Benefit-Cost Analysis

Introduction

This technical memorandum estimates the long-term benefits of the proposed I-85 & McCanless Road interchange in East Spencer, NC. This evaluation discusses all the Project Outcome Criteria specified in the Notice of Funding Opportunity (NOFO), although for some measures, a qualitative discussion is required. The assumptions and methods used to develop the Benefit-Cost Analysis (BCA) are detailed for each topic and are supported by supplementary material where appropriate.

The long-term quantifiable benefits of the project are presented in the Project Outcome Criteria. These include safety benefits, operational and travel time savings (economic impacts) and reduced emissions (environmental impacts). The benefits of State of Good Repair (SGR), bicycle/pedestrian and innovation are discussed as qualitative benefits. These qualitative benefits are not included in the BCA based on the current BCA Guidance.

The final section of this document summarizes the anticipated benefits and costs of the I-85 & McCanless Road interchange and calculates the overall Benefit-Cost Ratio. Supplemental materials can be found on the project website:

https://connect.ncdot.gov/resources/RAISE2025-EastSpencer/Pages/default.aspx

Years of Analysis

The analysis is based on an estimated construction completion date in 2033. A benefits period of 2034-2063 was used. This 30-year benefits period is consistent with the 2025 BCA Guidance for Discretionary Grant Programs (BCA Guidance) for projects involving the full reconstruction of highways or similar facilities.

Methodology

Benefits are estimated in accordance with the BCA Guidance. Where no specific approach was provided in the Guidance, best practices and research data as specified in the assumptions and methodology were used. The benefits quantified in the BCA use 2023 dollars (as advised by USDOT). Benefits for each project element are described within the benefit categories.

Analysis Assumptions

A list of assumptions for the I-85 & McCanless Road interchange is provided in the BCA workbook and summarized in *Tables 1 and 2. Table 1* displays the generalized BCA input values provided by the USDOT for a variety of categories that include auto occupancy rates, vehicle values of time, safety crash rate values and emissions damage costs.

Table 1: Input values from BCA Guidance

Input	Value
General Assumptions	
Analysis Period (Years)- Projects Involving Full Reconstruction of Highways or New Location Roadways	30
Discount Rate	3.1%
Discount Rate for Reductions in CO_2 Emissions	2%
Dollar Year	2023
Auto Occupancy (Passenger Vehicles, All Travel)	1.52
Auto Occupancy (Trucks) [1]	1.00
Truck Value of Time (Hourly Value)	$35.70
Passenger Vehicle Value of Time (Hourly Value)	$21.10
Operating Costs per Mile (Light Duty Vehicles)	$0.56
Operating Costs per Mile (Commercial Trucks)	$1.27
Safety – Crash Data Assumptions	
PDO Crash	$9,500
Injury Crash	$329,500
Fatal Crash	$14,806,000
Emissions – Assumption for Damage Costs per Metric Ton	
NO_X –2034 and beyond	$22,900
SO_X – 2034 and beyond	$63,700
$PM_{2.5}$ – 2034 and beyond	$1,108,000
CO_2 – 2034 and beyond	$284 to $375

Note: *Dollar values are in 2023-dollar values.*

[1] Value from https://www.fhwa.dot.gov/tpm/guidance/avo_factors.pdf

Table 2 lists project-specific assumptions. Most of these project-specific assumptions come from the Metrolina Regional Travel Demand Model and the North Carolina Department of Transportation (NCDOT) Traffic Safety Group.

Table 2: BCA Calculation Inputs – Project Specific

Input	Value	Source
General		
Annual Average Daily Traffic Volumes (AADT)	Varies by Scenario	Metrolina Regional Model
Compound Annual Growth Rate (Weighted average rate of all forecast roadway segments)	1.50%	
VHT/VMT values	Varies by Scenario	
Crashes ((categorized by type) from 2021 to 2023)	Varies by crash type	NCDOT Traffic Safety Group

The Metrolina Regional Travel Demand Model was used to determine the impacts to the study area's vehicle miles traveled (VMT) and vehicle hours traveled (VHT) with and without the project in place. The study area is shown in *Figure 1*.

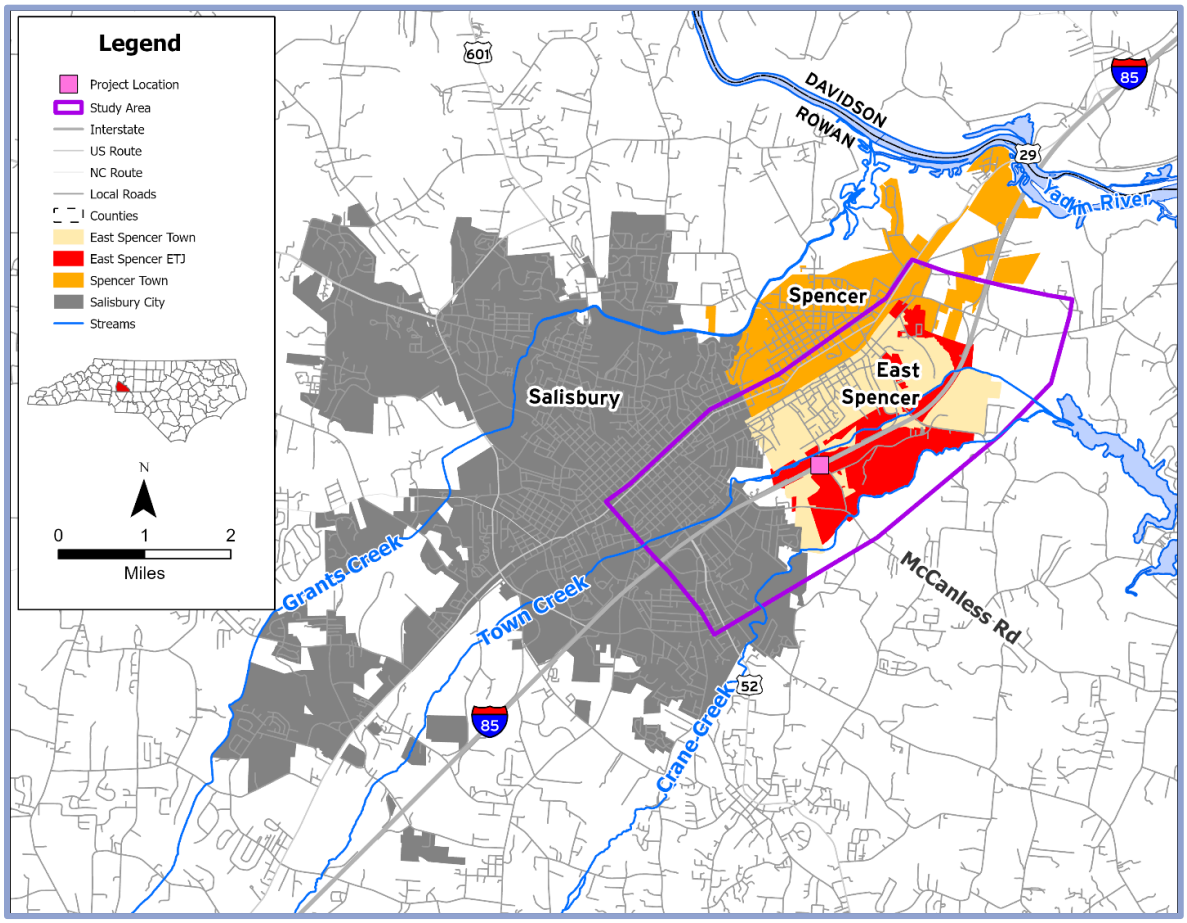

Figure 1: Project Location Map

Benefits

Criterion #1 – Safety

This project will protect non-motorized travelers from safety risks and will meet the "Safer Roads" component of the National Roadway Safety Strategy. Currently, Meridian Brick trucks must use Long Street and other secondary roads to access I-85 North or South. Long Street in particular provides challenges for pedestrians and bicyclists. The sidewalks are discontinuous in East Spencer, with wooden electric poles often placed in the middle, causing some pedestrians to leave the sidewalk and enter the road. The travel width of Long Street is 27 feet. There are no bike lanes and bicycles must share the travel lane with trucks and other vehicles.

Figure 2: Electric Pole Obstructing Sidewalk

From September 1, 2014, through August 31, 2024, there were 425 crashes on Long Street, including 3 fatal crashes. The total crash rate was 571.8 per 100 million vehicle miles and the fatal crash rate was 4.4 per 100 million vehicle miles. For a facility less than 4 miles long with an annual ADT of 5,300, this is an excessive number. Crashes involved 13 pedestrians, 4 bicyclists and 17 moped crashes. The estimated cost of these crashes exceeded $2 million.

Construction of the interchange would reduce truck traffic on Long Street and allow area residents an additional option to access I-85 for jobs, goods and services. Reducing this traffic on Long Street would provide a safer, less congested facility for bicyclists and pedestrians.

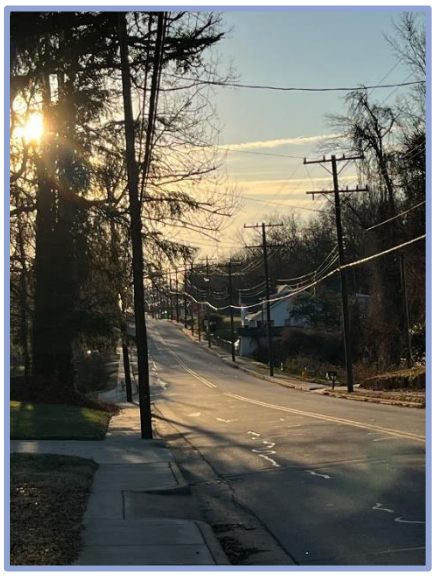

Figure 3: Long Street

According to the USDOT Equitable Transportation Community (ETC) Explorer, 13.7 percent of households in East Spencer do not own a motor vehicle. This would provide safer, less stressful access to goods and services for many residents.

The benefits of the project stretch beyond Long Street. Allowing area residents and commercial vehicles to access I-85 more directly would also reduce traffic on I-85 interchanges to the north (towards Greensboro) and to the south (towards Charlotte). This is especially important for those traveling to Charlotte. US 52/Innes Street (SR 2200) has an even higher crash rate than Long Street, with 1,228 crashes over the same time period, including 4 fatal crashes and 232 total injury crashes. A total of 23 crashes involved bicyclists or pedestrians. The overall crash rate is 1,848.32 per 100 million vehicle miles. Providing an alternative route will improve overall safety in the region.

A crash analysis was also conducted for Correll Street/McCanless Road (SR 2114). Over the same time period as the other facilities, 25 crashes were reported. There were no fatal crashes

and 9 injury crashes. The total crash rate was 256.90 per 100 million vehicle miles, which is substantially below the rates of the other area facilities.

For the purposes of the BCA, the reduction in overall VMT results in improved safety on area roadways. Historical crash rates for Rowan County (2021-2023) per VMT, by severity (fatal, injury, property damage only), were used to estimate the reduction in crashes associated with the reduction in VMT. **Using the factors previously listed, the total safety benefit savings was found to be $8.5 million, with a net present value in 2023 dollars of $4.3 million**.

Criterion #2 – Environmental Sustainability

The project will address the disproportionately negative impacts to a disadvantaged community. Based on the USDOT's Climate and Economic Justice Screening and Mapping Tool (CEJST), currently, the project area faces more Particulate Matter (PM) pollution, Toxic Release into the Air (toxicity-weighted concentration) and Risk Management Protection facilities than the majority of the state. It should be noted that the East Spencer census tract ranks in the highest 89th percentile with regards to residents diagnosed with asthma.

According to Quiros et al., 2017, heavy-duty on-road vehicles account for 70 percent of all freight transport and 20 percent of transportation-sector greenhouse gas (GHG) emissions in the United States. The study found that 2013 diesel semi-trucks with a payload of 19.6 tons had an average CO_2 emissions rate greater than 76 grams of CO_2 per ton-mile traveled. The proposed interchange would reroute trucks exiting and entering the brick plant, therefore reducing PM exposure to East Spencer residents. Based on data from the Town, Meridian Brick runs over 70 trucks down Long Street daily. Other vehicles would also use the proposed interchange. **The safety benefits of this reduction in greenhouse gases would provide a total benefit of $165,204,276, which for the purpose of this analysis, is discounted to $80,688,933.**

Criterion #3 – Quality of Life

Figure 4: East Spencer Home

This project would proactively address equity. The Developing an East Spencer Interchange for a Growth Nexus (DESIGN) project area includes one census tract, 37159050800, which is listed as both a Historically Disadvantaged Community (HDC) and an Area of Persistent Poverty (AoPP). The census tract is listed as disadvantaged due to transportation barriers, low income, unemployment and the percentage of residents with less than a high school education. According to the ETC Explorer, census tract 37159050800 has high transportation burden costs. Approximately 49.98 percent of the population in the tract is at or below 200 percent of the federal poverty line. The median household income is $41,387. The average household spends 22.41 percent of their income on transportation ($11,149 annually), and 23.08 percent of households in this tract spend more than 30 percent of their income on housing.

By converting the I-85 bridge into an interchange, the project will improve direct access to employment centers, goods and essential services, reducing travel times and transportation costs for residents. Ultimately, the project will promote equity by creating a more inclusive, accessible and affordable transportation network, enabling the residents of this underserved community to participate more fully in economic and social opportunities.

Figure 5: Vacant Auto Service Facility No Longer in Operation

The DESIGN project will enhance connectivity and eliminate transportation barriers to emergency care for workers in the area's brick plants and future industrial developments where dangerous conditions demand rapid access to medical services. The current lack of direct access to I-85 has already contributed to delays in emergency response, tragically highlighted by the death of a brick plant worker off McCanless Road. By improving connectivity, the interchange will reduce response times to critical facilities like Novant Health Urgent Care, ensuring faster, life-saving care for workers in high-risk industries. This project is essential for protecting the health and safety of the local workforce.

The DESIGN project will reduce transportation and housing cost burdens by improving access to public and private investments that can spur greater commercial and mixed-income residential development near the corridor. Enhanced connectivity will attract new businesses and residential projects. By facilitating more efficient transportation routes, the project will lower commuting costs for residents and create opportunities for affordable housing near employment centers, supporting a more integrated, cost-effective living environment for both current and future residents.

Figure 6: Correll Street

By connecting McCanless Road directly to I-85 via the interchange, the project will divert heavy truck traffic away from local streets, reducing congestion and improving safety for pedestrians in town. This redirection will enhance the walkability and accessibility of the area, making it easier for residents to navigate their community without relying on a car. By creating safer, more pedestrian-friendly spaces, the project will encourage a thriving environment where individuals can live, work and play, supported by a range of transportation choices that allow for greater mobility and community engagement.

Criterion #4 – Mobility and Community Connectivity

By providing more direct access to I-85, the project will directly increase intermodal freight movement and provide opportunities to attract commercial development critical to the Town's long-term financial stability. East Spencer is faced with transportation barriers. To the northwest, the CSX railroad tracks isolate the Town from the Town of Spencer, except for one railroad crossing at Jefferson Street on the northern edge of the Town limits. I-85, a valuable network that would connect the Town to the rest of the state and southeast region, slices through the edge of East Spencer, with no facilities that would allow traffic to flow into downtown. According to the EPA CEJST, East Spencer ranks in the 90th percentile of communities experiencing transportation barriers.

According to the ETC Explorer, 13.70 percent of households do not a vehicle. The estimated drive times to facilities are:

- Adult Education Opportunities – 34 minutes
- Grocery Stores – 5 minutes
- Medical Facilities – 6 minutes
- Parks – 4 minutes

As a focal point in East Spencer, the DESIGN project would connect the Town with two major interstates, I-85 and I-40, two national freight corridors carrying local traffic, commuters, tourists and freight. Currently, trucks exiting the brick plant must travel 2.5 miles to get to I-85 South and travel 3 miles to get to I-85 North. Both routes rely heavily on Long Street, a two-lane minor arterial road, which also serves as the main road for residents and visitors of East Spencer. The proposed interchange at McCanless Road would divert truck traffic from travelling through almost the entire limits of the Town using the communities main travel artery. In doing so, safety and mobility for motorists would improve, as well as connection to local community facilities.

Figure 7: Residential Homes Along Long Street

The annual daily VMT and VHT impacts were calculated using the Metrolina Regional Model. The Future Year model (2050) was run with and without the project in place. The model network links within the BCA study area were then extracted and the daily values were summarized. The daily values were then annualized for the purposes of the BCA calculations.

An in-depth analysis of the 2050 Future Year No-Build results underscores the urgent need for the interchange on SR 2114 and the I-85 corridor to enhance traffic operations. The projected data reveal significant congestion and queueing, driven by escalating traffic volumes and new developments that are intensifying demand for transportation connectivity. By implementing the proposed interchange design, we can effectively reroute traffic and alleviate these bottlenecks, ultimately ensuring that the DESIGN project operates efficiently for all users.

The build alternative is not merely a solution but rather a transformative opportunity for the East Spencer community. It is expected to provide essential capacity enhancements, significantly improving traffic flow compared to the 2050 No-Build scenario. In fact, the total intersection delay for all intersections along the project corridor is projected to decrease during both AM and PM peak periods under the Build scenario. While the intersection of McCanless Road at I-85 sees a slight increase in delay during the PM peak, overall improvements across other intersections will more than compensate, fostering a smoother traffic experience.

As highlighted in *Table 3,* the build alternative promises to reduce total delays during the peak hour time periods by at least 14% while enhancing average speeds compared to the 2050 No-Build scenario. This infrastructure upgrade is not just about traffic flow; it is a vital investment in the future of East Spencer.

Table 3: Network MOE Comparison

Year/Scenario	Vehicle Hours Traveled (VHT)		Vehicle Miles Traveled (VMT)		Average Speed (mph)		Total Delay	
	AM	PM	AM	PM	AM	PM	AM	PM
2022 Base Year No-Build	592.9	773.9	33,762.2	39,417.10	63.5	62.4	106.5	203.8
2050 Future Year No-Build	985.5	1,345.30	52,210.7	60,051.60	60.9	60.6	221.8	474.1
2050 Future Year Build	948.4	1,299.80	52,091.8	60,059.90	61.5	61.2	191.3	430.9
2022 Base Year Build	613.2	766.7	33,993.9	39,728.20	62.8	62.2	123.7	190.4

From a practical perspective, **the DESIGN project will reduce vehicle hours traveled, providing a total benefit of $90,403,933 in travel time savings and a $55,566,303 benefit in operational savings for a total benefit of $146,279,326 (net present value of $67,213,310).**

Criterion #5 – Economic Competitiveness and Opportunity

The project would promote wealth building for area residents, create good-paying jobs and promote long-term economic growth and broader economic and fiscal benefits. The I-85 corridor has emerged as a significant driver of economic growth and industrial development in the Southeast. Traditionally known for supporting a robust manufacturing base, this corridor has evolved into a dynamic hub that now integrates both legacy industries and emerging sectors. As a result, the I-85 corridor is positioning itself as a key contributor to the region's competitiveness in the global marketplace, fostering innovation, economic diversification and sustainable growth. The continued development along this corridor is expected to further enhance the Southeast's economic resilience, creating high-quality jobs and attracting international investment.

Figure 8: Brick Plant On Long Street

According to the Rowan Campaign for Economic Prosperity 2025-2029, Rowan County is experiencing a significant surge in industrial development along the I-85 corridor, attracting major national and international corporations. Notable recent projects include Macy's 1.4 million-square-foot fulfillment center and Chewy's 700,000-square-foot distribution center. With over 15 million square feet of industrial space under development, the region is well poised for continued growth. Crow Holdings is developing a state-of-the-art 710,600-square-foot facility, reflecting confidence in Rowan County's strategic location, pro-business environment, and skilled labor force. These investments are part of a broader economic boom along the corridor, which connects key metropolitan areas throughout the Southeast. As shown in *Figure 9,* the DESIGN project would provide East Spencer residents and commercial facilities with easy access to Charlotte, Greensboro and Winston-Salem.

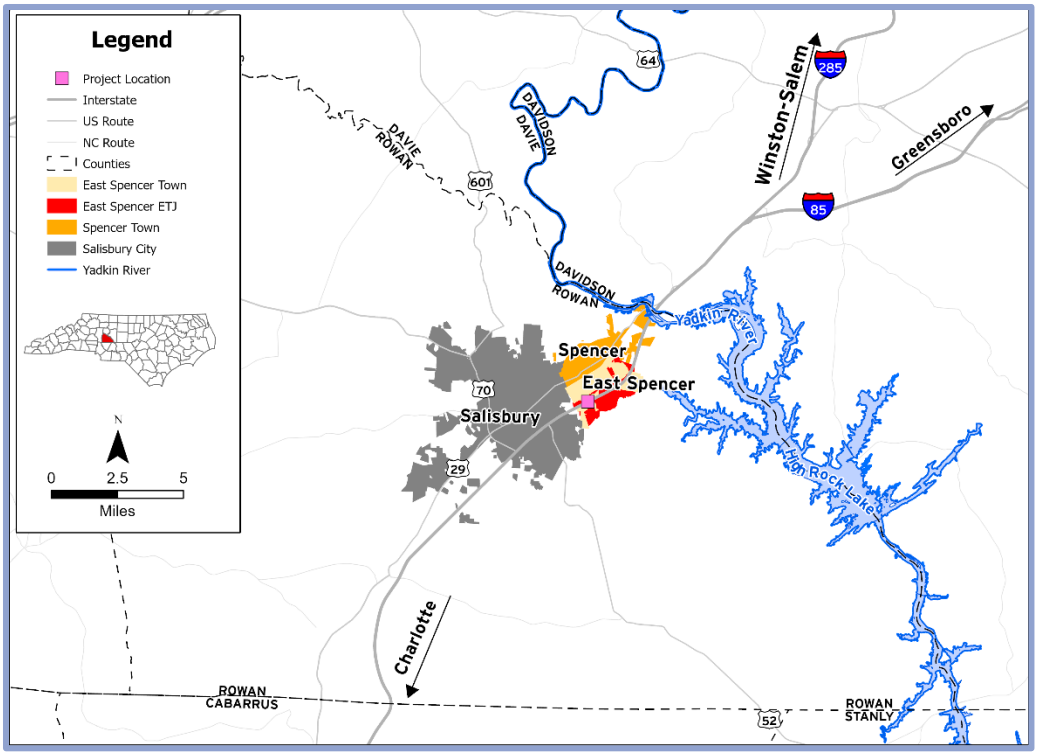

Figure 9: DESIGN Project Key Access Areas

The I-85 corridor, while inland, is strategically connected to global supply chains through inland ports located in Charlotte and Spartanburg. These ports facilitate access to major shipping channels via the ports of Charleston, Savannah and Wilmington. The corridor's development not only enhances local economies but also contributes to the broader economic landscape of the United States.

By converting the I-85 bridge into an interchange, the project will improve direct access to employment centers, goods and essential services, reducing travel times and transportation costs for residents. While economic development is not currently included as a quantifiable benefit, previous studies show the benefit of the DESIGN project. According to a 2022 report by the US Chamber of Commerce, "On average, a new (distribution center) DC employing 3,000 workers resulted in 5,111 total new jobs in an MSA including those 3,000 at the new DC, and sustained those new jobs over a 20-year period. Importantly, for ever(y) job created directly by a new DC, there are an additional 0.7 jobs created in the MSA." The report states that the average DC creates over 5,100 jobs, increases personal income by $500 million and grows wages by $360 million.

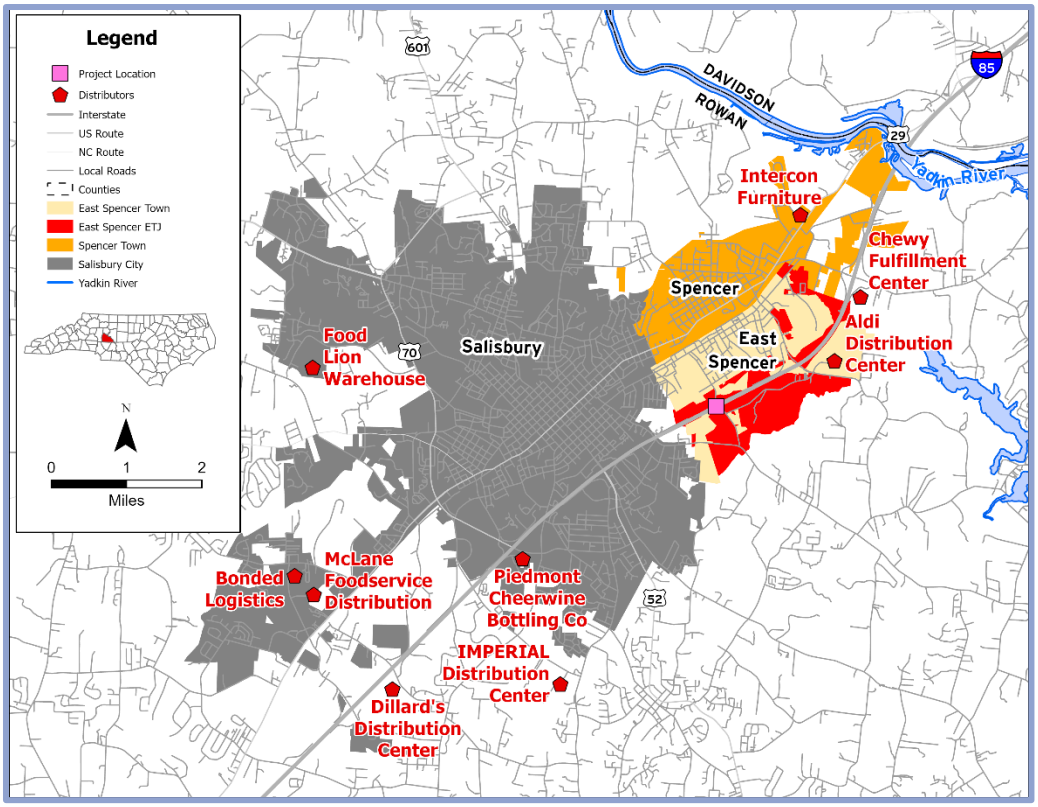

Figure 10: Rowan County Distribution Centers Distribution Centers

While Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant BCA criteria do not allow for anticipated economic impact, the DESIGN project provides definitive qualitative impacts. The project will reduce transportation and housing cost burdens by improving access to public and private investments that can spur greater commercial and mixed-income residential development near the corridor. Enhanced connectivity will attract new businesses and residential projects. By facilitating more efficient transportation routes, the project will lower commuting costs for residents and create opportunities for affordable housing near employment centers, supporting a more integrated, cost-effective living environment for both current and future residents.

Criterion #6 – State of Good Repair

The DESIGN project would reduce maintenance burdens on Long Street, create additional infrastructure that would be maintained in a State of Good Repair and address current transportation system vulnerabilities in an underserved community. NCDOT would take control of the interchange once it becomes a part of the I-85 system, ensuring it will be properly maintained to allow safe transport of people, goods and services.

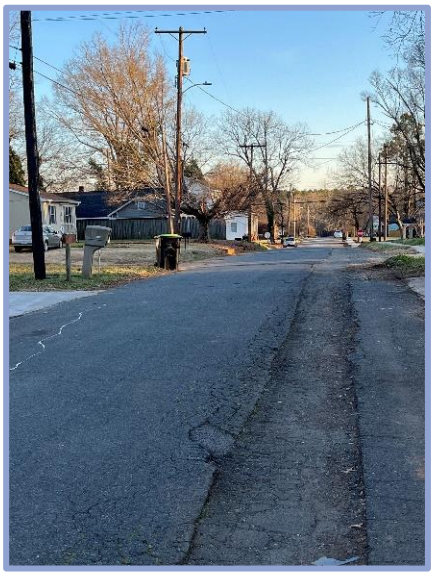

Figure 11: Damaged Infrastructure on Long Street Highlights Transportation Needs

Criterion #7 – Partnership and Collaboration

The DESIGN project will be driven by the partnership between the Town of East Spencer and NCDOT. In addition, during project development, the Town will follow USDOT's Promising Practices for Meaningful Public Involvement in Transportation Decision-Making Guide. Public Involvement practices will include:

- Title VI compliance.
- Community Participation Plan.
- LEP Outreach that follows the US Department of Justice LEP Guidance.
- The project is included in the Metropolitan Planning Organization's (MPO) Long-Range Transportation Plan and will be included in the NCDOT State Transportation Improvement Program.
- Public engagement activities, including a project website, public meetings and small group discussions.

Criterion #8 – Innovation

The DESIGN project is part of a long-range plan by the Town of East Spencer. With funding in place for the interchange, the Town can move forward with plans for the installation of an Electric Vehicle (EV) charging station on McCanless Road, as well as pursuing funds for developing bicycle and pedestrian accommodations connecting East Spencer with Hanford-Dole Elementary, as well as potential commercial facilities that can benefit from the proposed interchange.

Summary

The analysis resulted in a Benefit-Cost Ratio (BCR) of 3.10 and a $91.2 million net present value of benefits *(Table 4)*. This is considered a "high" economic analysis rating (the project's benefits will exceed its costs with a BCR of at least 2.0). East Spencer has concluded that these benefits reasonably justify the cost of the project.

Table 4: I-85 & McCanless Road Interchange Total Project Benefit-Cost Analysis

Capital Costs	Project Costs (NPV $2023)	Total Net Benefit	Total Net Benefit (NPV $2023)	Benefit-Cost Ratio
$39,900,000	$29,453,934	$181,775,250	$91,214,980	3.10