rail in North Carolina, the status of the Southeast High Speed Rail corridor, and the proposed service characteristics for the Western North Carolina service. Each meeting included an opportunity to discuss concerns identified by the stakeholders and provided contact information for the feasibility study team.

- Western North Carolina Rail Committee Sept. 7, 2022
- French Broad River MPO (TCC) Sept. 8, 2022
- French Broad River MPO (TAC) Sept. 22, 2022
- MPO / RPO Virtual Meeting / Call Jan. 11, 2023
- Western North Carolina Rail Committee March 1, 2023
- French Broad River MPO (TCC) March 9, 2023
- Cabarrus Rowan MPO May 24, 2023

In addition to meetings associated with this study, a rail community meeting was held at Raleigh Union Station on Feb. 21, 2023. The rail community meeting was held with communities along 12 potential rail corridors throughout the state to present and discuss FRA’s CID program. Cities, towns, and counties along the WNC corridor were among the invitees and attendees. At the meeting, NCDOT noted that it was applying to the FRA CID program for the Western North Carolina corridor.

To ensure community participation, a draft of this report was circulated to NS, NCR, Amtrak, and the following local governmental and community organizations:

- Cabarrus-Rowan MPO
- Charlotte Regional TPO
- Greater Hickory MPO
- Statesville
- Conover
- Hickory



- French Broad River MPO
- Foothills Regional TPO
- Western North Carolina Rail Committee
- Valdese
- Salisbury
- Morganton
- Marion
- Old Fort
- Asheville
- Black Mountain

Comments received from various stakeholders have been addressed in this document, and the Norfolk Southern Corporation letter is attached in the appendix. NCDOT will remain in contact with the stakeholders throughout the study process to provide relevant updates and move toward next steps.



Abbreviations

CID	Corridor Identification and Development Program
CTP	Comprehensive Transportation Plan
CPRF	Charlotte Passenger Rail Facility
DOT	Department of Transportation
FLIRT	Fast Light Intercity and Regional Train
FRA	Federal Railroad Administration
IIFA	Infrastructure Investment and Jobs Act
LRTP	Long Range Transportation Plan
M/L	Main Line
MP	Milepost
mph	Miles per hour
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
NB	Northbound
NC	North Carolina
NCDOT	North Carolina Department of Transportation
NCRR	North Carolina Railroad Company
NEPA	National Environmental Policy Act
NS	Norfolk Southern
PTC	Positive Train Control
RPO	Rural Planning Organization
RR	Railroad
RTC	Rail Traffic Controller software
SB	Southbound
STIP	State Transportation Improvement Plan
STI	Strategic Transportation Investments
TAC	Transportation Advisory Committee
TCC	Technical Coordinating Committee
TPO	Transportation Planning Organization
WNC	Western North Carolina

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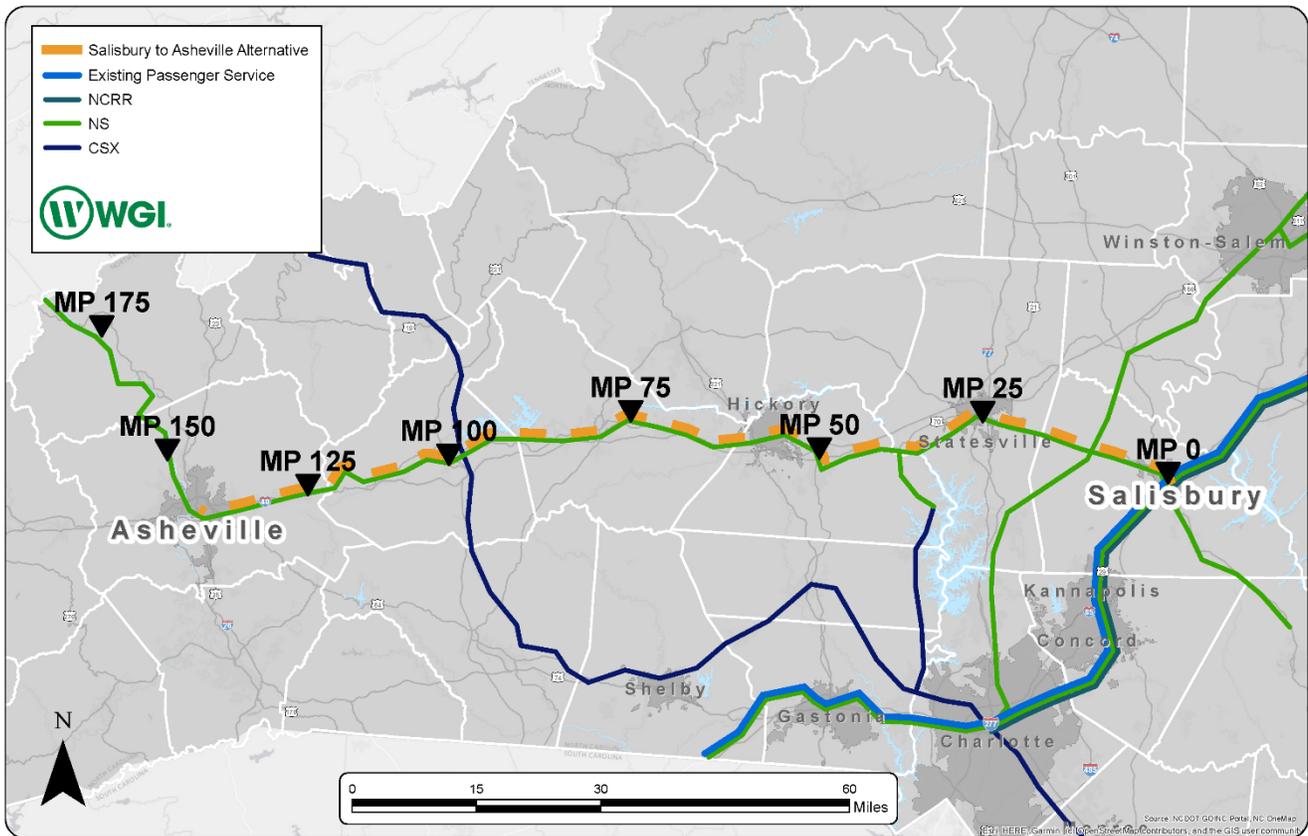
Appendix A

Proposed Infrastructure Improvements

Project Identifier	Project Description	Milepost
L1	Salisbury Station Trackage	0.0
L3	Construct Siding at Fiberton	8.8 - 10.3
L4	Extend North Siding & Convert to Mainline at Barber Junction	11.6 - 13.2
L5	Construct new mainline (M/L) (old M/L becomes Siding) at Elmwood	20.1 - 22.2
L7	Rehabilitate Siding at Eufola	32.3 - 33.8
L9	Rehabilitate Siding at Clarmont	40.0 - 42.6
L10	Extend Siding & Convert to M/L at Oyama	52.8 – 55.0
L11	Rehabilitate Siding at Connelly Springs	65.7 – 68.2
L14	Construct Siding at Morganton	81.0 – 83.2
L15	Rehabilitate Siding at Bridgewater	89.0 – 90.4
L16	Rehabilitate Siding at Clinchcross	95.2 – 97.4
L19	Siding Modifications at Old Fort	109.6 – 111.0
L20	Rehabilitate Siding at Coleman	118.5 – 119.7
L22	Rehabilitate Siding at Grovestone	126.5 – 127.9
L24-A¹	Construct Biltmore Village Station Track	138.7 – 138.9
L24-B¹	Construct River Arts District Station Track	141.6 – 141.8

¹Projects L24-A and L24B are two alternatives for potential station infrastructure improvements in the vicinity of Asheville. Only one project of this alternative set is likely to be selected.

Approximate Milepost Locations



Appendix B

Norfolk Southern Letter – Dated August 3, 2023



Norfolk Southern Corporation
650 W Peachtree St, NW
Atlanta, GA 30308

Kevin P. Lynch
Manager Passenger Policy
Kevin.Lynch@nscorp.com

August 3, 2023

Eddie McFalls
Strategic Initiatives Consultant
North Carolina Department of Transportation
1 South Wilmington Street
Raleigh, NC 27699
via electronic mail

Re: Draft Western North Carolina Passenger Rail Feasibility Study

Dear Mr. McFalls:

We appreciate the opportunity to review and comment on the June 2023 draft of the Western North Carolina Passenger Rail Feasibility Study (the “Report”). The Report provides a comprehensive review of previous studies, and we believe it highlights as well, the many challenges associated with new intercity passenger service between Salisbury, NC, and Asheville, NC on Norfolk Southern (NS).

Norfolk Southern cannot validate the various conclusion in this Report (e.g., transit times, operational impacts, and the cost of capital improvement listed in this latest study). In the Report’s own words, it does not “include detailed input from freight railroads. The estimates and infrastructure assumptions were prepared using general assumptions.” Railroading is a capital-intensive industry, and the terrain associated with this segment of railroad in particular is very challenging from a construction standpoint.

NS does support the expansion of passenger rail service in North Carolina and elsewhere. That expansion, of course, needs to be done so that the passenger service expansion is transparent to our current and future freight and intercity passenger operations. Expansion contemplated by the Report could only be effectuated after study and agreement with NS. The NS Team looks forward to discussing this further during the upcoming meeting between our parties on August 16th, 2023.

Sincerely,

A handwritten signature in black ink that reads "Kevin P. Lynch". The signature is written in a cursive, flowing style.

Kevin P. Lynch

