3.19 Sustainability

3.19.1 WHAT IS SUSTAINABILITY?

Federal Highway Administration (FHWA) describes sustainability using the "triple bottom line", which considers three principles: Social (also known as equity or people), Environmental (also known as ecology or planet), and Economic (also known as money or profit).[1] The goal of sustainability is the satisfaction of basic social and economic needs, both present and future, and the responsible use of natural resources, all while maintaining or improving the well-being of the environment on which life depends.

"Triple Bottom Line" Principles:

- **Social**
- **Environmental**
- **Economic**

3.19.1.1 What is a sustainable highway?

FHWA views sustainable highways as an integral part of sustainable development.[2] A sustainable highway should satisfy lifecycle functional requirements of societal development and economic growth while striving to enhance the natural environment and reduce consumption of natural resources. The sustainability characteristics of a highway or roadway project should be assessed and considered for implementation throughout its lifecycle, from conception through construction, operations, and maintenance.

Sustainability in highways should be addressed with the understanding that highways are one part of transportation infrastructure, and transportation is one aspect of meeting human needs. In addition to addressing environmental and natural resource needs, the development of a sustainable highway should focus on access (not just mobility), moving people and goods (not just vehicles), and providing people with transportation choices, such as safe and comfortable routes for walking, cycling, and transit.

Sustainable transportation may be described or defined in many ways that broadly address environmental, social and economic impacts, safety, affordability, and accessibility of transportation services. Transportation agencies address sustainability through a wide range of initiatives, as well as addressing requirements of the National Environmental Policy Act (NEPA). Measures of project success include a wide range of indicators, such as travel performance, gains achieved through material selection, and construction methods.

3.19.2 WHAT ARE THE SUSTAINABILITY GOALS FOR THE PROJECT?

A project team consisting of representatives from FHWA, SCDOT, and design, environmental, and public involvement leads have established sustainability goals and monitored progress during project development. Initial sustainability goals established during initial workshops in June 2015 include:

- Align the project with FHWA's Partnership for Sustainable Communities [3]

[1] https://www.sustainablehighways.org/296/what-is-sustainability.html
[2] https://www.sustainablehighways.org/203/what-is-a-sustainable-highway.html
[3] https://www.fhwa.dot.gov/livability/partnership/leveraging_the_partnership/leveragingandpartnership.pdf

- Achieve net gain when offsetting environmental impacts
- Consider river systems and regulated floodways
- Consider floodplain and culvert design innovations
- Address aging stormwater infrastructure
- Evaluate the resiliency of the corridor and the ability to maintain cargo routes, mobility, and access
- Implement compensatory stream and wetland mitigation
- Implement context sensitive solutions, public involvement and outreach [4]
- Consider research and construction innovation
- Implement erosion and sediment control
- Conduct environmental compliance

3.19.3 HOW IS SUSTAINABILITY BEING DOCUMENTED FOR THE PROJECT?

3.19.3.1 Envision

Envision is a sustainability rating system and planning guide for introducing sustainability considerations into infrastructure projects.[5] Envision was developed in joint collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI). ISI is a not-for-profit education and research organization founded by the American Public Works Association, the American Council of Engineering Companies, and the American Society of Civil Engineers.

The Envision Guidance Manual (Version 2) covers the use of the Envision rating system for the planning and design phase. Envision has 60 sustainability criteria (called 'credits') organized into five categories:

- Quality of Life: Purpose, Community, Wellbeing
- Leadership: Collaboration, Management, Planning
- Resource Allocation: Materials, Energy, Water
- Natural World: Siting, Land and Water, Biodiversity
- Climate and Risk: Emissions, Resilience

Sustainability ratings for infrastructure projects are established through a performance assessment that awards points for up to five levels of achievement within each credit. Additional points for innovative performance can be earned in each category. Projects that apply Envision and opt to go through ISI's independent, third-party review (called 'Verification') may be eligible for Envision awards. ISI plans to release Version 3 of the Envision Guidance Manual in February 2018, which would include new and revised credits and updated documentation requirements. SCDOT anticipates submitting documentation for ISI Verification of planning efforts upon completion of the Final EIS.

[4] www.fhwa.dot.gov/planning/css/
[5] http://sustainableinfrastructure.org/envision/

3.19.3.2 FHWA INVEST

FHWA's Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) is a web-based self-evaluation tool comprised of voluntary sustainability best practices, called criteria, which cover the full lifecycle of transportation services, including system planning, project planning, design, and construction, and operations and maintenance.[6] To cover the full transportation lifecycle, the INVEST criteria are divided into four modules: System Planning for States (SPS), System Planning for Regions (SPR), Project Development (PD), and Operations and Maintenance (OM). The PD module includes criteria that span the entire project development process from early planning, alternatives analysis, environmental documentation, preliminary and final design, and construction. The PD module consists of multiple scorecards designed to recognize the varying scope, scale, and context of projects across the country. The PD module includes 33 criteria that are generally organized from planning to design to construction. Criteria within the PD module include topic areas such as context sensitive project development, ecological connectivity, pedestrian and bicycle facilities, and construction waste management.

INVEST has 7 project scorecards available for the evaluation of projects based on both the type of project (paving, basic, extended, or scenic/recreational) and the location (rural or urban). The Extended Urban scorecard applies to major reconstruction projects that add travel lanes to an existing roadway and is being used for the Carolina Crossroads project.

3.19.4 WHAT ARE KEY SUSTAINABILITY CONSIDERATIONS FOR THE PROJECT?

The following sections provide a broad overview of the key sustainability considerations for the project. Detailed sustainability considerations can be found in the Envision Manual (Version 2) and FHWA INVEST PD Extended Urban scorecard.

3.19.4.1 Communities and Public Outreach

3.19.4.1.1 Stakeholder involvement

Sustainability considers the social effects of a project, including the establishment of sound and meaningful programs for stakeholder identification, engagement and involvement during decision making. NEPA requires that agencies “make diligent efforts to involve the public in preparing and implementing their NEPA procedures.”[7] Public and agency participation has been an important part of the proposed Carolina Crossroads I-20/26/126 Corridor Improvement Project (Carolina Crossroads), and the project team made a commitment at the beginning of the project to encourage and solicit public participation and feedback. Chapter 4 of the DEIS provides a detailed summary of communications tools and stakeholder involvement during scoping and preparation of the DEIS. The comprehensive public involvement process is an essential component of the project’s sustainability, and meets the project team’s sustainability goal of implementing context sensitive solutions, public involvement, and outreach.

[6] https://www.sustainablehighways.org
[7] 40 CFR 1506.6(a)

3.19.4.1.2 Community mobility

SCDOT is evaluating how to locate, design and construct the proposed project to ease traffic congestion, improve mobility and access, and otherwise improve community livability. Community mobility is measured by the extent to which the project improves access, reductions in commute times, and traverse times to existing facilities and transportation.

SCDOT is considering community mobility by evaluating anticipated traffic flows and volumes (Chapter 3.1), preferred modes of access, and effects on mobility. Discussions have been held with stakeholders and decision-makers to optimize design choices. SCDOT has also worked decision-makers in adjacent facilities, such as CSX railroads, and transportation hubs, such as COMET, to determine best modes of access. Access and mobility principles, concepts, requirements, and specifications have been incorporated in the design, and expected outcomes. An example of a community mobility consideration includes the proposed overpass between Tram Road and Beatty Road over I-26.

3.19.4.1.3 Impact assessments

As part of the DEIS process, the project team conducted numerous technical studies and impact assessments to determine how the proposed project would affect community resources. Minimizing noise during construction and operation of the proposed project, preserving historic and cultural sites, and maintaining the local character of a community are key components of sustainability. Noise studies, cultural resource studies, and community impact assessments are examples of ways the project team evaluated community resources.

3.19.4.2 Natural World

3.19.4.2.1 Prime habitats

Prime habitat are areas of high ecological value such as, but not limited to, old-growth forest, national parks and wildlife refuges, and wild and scenic rivers. Saluda River is a South Carolina state scenic river and was identified as a prime habitat within the PSA. SCDOT has evaluated potential effects on the Saluda River as part of the alternatives screening and DEIS. RA 7 and RA 8 were eliminated from further consideration during the alternatives screening, in part, because of their potential impacts on the Saluda River and encroachments on the river floodplain. Avoiding and minimizing impacts to the Saluda River has been a key sustainability component of the project.

3.19.4.2.2 Greenfields

SCDOT evaluated the project's potential effects on land use (Chapter 3.1). Land use is also a component of sustainability and SCDOT evaluated how the proposed project would affect greenfields compared to brownfields. Greenfields are defined as undeveloped land, while greyfields are defined as previously developed land. Sustainability promotes the conservation of undeveloped land by locating projects on previously developed greyfield sites. RA 1 and RA 5 Optimized are predominantly located on greyfields, and avoid the development of greenfields compared to alternatives outside the existing project corridor. SCDOT used GIS and land use data to estimate the percentage of RA 1 and RA 5 Optimized within greenfields and greyfields. Results of the analysis are presented in Table 3.19-1.

Table 3.19-1 RA1 & RA5 Modified Greyfield and Greenfield Analysis

	Total alternative area (AC)	Total impacted parcels (AC)	Greyfield ROW (greyfield) (AC)	Impacted greyfield parcels (AC)	total greyfield (AC)	%	Greenfield Total greenfield (AC)	%
RA1 (Preferred)	904.6	111.7	792.9	76.17	869.1	96.1%	35.5	3.9%
RA5 Modified	922.4	134.5	787.9	86.3	874.2	94.8%	48.2	5.2%

3.19.4.2.3 Wetlands and Floodplains

SCDOT evaluated how the proposed project would impact wetlands (Chapter 3.8) and floodplains (Chapter 3.9) as part of the DEIS. During the DEIS process, the project team evaluated alternatives based on their potential effects on wetlands and surface water. While the proposed project does not completely avoid wetlands and waters, impacts have been minimized by eliminating alternatives that parallel the Saluda River. As discussed in Chapter 3.7, impacts to wetlands and waters would be mitigated through the restoration, enhancement, and/or preservation of wetlands, streams and other aquatic resources.[8]

During the DEIS process, the project team also evaluated ways to preserve floodplain functions by limiting development and development impacts to maintain water management capacities and capabilities. Evaluating the project's potential effects on river systems and regulated floodways, and considering floodplain and culvert design, were initial sustainability goals of the project team. During the alternatives screening, each reasonable alternative was evaluated, in part, based on the potential effects within the FEMA floodplain. RA 7 and RA 8 that paralleled the Saluda River and resulted in the greatest impacts to floodplains were eliminated from further evaluation in the DEIS. SCDOT proposes to design water dependent infrastructure, such as bridges and culverts, to minimize floodplain impacts, maintain pre-development floodplain storage, and maintain or reduce flood elevations.

3.19.4.2.4 Biodiversity

A key sustainability consideration has been avoiding and minimizing impacts to sensitive ecological habitats in an effort to preserve species biodiversity. SCDOT has worked with federal, state, and local agencies to identify existing habitats in or near the proposed project. The Natural Resources Technical Report (Appendix K) and agency coordination has confirmed that the proposed project would not impact federally protected species. Alternatives that paralleled the Saluda River and would have adversely affected riparian and riverine habitats were eliminated from further evaluation in the DEIS. As noted in Chapter 3.9, SCDOT would further minimize impacts to species biodiversity by complying with the ESA, BGEPA, and MBTA.

[8] 33 CFR §332.2

3.19.4.3 Climate and Risk

The Carolina Crossroads Project is being planned and designed to be resilient to short- and long-term climate risks specific to its location and geography. Air pollutants, including carbon dioxide, methane, sulfur dioxide, and nitrogen oxides are major contributors to climate change. Carbon dioxide, a greenhouse gas (GHG), is the main pollutant responsible for causing a gradual heating of the Earth's atmosphere and surface, accounting for nearly three-quarters of global greenhouse gas emissions and 84 percent of U.S. greenhouse gas emissions.[9] One of the benefits of the Carolina Crossroads project is a potential reduction in GHG emissions through increased traffic flow and a decrease in traffic congestion and idling vehicles due to reduced traffic flow.

A Climate Change Risk Assessment and Adaptation Plan was prepared by the project team to account for the impacts of a changing climate on the range of operating conditions assumed in the design of the proposed project. Specifically, the Climate Impact Assessment and Adaptation Plan includes a risk analysis, vulnerability assessment, and adaptation plan.

A risk analysis was conducted to understand the range of potential changes in future climate variables such as air temperature, rainfall intensity, humidity, flood/drought, and corrosion. Table 3.19-2summarizes the four greatest climate change risks identified in the aforementioned reports that are most relevant to the Carolina Crossroads project design and operations.

Table 3.19-2 Climate Risks Relevant to the Carolina Crossroads Project Corridor

NCA climate change impacts to the southeast	Short- and long-term considerations for the Carolina Crossroads project
Increased heat wave/humidity intensity and frequency	Required to operate at high temperatures. TSM/TDM continuation to elevate traffic congestion and promote traffic flow Project goal is to improve traffic flow and reduce wait times
Extreme precipitation events and flooding have increased during the last century, and these trends are expected to continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health and infrastructure.	Design criteria for stormwater retention/conveyance in accordance climate change projections for increase precipitation intensities Flood protection considerations and hardening 50-year flood event design criteria
Increased threat of tornadic activity in extreme storms	Hardening of all components of the project and project systems Improved signage and warning mediums for severe weather
Increased high wind events, which are primarily related to the increased threat of Tropical Cyclone activity	Hardening of all components of the project and project systems Aerodynamic design of structural components Improved signage and warning mediums for severe weather

[9] https://www.epa.gov/ghgemissions/overview-greenhouse-gases

A vulnerability assessment was conducted based on the risks identified in the risk analysis. An adaptation plan was prepared for resilient infrastructure that takes into account the impacts of a changing climate on the range of infrastructure configurations and operating conditions assumed in the design of the proposed Carolina Crossroads project. The Carolina Crossroads project siting and design is being guided by both regulatory requirements and the identification of additional vulnerabilities assessed using historic climate data and from future climate extremes for the project study area identified during the design process. Assessed vulnerabilities include, but are not limited to: increased heat wave intensity, extreme rainfall, and severe storm/wind and tornadic events.

3.19.4.3.1 Increased Heat Wave Intensity

In order to mitigate the effects of heat waves and increasing temperatures and extreme cold temperatures, materials should be used within the tolerance for thermal expansion/contraction expected in the range of current and future temperatures anticipated in the project study area. A number of components of the Carolina Crossroads system would be designed to withstand high/low temperatures, including the structural members, concrete supports, roadbed and road surfaces.

3.19.4.3.2 Extreme Rainfall and Severe Storm/Wind and Tornadic Events

As is further described in the 2014 National Climate Assessment,[10] an analysis of the rainfall patterns across South Carolina has shown that there has been a large increase in the number of days with heavy rainfall, but no significant increase in total annual precipitation. An increase in heavy downpours has contributed to flooding, discharge of untreated sewage due to excess water in combined sewage overflow systems, erosion, and declining water quality. Changing land uses combined with an increase in heavy downpours has resulted in reduced water infiltration into the soil and an increase in surface runoff.

Increases in the frequency and intensity of extreme precipitation result in an increased risk of river and flash floods, which affects the integrity of road systems and interchanges. Detailed flood studies of stream and river crossings would be required as part of the final roadway design. For project impacts within regulated floodways, structures would be designed to avoid increases in the base flood elevation. As design progresses, SCDOT would complete an assessment of how the project could impact stormwater runoff and erosion to help inform design and layout decisions. Design criteria for the proposed Carolina Crossroads project would be held to the 50-year precipitation and runoff threshold to ensure accommodations for extreme precipitation events now and into the future in the project study area. The SCDOT design standard requires that structures be designed to avoid increases in the 100-year storm event water surface elevation.

[10] https://nca2014.globalchange.gov/

3.19.5 HOW WOULD SUSTAINABILITY BE DOCUMENTED DURING CONSTRUCTION AND OPERATION OF THE PROJECT?

3.19.5.1 Sustainability management plan

SCDOT would develop a project management system that can manage the scope, scale and complexity of the Carolina Crossroads project while seeking to improve sustainable performance. The plan would include project roles, responsibilities and authorities within the project team for addressing the issues of sustainability for the project. The plan would also include a sustainability management policy commensurate with the scope, scale and complexity of the project. The plan would build upon the sustainability goals developed during the DEIS process and include:

- Federal, state, and local agency roles, as well as the roles of project stakeholders within the affected communities.
- Commitments from SCDOT and the project team to meet or exceed health and safety standards and implement the project's sustainability objectives and targets.
- List of project goals, objectives, and performance targets related to sustainability within the community.
- Processes and management controls in the form of procedures, flowcharts, checklists, and other documented control measures

3.19.5.2 Documentation of materials and resources

Tracking materials and resource usage during construction are key sustainability considerations of the project. SCDOT would consider innovation in construction and operation methods to meet the project's sustainability goals.

3.19.5.2.1 Use of regional materials

The use or regional materials helps to minimize transportation costs and impacts and retain regional benefits by specifying local sources. During construction, SCDOT and the project team would document the following, as applicable:

- Total cost of materials.
- Inventory of materials, plants, aggregates, and soils for construction sourced near the site.
    - Soils: Extraction, harvest, or recovery and manufacture preferably within 50 miles.
    - Aggregate: Extraction, harvest, or recovery and manufacture preferably within 50 mi.
    - Plants: All growing facilities for the plants preferably within 250 miles.
    - All other materials: Extraction, harvest, or recovery and manufacture preferably within 500 mi.
- Calculations of percentage of total project materials by costs that are sourced locally.

3.19.5.2.2 Use of recycled materials

The use of recycled materials helps to reduce the use of virgin materials and avoid sending useful materials to landfills. During construction, SCDOT and the project team would document the use of recycled materials and

material with recycled content. Recycled materials would meet state or local solid waste agency requirements for using recycled materials in construction. Any recycled materials used must not pose significant risks to human health and safety or the environment. Types of documentation may include:

- Total quantity of recycled materials by weight or volume.
- Name of the product, the name of the manufacturer, the weight or volume of the material, and the percentage of recycled content (either postindustrial or post-consumer recycled content).
- Calculations of percentage of total project materials by weight or volume that are reused or recycled.

3.19.5.2.3 Earthwork balance

SCDOT and the project team would minimize the movement of soils and other excavated materials off site to reduce transportation and environmental impacts. Balancing the volume of excavated material and the volume of fill material is often referred to as an earthwork balance. The project team would document the amount of material retained on site.

3.19.5.2.4 Water and energy use

During final design, SCDOT and the project team would use lighting assessments to evaluate potential opportunities to reduce energy usage during operation of the proposed project. SCDOT and the project team would also document and monitor the usage of water during construction.

3.19.5.3 Environmental compliance

The Final EIS and ROD would define required mitigation for the I-20/26/126 Carolina Crossroads project. In addition, environmental permits may be obtained during the design of the project, which would specify additional requirements to be adhered to during construction. SCDOT's Compliance Division is tasked with ensuring all environmental commitments are adhered to during the construction phase and any monitoring commitments are met post-construction. Within this Division are the Compliance Division Manager, Compliance Managers for SCDOT Engineering Districts, and a QA/QC Manager. A detailed Environmental Monitoring Plan would be developed and updated to include environmental commitments from the Final EIS and ROD, environmental permits, and other environmental approvals are implemented.

A compliance team would provide support to SCDOT staff during construction of the project and assist in keeping activities in compliance with environmental requirements. The compliance team would compile environmental commitments, permit standard/special conditions, and maintain environmental journal with the appropriate environmental compliance forms. The compliance team would also complete environmental close-out packet at the end of every USACE permitted project.

Typical tasks in the Environmental Monitoring Plan may include:

- Attend project pre-bid meeting for environmental inquiries.
- Attend preconstruction/partnering meeting to highlight staging, access, initial BMP site preparation, reporting requirements, special conditions, etc.

- Participate as needed in regular contractor meetings on site to address questions and environmental concerns; participate as needed with resource agencies to address questions and concerns.
- Review construction site with environmental compliance forms; provide copies of all reports to the
- Review Weekly Sediment and Erosion Control Site Inspection Reports as needed.
- Respond within 24 hours to any requests from the SCDOT project authority regarding changing site conditions.
- Review permit plans, construction plans, construction contracts, and reconcile differences.
- Track compensatory mitigation (on-site or confirm receipt of bank credit transfer).
- Coordinate with the SCDOT project authority and contractor to ensure project jurisdictional boundaries are clearly identified and marked.
- Coordinate with SCDOT project authority and contractor to review debris pile areas, staging areas, borrow pits, and lay-down sites in environmentally sensitive locations.
- Review construction access through jurisdictional crossings.
- Act as the liaison for jurisdictional violations and develop resolution agreements as needed.
- Coordinate major environmental concerns through the SCDOT Environmental Compliance Division Manager.
- All coordination with state and federal agencies must be done through the SCDOT Environmental Services Office.
- Deliverables would likely include completed environmental compliance forms and the environmental construction close-out packet (compliance forms, site photographs).

3.19.5.4 Public outreach during construction

Public outreach during construction is an integral component of the sustainability plan. SCDOT and the project team would develop a communications plan during construction to notify the public about changes in traffic patterns. Consideration would be given to the use of alternative modes of transportation, routes of construction vehicles and materials, and reduction of construction noise.