THE STRATEGIC 10-YEAR ASSET MANAGEMENT PLAN

SCDOT

December 31, 2022

Infrastructure Investment and Jobs Act (IIJA) Submittal

CERTIFICATION LETTER

U.S. Department of Transportation
Federal Highway Administration

1835 Assembly Street, Suite 1270
Columbia, SC 29201

March 1, 2023

In Reply Refer To:
HDA-SC

Ms. Christy Hall
Secretary of Transportation
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29201

Dear Secretary Hall:

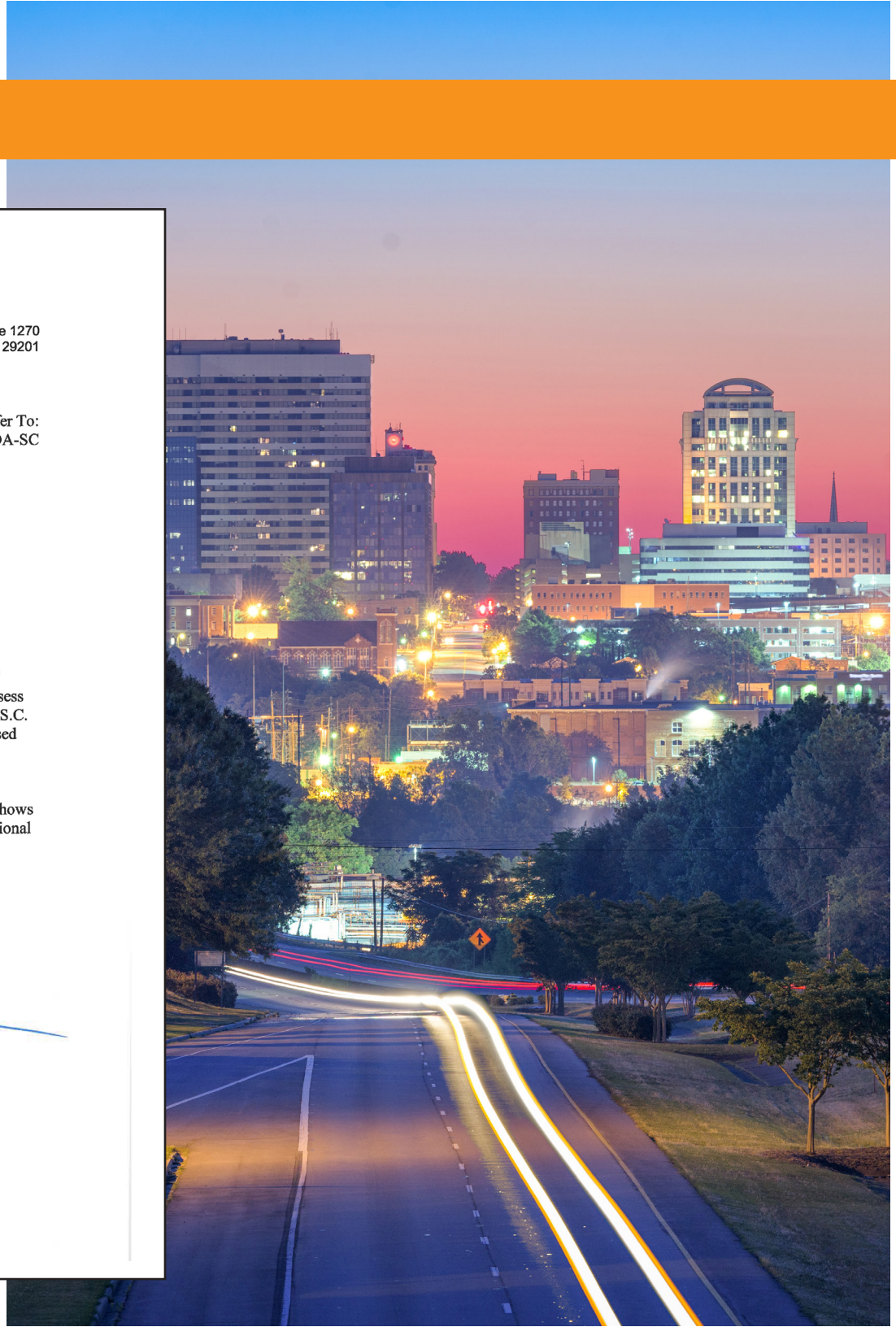
The Federal Highway Administration (FHWA) reviewed the South Carolina Department of Transportation (SCDOT) 2022 Strategic Ten-Year Asset Management Plan (STAMP) to assess whether the processes outlined satisfy the asset management requirements set forth in 23 U.S.C. 119(e), as amended by the Bipartisan Infrastructure Law (BIL), and 23 CFR 515.13(a). Based on our review, we have determined that the processes meet the requirements; therefore, the SCDOT TAMP development processes are recertified.

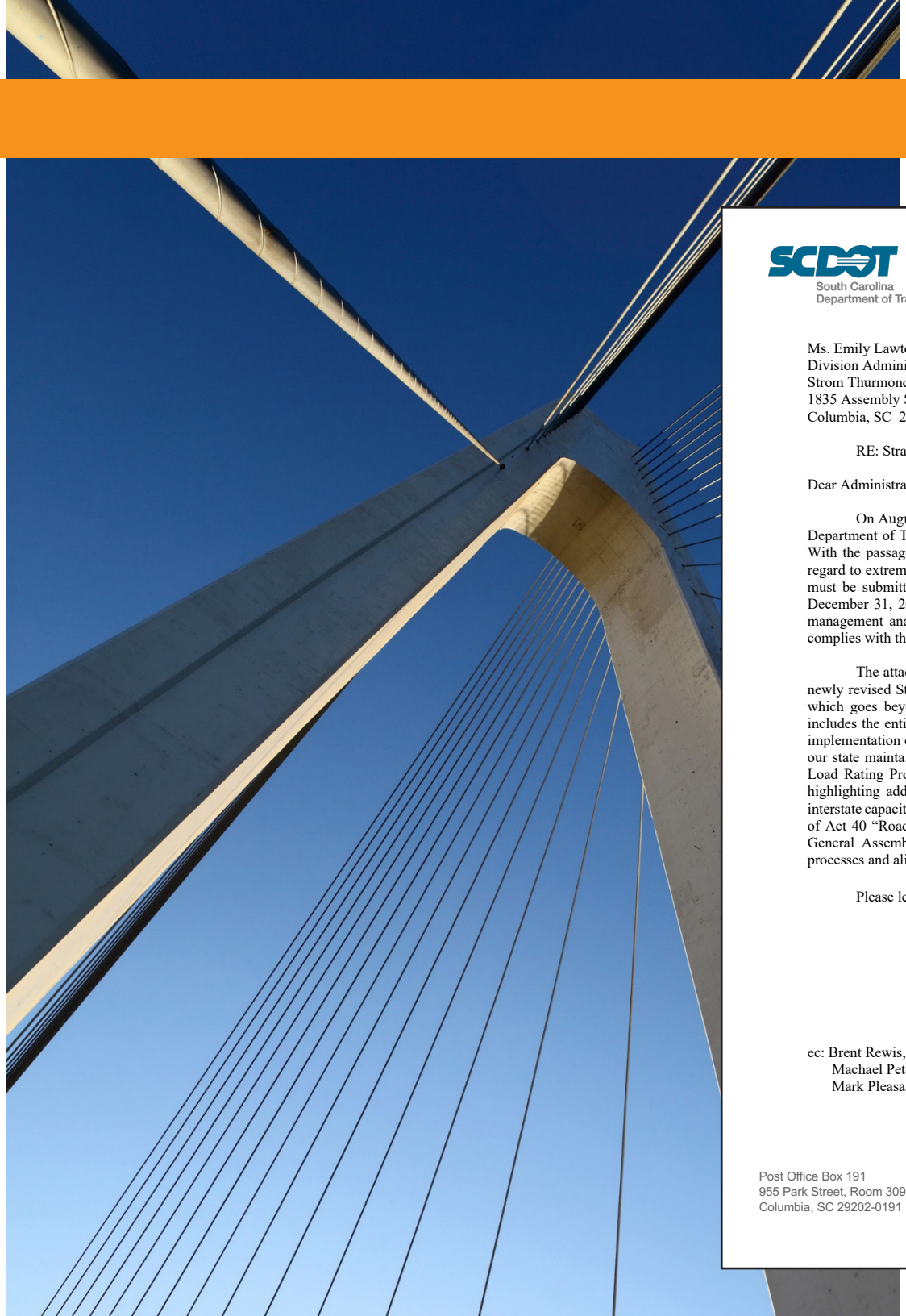
We would like to commend you and your staff for the development of the STAMP, which shows continued progress towards a state of good repair over the life cycle of the assets on the National Highway System (NHS).

Sincerely,

Emily O. Lawton
Division Administrator

ec:
Brent Rewis, SCDOT





LETTER OF TRANSMITTAL

SCDOT
South Carolina
Department of Transportation

Christy A. Hall, P.E.
Secretary of Transportation
803-737-0874 | 803-737-2038 Fax

December 31, 2022

Ms. Emily Lawton
Division Administrator, Federal Highway Administration
Strom Thurmond Federal Building
1835 Assembly Street, Suite 1270
Columbia, SC 29201

RE: Strategic Ten-Year Asset Management Plan (STAMP) IIJA Compliant Submittal

Dear Administrator Lawton:

On August 29, 2019, the Federal Highway Administration (FHWA) certified that the South Carolina Department of Transportation (SCDOT) TAMP complied with 23 CFR 515.13(b)(1)(2) and 23 U.S.C. 119. With the passage of the Infrastructure and Investment Jobs Act (IIJA) in 2021, additional requirements in regard to extreme weather and resilience in life cycle planning and risk management processes and analyses must be submitted to have an IIJA compliant asset management plan. FHWA granted an extension until December 31, 2022 to consider extreme weather and resilience as part of the life-cycle planning and risk management analysis. The Agency has completed revisions and has submitted an updated STAMP that complies with the IIJA amendment.

The attached STAMP is a comprehensive, all-inclusive document that has incorporated the agency's newly revised Strategic Plan, Ten-Year Investment Plan (2018-2027), Asset Management Plan (2022-2032) which goes beyond the federally required National Highway System (NHS) pavements and bridges and includes the entire State Highway System (SHS), and Transportation Performance Measures (TPM). Since implementation of the Ten-Year Investment Plan the agency has made unprecedented improvements in all of our state maintained pavements. The Bridge Program has been completely restructured with results of the Load Rating Program that provided invaluable new data points and initiated the revision of the program highlighting additional bridge replacement and repair needs. Additional funding for pavements, bridges, interstate capacity, Regional Mobility program and other programs has been made possible through the phasing of Act 40 "Roads Bill", IIJA funds with state match, and one-time appropriations from the South Carolina General Assembly. The Department will continue to use asset management principles to improve our processes and align our project selection with our investment goals.

Please let me know if you have any questions or need additional information.

Sincerely,

Christy A. Hall, PE
Secretary of Transportation

ec: Brent Rewis, Deputy Secretary for Intermodal Planning
Machael Peterson, Director of Planning
Mark Pleasant, FHWA Community Planner

Post Office Box 191
955 Park Street, Room 309
Columbia, SC 29202-0191

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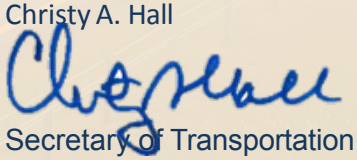
A MESSAGE FROM THE SECRETARY

As the Secretary of Transportation, I am happy to present the updated (2022) SCDOT 2022-2032 Infrastructure Investment and Jobs Act (IIJA) Strategic 10-Year Asset Management Plan (STAMP). This plan documents our commitment to the Governor, General Assembly, and the citizens of South Carolina that SCDOT will maintain the State Highway System in the highest state of good repair possible given the funding available. This is made possible through the acceptance and implementation of asset and performance management principles and practices that tie defined asset condition outcomes to specific levels of investment. This STAMP also describes the asset management practices that SCDOT implemented, to ensure that our pavement and bridge assets have the longest service life possible for the least practical cost. In addition to the increase in state funding made possible by Act 40, SCDOT has also received an increase in over 30 percent of federal funding through the Infrastructure Investment and Jobs Act (IIJA) passed in October 2021 and one time appropriations from the General Assembly. Without the additional funding, the goals and targets set for the improvement of our pavements, bridges, and the safety of our system would not be possible.

This STAMP goes beyond what is federally required by including the pavement and bridge assets on the entire State Highway System in South Carolina, not just the pavement and bridge assets on the National Highway System (NHS). We have also included our safety targets in the TAMP because safety is our top priority. SCDOT is committed to improving safety on our highway system, especially on our rural roads. We have developed the Rural Road Safety Program to specifically address safety on these roads that comprise only five percent of the system, but account for thirty percent of the fatal and serious injury crashes in the state.

In the future we will be adding additional assets to the STAMP and non-asset targets. And finally, we have described how the STAMP relates to our other planning documents. These include our Strategic Plan, our long range Multimodal Transportation Plan, and the Statewide Transportation Improvement Program (STIP), in an effort to show how these plans all work together to provide a clear vision of where we want to go with our transportation system, and how we are going to get there. Asset and Performance Management are a big part of the new way we conduct business at SCDOT. As we like to say, “This ain’t your father’s DOT”. I hope you will find the information in this document helpful in understanding how we maintain and preserve the pavement and bridge assets on the state highway system, and how this will enable us to rebuild that system into one that will meet the needs of every South Carolinian today and in the future.

Christy A. Hall



Secretary of Transportation

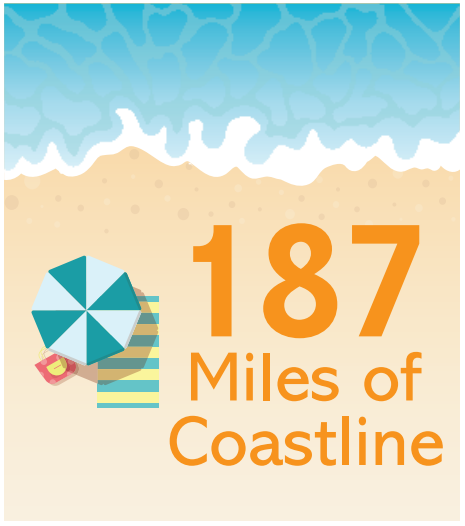
4TH LARGEST STATE OWNED SYSTEM

528M TONS FREIGHT MOVED ACROSS SC IN 2019

5.1M POPULATION

STAMP 2022 SCDOT

23 BILLION IN TOURISM 2021



187 Miles of Coastline

46 COUNTIES

$270B GROSS STATE PRODUCT

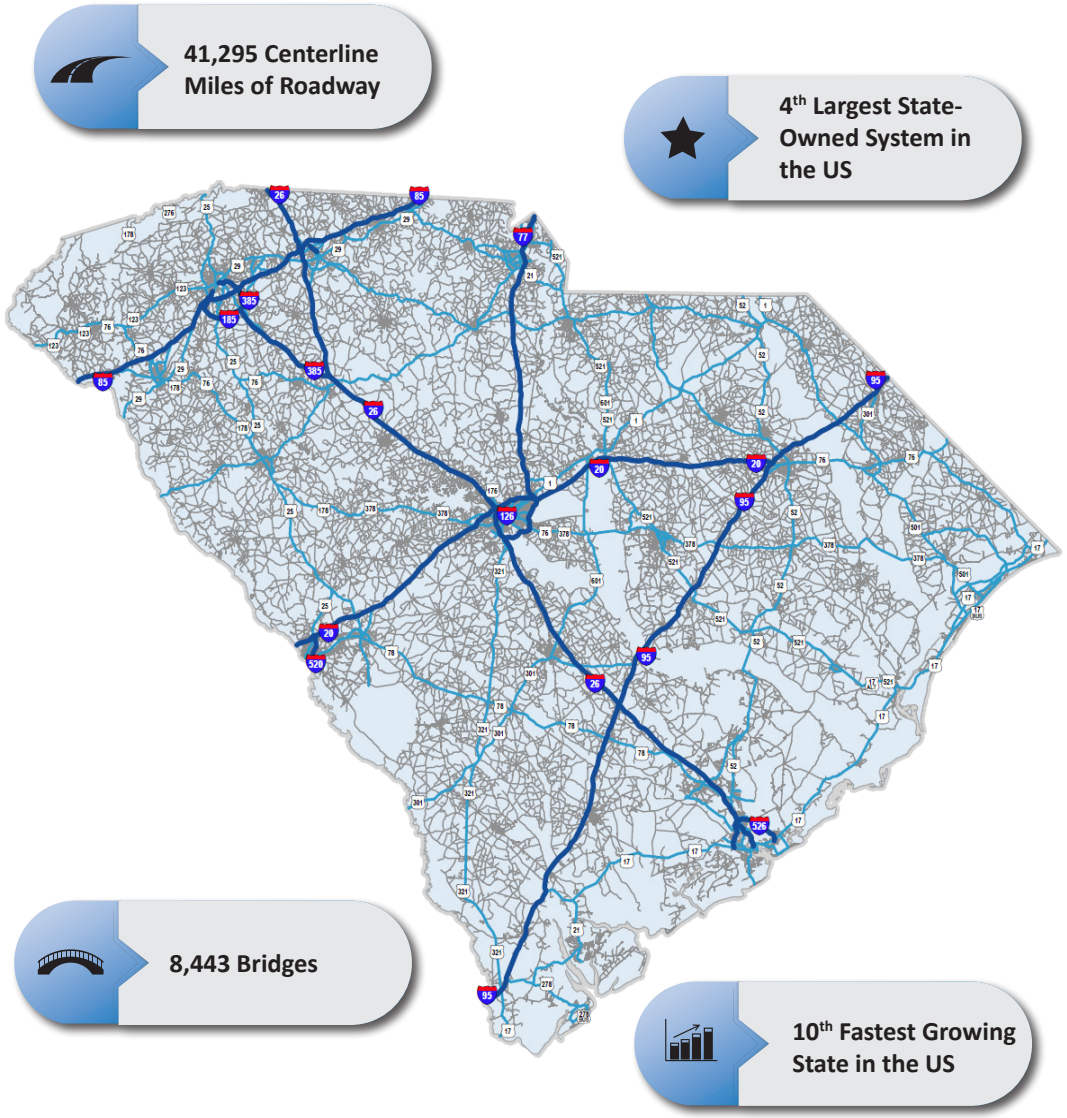
EXECUTIVE SUMMARY

Executive Summary

The South Carolina Department of Transportation (SCDOT) is the state agency in South Carolina responsible for planning, maintaining and operating 41,295 centerline miles of roadway and 8,443 bridges, which makes up the fourth largest state-owned system in the United States. The state-owned highway system in South Carolina is shown in the figure to the right.

The highway system is vital to the increasing growth of South Carolina's economy. In 2021, non-farm employment grew by 2.5% according to Bureau of Labor Statistics data. In addition, South Carolina was 10th in the nation for population growth between 2010 and 2020 according to the US Census Bureau and the State's population increased by 10.7% over this period. South Carolina's population is expected to grow an additional 31% by 2040, with a corresponding household growth of 32% by the year 2040. Based on job and population growth, SCDOT is projecting a 0.9% average annual increase in total miles traveled on its highway system. South Carolina's highway system interconnects ports with major cities and commercial hubs and promotes the efficient transfer of both goods and people within the State and across interstate corridors.

To manage these transportation assets, SCDOT has developed the 10-Year Plan which describes the primary means for achieving asset management objectives and aligns with the State's mission and strategic goals. The **Strategic 10-Year Asset Management Plan (STAMP)** is the planning document and management tool that ties together the agency's Strategic Plan, 10-Year Plan, and satisfies FHWA asset management plan requirements. The STAMP brings together the agency's processes and stakeholders to achieve a common understanding and commitment to improve South Carolina's road and bridge network.



Transportation Asset Management

The Secretary of Transportation and the governing board of the agency, the SCDOT Commission, have reaffirmed the importance of the Strategic 10-Year Asset Management Plan (STAMP) for accountability and transparency regarding the use of tax payer funds especially in light of the 2017 legislation that dramatically increased state funding for infrastructure in South Carolina. Tying a planned investment level to a predicted outcome has been a shift in the way SCDOT manages its programs and is essential to earning the public's trust through the effective deployment of resources to achieving results. SCDOT's STAMP is all-inclusive by incorporating state and federal funding together for a more robust plan for the State.

At its core, transportation asset management is the process of operating, maintaining, and improving infrastructure through maintenance, preservation, repair, and rehabilitation during the assets' life. SCDOT has adopted transportation asset and performance management as a best management practice and has fully embraced the concept for all of its programs.

South Carolina STAMP Scope

The scope of the South Carolina Strategic 10-Year Asset Management Plan (STAMP) is inclusive of The Federal Highway Administration (FHWA) requirements that include a summary listing of National Highway System (NHS) pavements and bridges. In addition SCDOT has also elected to include all pavement and bridge assets that the agency maintains. The Strategic Plan, The original 10-Year Plan (2018-2027) and Safety Objectives and Targets.

SCDOT's Strategic Plan Goals

The executive leadership team of SCDOT has updated the Strategic Plan in 2022, which forms the guiding principles of SCDOT's Investment Strategies, focusing on the maintenance, preservation, and safety of the existing transportation infrastructure, directing investments based on a hierarchy of highway systems and priority networks, integrating risk-based prioritization, improving safety, advancing lifecycle cost in investment programming, and enhancing mobility.

The three major goals of the SCDOT Strategic Plan are to:

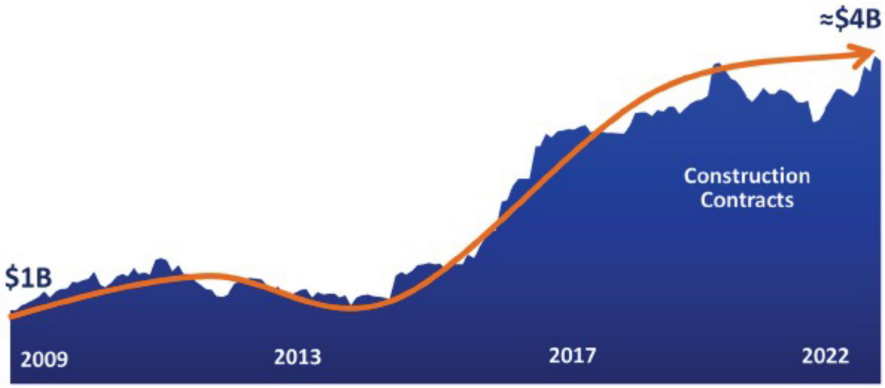
1. Improve safety programs and outcomes in high-risk areas;
2. Maintain and preserve its existing transportation infrastructure;
3. Improve program delivery to increase the efficiency and reliability of the road and bridge network

Goals 1, 2, and 3 directly align with the objectives of the STAMP providing a clear and consistent link between SCDOT's mission and purpose of asset management.

SCDOT's 10-Year Plan (2018-2027)

SCDOT's 10-Year Plan (2018-2027) is the primary means for achieving the agency's asset management objectives. Since the implementation, unprecedented progress has been made possible through Act 40 of 2017. The passage of the landmark legislation has infused approximately $2.45 billion (cumulative from July 1, 2017 to May 31, 2022), net amount of funding for programs. With foresight from the General Assembly, a diversified revenue stream was created. Additional federal funding through the IIJA, recurring matching state funds, one-time funding to accelerate significant Interstate projects and potential federal grant opportunities the agency is well positioned to deploy additional projects. SCDOT is focused its efforts to getting the system to a good state of repair through the development and implementation of an aggressive plan to drive investments through asset management principles to aid in recovering the system from the past three decades of underfunding.

SCDOT has dramatically increased its work program by quadrupling its construction program to a record breaking $4.0 billion level by September of 2022. The transportation industry has responded by completing record breaking levels of work as show in the figure below.

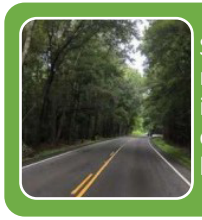


SCDOT has dramatically improved the condition and operation of the of the State Highway System (SHS) inclusive of the National Highway System (NHS). The single largest area of investment has been in paving the large network of roads through a performance based approach. Accomplishments to date (2018 – September 2022) of major program areas are below:

Over 5,800 lane miles of paving has been completed with a focus on primary routes that carries 47% of the state's traffic on a daily basis

The vital links in the transportation system are bridges. The Bridge Program has been completely restructured and is described in detail throught this document. To date 274 bridges have been completed, or under contract.

South Carolina is booming and the economy is dependent upon good Interstates to feed the economic engine. To date 82.5 miles of Interstate miles have been completed or advanced to construction.

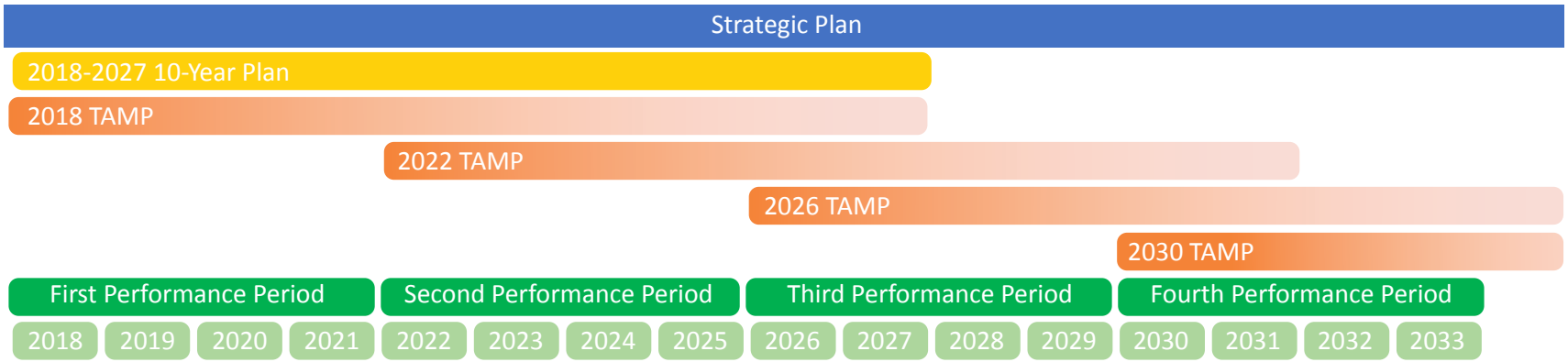


South Carolina ranks #1 for Rural Fatality Rates in the nation. Nearly 30% of the state's fatalities and serious injury crashes occur on rural roads that make up only 5% of the network. To date 793 miles of rural roads have been addressed through the Rural Road Safety Program.

All Inclusive Planning

The SCDOT team has incorporated the Strategic Plan, 10-Year Plan, and Asset management Plan into a single document called the STAMP. With the passage of the 2017 legislation "Roads Bill" that created sustainable funding to bring the system back to a good state of repair, in addition to the federal funding increase provided by the Infrastructure Investment and Jobs Act (IIJA), the agency is positioned to make dramatic improvement in the condition and performance of the transportation network. Within the 10-year period (2018-2027) and beyond, the agency's task is to repair, rebuild and operate our transportation network while ensuring that our citizens and businesses can travel on a safe and reliable system. This is a core function of government with which SCDOT has been entrusted. With the responsibility to effectively and efficiently utilize tax payer funds to maintain the state-owned transportation system, SCDOT will accomplish this mission by aligning the entire organization towards an overarching Strategic Plan. To guide the agency's initiatives, the 10-Year Plan focuses on major program priorities and places a high value on accountability and transparency; and the Asset Management Plan articulates asset condition, investment strategies, and embraces performance management principles that enables the agency to determine achievement of goals. Finally, to track the progress towards the Strategic Plan goals, 10-Year Plan, and Asset Management Plan, performance management is used to provide outcome-based measures and provide information to guide decisions regarding changing or adjusting goals, targets, or investment levels. The organization also utilizes risk management strategies to help identify and mitigate potential threats and opportunities to achieving success.

The timeline relationships between the Strategic 10-Year Asset Management Plan (STAMP), the higher level Strategic Plan, the original 2018-2027 10 Year Plan, and the federally defined Transportation Performance Management (TPM) Performance Periods is shown in the following figure from Chapter 1. It can be seen that while the 2018-2027 10 Year Plan was developed specifically in association with the 2017 legislation, the STAMP is designed to bring together this original 2018-2027 10 Year Plan, the 10 year planning horizon for NHS pavement and bridges required by the transportation asset management plan federal legislation, the higher level Strategic Plan and associated goals, and the TPM performance periods. As required by federal law, the STAMP is updated every four years, and is currently planned to coincide with the TPM performance periods.



Planned Investments

In order to link planned investment level to a predicted outcome as noted above, Federal Highways requires states and MPOs to establish two-year and/or four-year performance targets for each measure. Current two-year targets represent expected pavement and bridge condition at the end of calendar year 2023, while the current four-year targets represent expected condition at the end of calendar year 2025. The tables below from Chapter 3, display the federally required Performance Measures and Targets.

Pavement Condition Measures and Targets

The pavement condition measures represent the percentage of lane-miles on the Interstate or non-Interstate NHS that are in good condition or poor condition. Pavement in good condition suggests that no major investment is needed, except for preservation treatments in order to keep the good pavements good. Pavement in poor condition suggests major reconstruction investment is needed due to either ride quality or a structural deficiency.

The target setting process included internal staff meetings from Planning, Road Data Services, and Maintenance. SCDOT analysts used collects condition data annually for submission to FHWA. Using historical data, staff developed deterioration models for the different pavements by segment. Over the 4-year period, staff also examined whether there were any planned improvements made to the pavements that would be inspected and reported to HPMS within four-years based on SCDOT's investment strategies. The table illustrates that SCDOT anticipates improving the percent of good pavements, while maintaining poor pavements well below target levels.

2-year and 4-year Targets for Pavement System, Federally Required (Federal Metric)

Performance Measure	South Carolina Performance Baseline (2021)	South Carolina 2-year Target (2022-2023)	South Carolina 4-year Target (2022-2025)
Percent of pavements of the Interstate System in Good Condition	75.8%	77.0%	78.0%
Percent of pavements of the Interstate System in Poor Condition	0.2%	2.5%	2.5%
Percent of pavement of the Non-Interstate NHS System in Good Condition	38.5%	36.0%	38.0%
Percent of pavement of the Non-Interstate NHS in Poor Condition	1.6%	10.0%	10.0%

Bridge Condition Measures and Targets

The bridge condition measures represent the percentage of bridges, by deck area, on the NHS that are in good condition or poor condition. The condition of each bridge is evaluated by assessing four bridge components: deck, superstructure, substructure, and culverts. FHWA created a metric rating threshold for each component to establish good or poor condition. Every bridge on the NHS is evaluated using these component ratings. While good condition bridges may not require major investment, bridge presentation techniques and actions may be appropriate to maintain condition levels. Bridges in poor condition are safe to drive on; however, they are nearing a point where substantial reconstruction or replacement is needed.

The National Bridge Inspection Standards (NBIS) apply to all publicly owned highway bridges longer than twenty feet located on public roads. NBIS are federal regulations (23CFR 650) establishing requirements for bridge inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and maintenance of bridge inventory. Information from these inspections is stored in the National Bridge Inventory (NBI) database, created in 1972.

SCDOT Staff analyzed historic NBI submittal data from 1992 through 2021 and developed modeling scenarios to forecast the bridges that would move from Good to Fair or Fair to Poor during the 2 and 4-year target window. Staff then collected data from construction and maintenance offices to determine the number of bridges, and corresponding deck area that were to be improved in the same window of time. The table clearly illustrates that both the 2021 baseline, 2 and 4 year targets are projected to fall below the maximum 10% of deck area allowed by federal highways for poor condition bridges on the NHS.

2-year and 4-year Targets for Bridge System, Federally Required

Performance Measure	South Carolina Performance Baseline (2021)	South Carolina 2-year Target (2022-2023)	South Carolina 4-year Target (2022-2025)
Percent of NHS bridges classified as in Good Condition	38.5%	35.0%	34.0%
Percent of NHS bridges classified as in Poor Condition	4.3%	6.0%	6.0%

Investment Plans

In the two tables below from Chapter 7, planned investments for preservation, rehabilitation, and reconstruction/replacement are shown for the 10 year period 2022-2032 for pavements and bridges.

The Agency is using these investment strategies in its plan to make progress toward achievement of its pavement and bridge targets.

Planned Pavement Budget Allocations by Work Type (in Millions) FY 2022-FY 2032

Planned Pavement Budget Allocations by Work Type (In Millions) FY 2022-2032											
Pavement Asset Budget	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Category	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned
Interstate	$203.03	$208.96	$212.62	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
Preservation	$20.30	$20.90	$21.26	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
Rehabilitation	$182.73	$188.06	$191.36	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00
Reconstruction	$	$	$	$	$	$	$	$	$	$	$
Non-Interstate NHS	$90.00	$98.00	$100.00	$107.00	$114.00	$122.00	$122.00	$122.00	$122.00	$122.00	$122.00
Preservation	$9.00	$9.80	$10.00	$10.70	$11.40	$12.20	$12.20	$12.20	$12.20	$12.20	$12.20
Rehabilitation	$76.50	$83.30	$85.00	$90.95	$96.90	$103.70	$103.70	$103.70	$103.70	$103.70	$103.70
Reconstruction	$4.50	$4.90	$5.00	$5.35	$5.70	$6.10	$6.10	$6.10	$6.10	$6.10	$6.10
Non-NHS Primary	$180.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00
Preservation	$18.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
Rehabilitation	$128.14	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86
Reconstruction	$33.86	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14
FA Secondary	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00
Preservation	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00
Rehabilitation	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21
Reconstruction	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79
NFA Secondary**	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00
Preservation	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20
Rehabilitation	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94
Reconstruction	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86
Total	$695.03	$768.96	$774.62	$719.00	$726.00	$734.00	$734.00	$734.00	$734.00	$734.00	$734.00

Planned Bridge Budget Allocations by Work Type (In Millions) FY 2022-2032

Planned Bridge Budget Allocations by Work Type (In Millions) FY 2022-2032											
Bridge Asset Budget Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned
NHS	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65	$58.65
Preservation	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87
Rehabilitation	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73
Replacement	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06
FA Non-NHS	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Preservation	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99
Rehabilitation	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76
Replacement	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22
New Location	$	$	$	$	$	$	$	$	$	$	$
Off System	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11	$27.11
Preservation	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41
Rehabilitation	$	$	$	$	$	$	$	$	$	$	$
Replacement	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70
Bridge Reactionary Maintenance	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25	$19.25
Bridge Repair	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
Bridge Maintenance	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00
Bridge Inspection	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00	$25.00
Totals	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01	$228.01
Bridge Reactionary Maintenance, Bridge Repair, Bridge Maintenance, and Bridge Inspection are new program categories in response to inspection findings, can apply to any bridge asset category											

The development of targets and planned investments are the result of considerable data analysis and draw on the experience and knowledge of numerous SCDOT personnel. The details of these processes are contained in this STAMP document which is scheduled to be updated and improved every 4 years.

CHAPTER 1 INTRODUCTION

1. Introduction

1.1 Strategic Transportation Asset Management Overview

Transportation asset management is defined as a "strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost (23 U.S.C.1010(a)(2)). Effective July 2012, state departments of transportation were required to develop a risk-based 10-Year Transport Asset Management Plan (TAMP) with an emphasis on performance-based management. This requirement is a result of both the 2012 surface transportation bill, Moving Ahead for Progress in the 21st Century (MAP-21), and the 2015 Fixing America's Surface Transportation Act (FAST Act). The State of South Carolina Legislature similarly emphasized the importance of transportation asset management, and directed the South Carolina Department of Transportation (SCDOT) to develop an asset management Plan in 2018. SCDOT's STAMP update, presented here, therefore incorporates the Strategic Plan, and SCDOT's 2018-2027 10-Year Plan. In accordance with the requirements of MAP-21 and FAST Act, this STAMP separately reflects road and bridge assets on the NHS.

The Secretary of Transportation and the SCDOT Commission, have reaffirmed the importance of transportation asset management for accountability and transparency regarding the use of taxpayer funds especially with the passage of legislation in 2017 that dramatically increased state funding for infrastructure in South Carolina. This legislation resulted in the development of the 2018-2027 10-year Plan. Tying a planned investment level to a predicted outcome is a major shift in the way SCDOT manages its programs and is essential to earning the public's trust through the effective deployment of resources to achieving results.

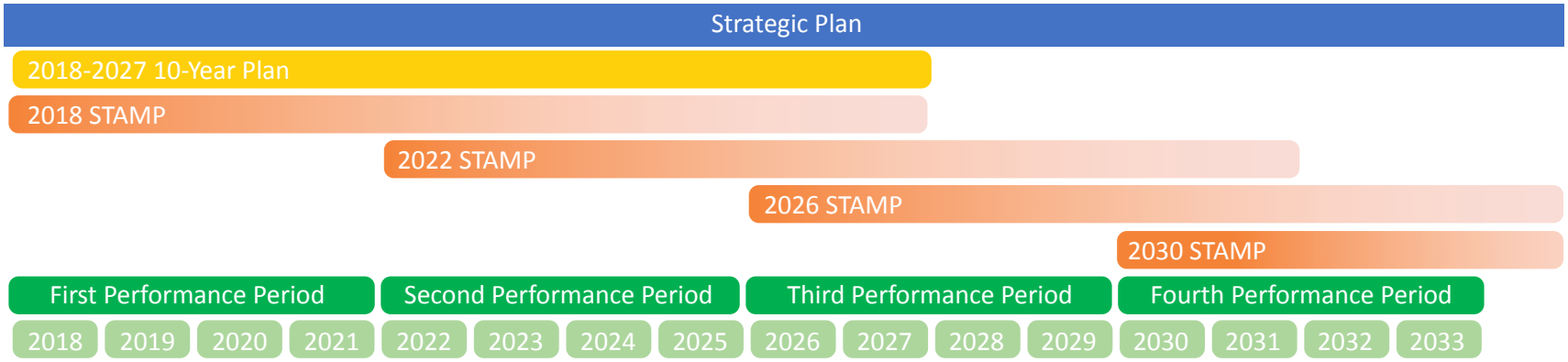
SCDOT has embraced the philosophies of performance and asset management as a management practice. This document supports SCDOT's Strategic Plan, which serves as a roadmap by outlining the agency's vision, mission, values, and goals. SCDOT has developed this STAMP to document procedures in practicing transportation asset management and is implementing this Plan to achieve the condition targets established by SCDOT, and the agency's

1.2 All Inclusive Planning

The SCDOT team has incorporated the Strategic Plan, and the 2018-2027 10-Year Plan into a single document called the Strategic Transportation Asset Management Plan (STAMP). The agency was positioned to make dramatic improvements in the condition and performance of the transportation network with the passage of the 2017 legislation, "Roads Bill" that created sustainable funding to bringing the system back to a good state of repair, in addition to the federal funding increase provided by the Infrastructure Investment and Jobs Act (IIJA). Over the original 10-Year plan period from 2018-2027 and beyond, the agency's task is to repair, rebuild and operate our transportation network to ensure that our citizens and businesses can travel on a safe and reliable system. This is a core function of government and SCDOT is entrusted with the responsibility to effectively and efficiently utilize tax payer funds to maintain the state-owned transportation system. The agency will accomplish this mission by aligning the entire organization towards an overarching Strategic Plan to guide our initiatives. This plan is presented in the next section. In addition, following the 2017 legislation, a 2018-2027 10-Year Plan, also presented below in this chapter, was developed that focused on major program priorities and places a high value on accountability and transparency. Finally, this document, the Strategic 10 Year Asset Management Plan for the period from 2022 to 2032, articulates asset condition, investment strategies and embraces the performance management principles that enable the agency to determine achievement of goals. These plans and their respective timelines are shown in Figure 1-1 and Figure 1-1.

To track the progress towards goals of the Strategic Plan, the 2018-2027 10-Year Plan, and this overarching Strategic 10 Year Asset Management Plan, performance management is used to provide outcome-based measures and provide information to guide decisions regarding changing or adjusting goals, targets or investment levels. The organization also utilizes risk management strategies to help identify and mitigate potential threats and opportunities to achieving success.

Figure 1-1. All Inclusive Plan Timelines

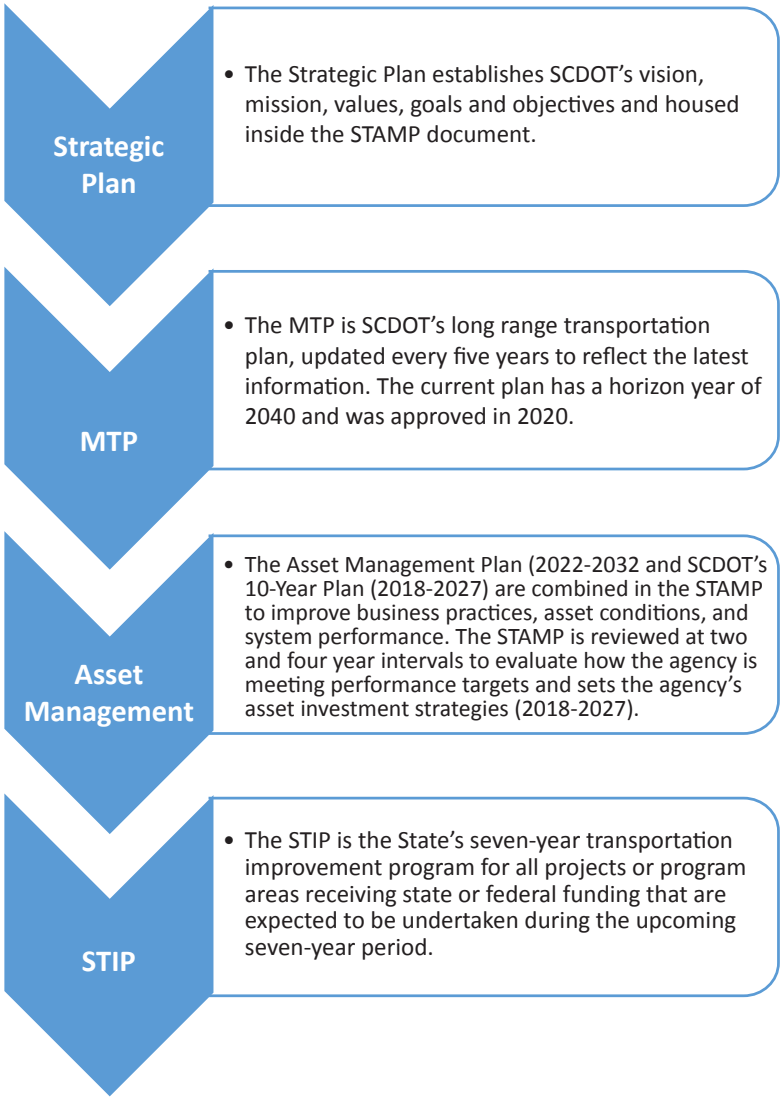


1.3 STAMP relationship to other Planning Documents

As a strategic document, the STAMP is used as a supporting tool to improve business practices that lead to better asset preservation and system performance. The STAMP serves as a pivotal document that links and bridges other planning documents within the agency to improve organizational business performance.

SCDOT develops and implements different transportation planning documents, including the Strategic Plan, Statewide Multimodal Transportation Plan (MTP), and Statewide Transportation Improvement Program (STIP). The STAMP is a key document that bridges long- and shortterm plans and supports the Strategic Plan that serves as a roadmap to making efficient resource allocation decisions. The strategic goals serve as the basis for the investment strategies considered in the performance and asset management decision/analysis process. The MTP provides a 20- year vision for improving future condition, performance and accessibility of transportation infrastructure and services that enhance the mobility and economic competitiveness of South Carolina. The Strategic Plan and the
2018-2027 10-Year Plan are contained within the STAMP. As noted previously, this document has a 10 year horizon, and is updated on average every 4 years. With the current 10 year 2022-2023 planning period, the STAMP serves as a blueprint to support the agency's effort to meet infrastructure conditional goals as well as to achieve national performance targets stipulated by transportation bills. The STAMP provides investment level planning for program budgets and is reviewed at two and four year intervals to evaluate how the agency is meeting performance targets and annually to evaluate investment strategies. Finally, the Statewide Transportation Improvement Program (STIP) is the seven-year transportation improvement program for all projects or program areas receiving state or federal funding that are expected to be undertaken. Investment strategies outlined in the STAMP feed projects and programs that are included in the STIP. Figure 1-2 shows the relationship between the agency's planning documents.

Figure 1-2. Planning Document Relationships



1.4 Transportation Asset Management Drivers

Transportation asset management at SCDOT is aligned with the agency's vision, mission, values, and goals. SCDOT has long recognized the importance of applying and institutionalizing transportation asset management. SCDOT applauds the federal legislation requiring a systematic approach to managing transportation infrastructure, as it simply reinforces efforts already underway at the state level. The main transportation asset management drivers include:

Extending asset life: Adopting transportation asset management principles enables SCDOT to invest in cost-effective strategies that involve proactively maintaining, preserving, and improving the performance and conditions of transportation assets, which results in extending the productive life of transportation assets.

Optimizing available resources: SCDOT's transportation assets have many competing needs for preservation and improvement with limited available resources. Transportation asset management principles are utilized to make informative decisions to balance competing needs and financial constraints to achieve defined performance targets, which enable SCDOT to make the best use of available resources.

Achieving customer expectations: South Carolina citizens demand transparency in public investments. These demands drive SCDOT to adopt a systematic and formal approach to invest in transportation projects and programs that enable the agency to work towards meeting citizen expectations.

Complying with state and federal requirements: SCDOT's commitment to meeting state and federal requirements demands the use of transportation asset management principles.

Meeting system demand: demand for capacity continues to grow as the population and freight movement increases. For the State of South Carolina to maximize its economic competitiveness in a global economy, SCDOT must proactively plan to meet capacity and infrastructure needs.

1.5 Organizational and Asset Management Structure

The Transportation Commission is the administrative and governing authority of the South Carolina Department of Transportation. The Commission is composed of nine members: one member from each Congressional District and two at-large members. The District members are appointed by the Governor, subject to approval of the legislative delegations of their respective Districts. The two at-large members of the Commission are also appointed by the Governor, subject to approval by a separate confirmation vote in both the Senate and the House of Representatives. In addition, the Commission, with the advice and consent of the Senate, appoints the Secretary of Transportation, who manages the day-to-day operations of SCDOT and carries out the policies of the Commission. Figure 1-4 on the following page, illustrates the organizational structure for SCDOT, which is divided into the following organizational units: Intermodal Planning, Finance and Administration, Engineering (including maintenance), Human Resources, Minority and Small Business Affairs, Chief Council, Public Engagement and Governmental Affairs. Figure 1-4 also shows further divisional offices under each organizational unit that support the operation of the transportation system in South Carolina.

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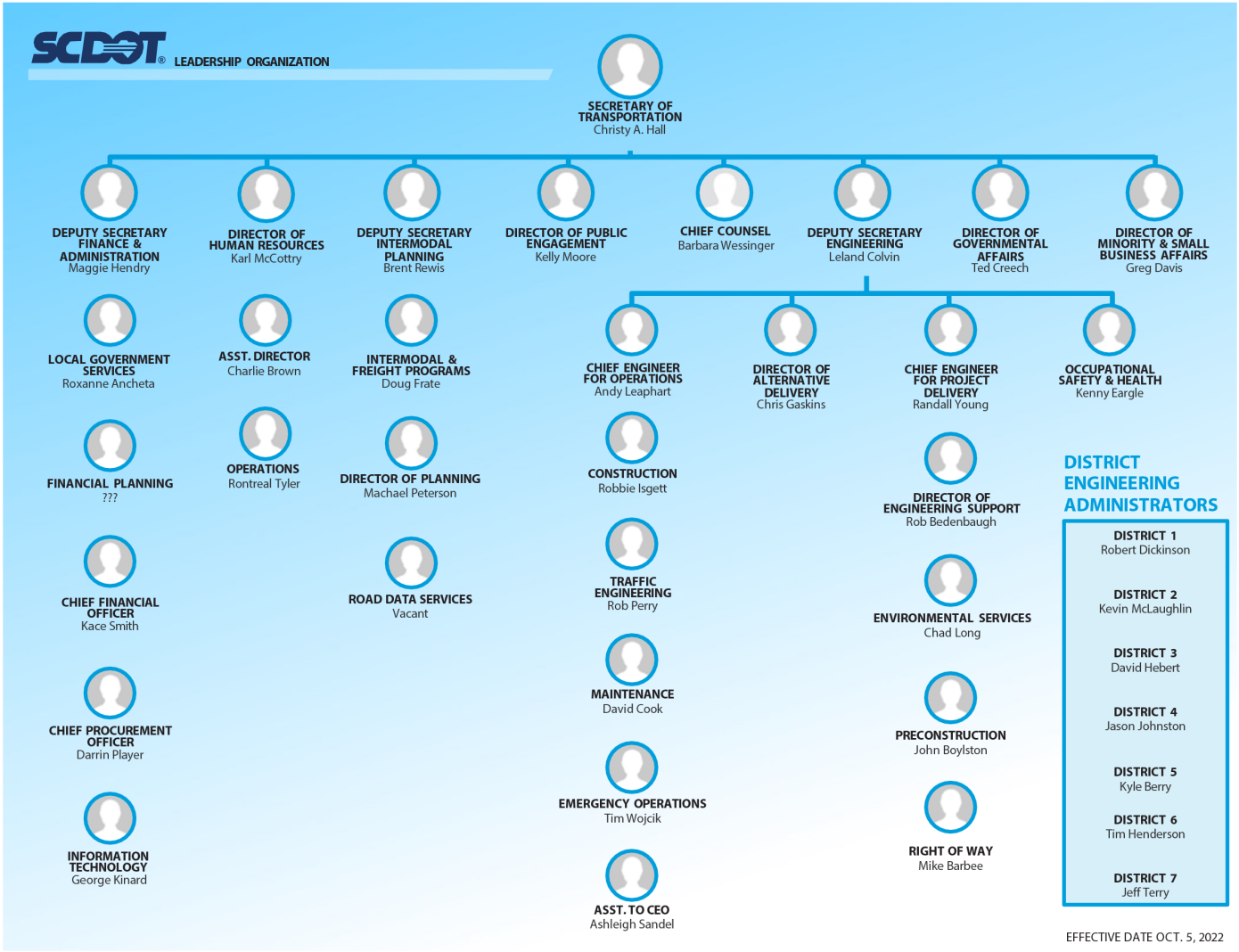
Figure 1-3. SCDOT Planning Document Structure



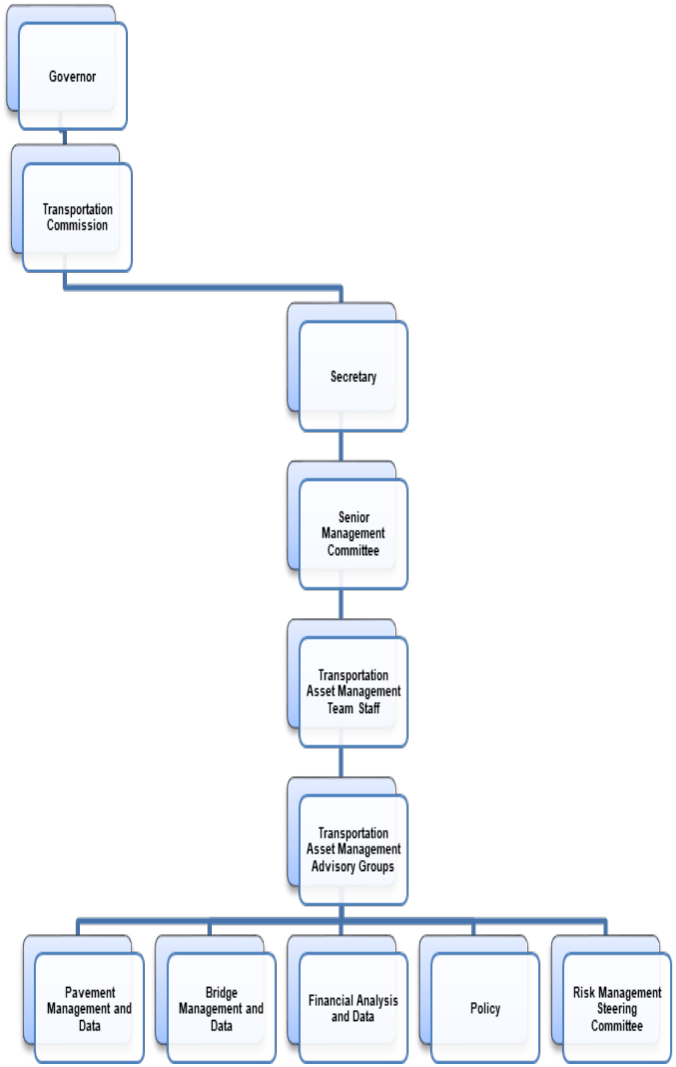
1.8 Asset Management Governance Structure

The Intermodal Planning Division is responsible for Planning and Asset Management at SCDOT. However, asset management is a business practice that pervades all divisions and units within SCDOT. The agency has implemented a transportation asset management governance structure that brings together diverse workgroups to champion the process, identify issues, provide inputs, and perform system-level analysis.

Figure 1-4. SCDOT Transportation Asset Management Governance Structure illustrates the transportation asset management governance structure and consists of the following functional tiers:

- Governor
- Transportation Commission
- Secretary of Transportation
- Senior Management Committee
- TAM Team Staff
- TAM Advisory Groups including subject matter experts in:
  - Pavement
  - Bridges
  - Finance
  - Policy
  - Risk Management

Figure 1-4. SCDOT Transportation Asset Management Governance Structure



The specific functions of each tier are listed in the following subsections:

Governors Enterprise Strategic Priorities

South Carolina's Statewide Enterprise Strategic Objectives require state agencies to integrate Enterprise Strategic Objectives in their own strategic planning and identify the enterprise strategic objective that is linked to each agency-level goal. Below is the list of Statewide Enterprise Strategic Objectives:

- Education, Training and Human Development
- Improve educational infrastructure to elevate the levels of educational preparedness of every South Carolinian to lead a healthy and productive life, including success in a job or career and in the community
- Healthy and Safe Families
- Enhance public well-being by delivering efficient and cost-effective public health and support services
- Maintaining Safety, Integrity, and Security
- Protect the safety, integrity, and security of statewide public resources, data, infrastructure and citizens including timely response to emergencies, disasters and emerging threats
- Public Infrastructure and Economic Development
- Build a world-class and safe public infrastructure to enhance the quality of life of our citizens and to promote the state in global competiveness as a location for business, investment, talent, innovation and visitors
- Government and Citizens
- Deliver a government that serves the needs of South Carolinians and achieves inter-agency collaboration to deliver highly effective, efficient, and innovative programs

SCDOT Transportation Commission

The SCDOT Transportation Commission, as required by South Carolina Act 40 of 2017, approves any policy related to transportation asset management including the adoption of performance based targets by the request of the SCDOT Secretary of Transportation.

Secretary of Transportation

As required by title 23 of the Code of Federal Regulations, section 515.9, the Secretary of SCDOT approves the STAMP for submittal to Federal Highway Administration (FHWA). The Secretary directs all transportation asset management policy initiatives at SCDOT and recommends the appropriate policy approval by the Transportation Commission. In addition, the Secretary:

- Establishes the long-term strategic goals;
- Establishes the recommended targets, by program, to align to the long-term strategic goals;
- Recommends to the SCDOT Commission the required or adjusted investment levels, by program, to achieve the 10-Year targets;
- Ensures asset management strategy and policy are in harmony with statewide policy;
- Directs transparency, accountability, and communication efforts relating to the STAMP; and
- Provides an annual report regarding progress towards achieving the targets outlined in the STAMP.

Senior Management Committee

The Senior Management Committee, led by the Deputy Secretary for Intermodal Planning, or his or her designee, provides strategic vision and executive leadership for asset management, The committee consists of all SCDOT Deputy Secretaries and Directors of: Planning and Asset Management, Intermodal and Freight Programs, Maintenance, Road Data Services, Traffic Engineering, Strategic Planning and Reporting, and Program Controls. The committee is empowered to make large-scale cross-functional area recommendations to the Secretary. The mission of the committee is to:

- Ensure asset management strategy and policy is in harmony with long-term strategic plans and statewide policy;
- Foster an environment in which the most effective program of projects is selected and delivered on time and on budget;
- Define objectives and strategies for preservation, and preventive and corrective maintenance;
- Review all asset management policies that impact internal and external stakeholders and recommend them to the Secretary for approval;
- Review and decide on asset management standards, practices, and programs;
- Manage communications with external stakeholders; and
- Prepare an annual report regarding progress towards achieving the targets outlined in the STAMP.

Transportation Asset Management Team

The Transportation Asset Management Team consists of the Chief Asset and Performance Manager and his or her staff. The role of the Transportation Asset Management Team is to:

- Bring leaders from across the agency together to direct asset management policies and effort;
- Recommend policy to achieve SCDOT's transportation asset management vision;
- Recommend deliverables for Senior Management Committee consideration;
- Develop and articulate an investment strategy, framework, and process to preserve and manage the multimodal transportation assets of the State in a manner that is economically, environmentally, and socially sustainable;
- Serve as a champion and provide guidance for the transportation asset management advisory groups;
- Recommend performance measures;
- Align the agency's asset-specific management efforts across the Divisions;
- Develop and share best practices across the advisory groups;
- Recommend policy and procedure modifications to improve project development and delivery; and
- Assist the Senior Management Committee in providing a liaison role with FHWA on policy and procedural matters relating to asset management.

Transportation Asset Management Advisory Groups

Each advisory group is selected by the Chief Asset and Performance Manager. The groups are made up of subject matter experts to provide knowledgeable inputs as well as undertake technical analyses required for transportation asset management. Some of the tasks the advisory groups undertake include pavement and bridge data analysis and programming, financial analysis and planning, policy setting, risk management and target setting.

1.9 Making Progress

SCDOT has been practicing some level of asset management prior to the enactment of MAP-21. In fact, South Carolina Act 114 of 2007 introduced a strategic and systematic approach to transportation investment at SCDOT. Act 114 requires SCDOT to use objective data in prioritizing transportation projects for bridge replacement, interstate mainline capacity improvements, interstate interchanges, and resurfacing projects. Maintenance, preservation, expansion, and replacement or rehabilitation activities at SCDOT are guided by asset condition, traffic, economic development potential, district maintenance capabilities, the frequency and effectiveness of repairs, and funding availability. These inputs in the decision process enable SCDOT to invest in projects and programs that yield greater benefits on investment, as well as mitigate potential risks.

SCDOT has made notable advances in managing its roadway network. The agency continues to engage in efforts that balance resources and increased maintenance, preservation, and renewal needs. To maximize the utilization of available resources, SCDOT has adopted a three part strategic approach to preserve its pavements: Preservation, Rehabilitation, and Reconstruction. These interventions are recommended for qualifying asset categories or systems using well-documented inventory and condition information. SCDOT employs programs, such as the Maintenance Assessment Program (MAP), to evaluate maintenance performance on primary and secondary roadways by assessing the maintenance level of service (LOS) being provided with the funding available.

Originally the 2017 Roads Bill identified 465 priority bridges to be replaced. In 2021 with the completion of the three-year Load Rating Effort and additional funding, it became evident that a more holistic approach was needed to deliver the bridge program. SCDOT has expanded the scope of the program and increased the number of bridges delivered to 500, with a focus on evaluating each bridge for repair/rehab versus replacement. The bridge program is described further in Chapter 4.5.

The STAMP is the current asset management plan for roadway and bridge networks in South Carolina. The STAMP integrates the 10-Year Plan with the agency's strategic goals, mission and objectives to be consistent with the purpose of asset management. Through a performance based approach the STAMP and 10-Year Plan defines the inventory and condition of assets, establishes condition targets, and investment strategies to close gaps and define a constrained financial plan. The South Carolina STAMP goes beyond federal requirements and includes all pavement and bridge systems, along with the 10-Year Plan and 10-Year Safety Targets and Objectives.

1.10 Continual Process Improvement

Continual process improvement at SCDOT encompasses many different strategies. The agency continues to seek insights from regional, national, and international best practices and standards in transportation asset management to improve its way of doing business and serving the citizens of South Carolina and roadway users. SCDOT uses transportation asset management principles to plan investment decisions, implement strategic decisions, create a knowledge base for informed decision-making, and determine whether the effects of its strategies are moving toward its goals and objectives. SCDOT uses results from these processes to make flexible, effective, and efficient improvements in programmatic, contractual, and financial management in the agency. Some other efforts to ensure continual process improvement at SCDOT include, but are not limited to, peer-to-peer exchanges, webinars, National Highway Institute trainings, and workshops. Specifically, SCDOT has targeted the following strategies to improve transportation asset management practices:

- Collaborate with local transportation and transit operators to enable a broader functionality of the transportation system;
- Develop robust deterioration models for pavement and bridge assets to better predict asset condition and inform treatment selection;
- Develop analytical tools capable of performing scenario and cross-assets/program tradeoff analysis to inform decision-making;
- Develop effective methods to incorporate other assets beyond pavements and bridges;
- Improve the dissemination of information to the general public on the state of asset condition and system performance, including highlighting performance through dashboards on SCDOT's webpage; and
- Engage with Metropolitan Planning Organizations, Council of Governments, and County Transportation Committees by hosting and facilitating regional transportation forums with agency headquarter and district staff.

1.11 Benefits to Citizens of South Carolina

SCDOT's overall goals with transportation asset management are to preserve its transportation infrastructure at a minimum practicable cost over the service life of the assets, incorporate risk analyses to ensure the risks that jeopardize projects are mitigated, and perform tradeoff analyses in decision making to achieve greater benefits. For South Carolina citizens and its economy to be competitive now and in the future, the State must maintain a functional and resilient transportation system. Good asset management practices help SCDOT explore strategies to efficiently carry South Carolina's transportation system through the 21st century.

SCDOT understands that reliable transportation is the backbone of a robust and thriving economy, and investments in transportation must be made effectively to improve the economic and social quality of life for the citizens of the State. The benefits and importance of asset management impact every citizen of the State. A well-maintained and preserved transportation system helps revitalize business districts. Furthermore, individual citizens save time and money from reduced congestion and vehicle maintenance costs. Asset management enables SCDOT to identify future demands and strategize for long-term planning and maintenance of the State's transportation system.

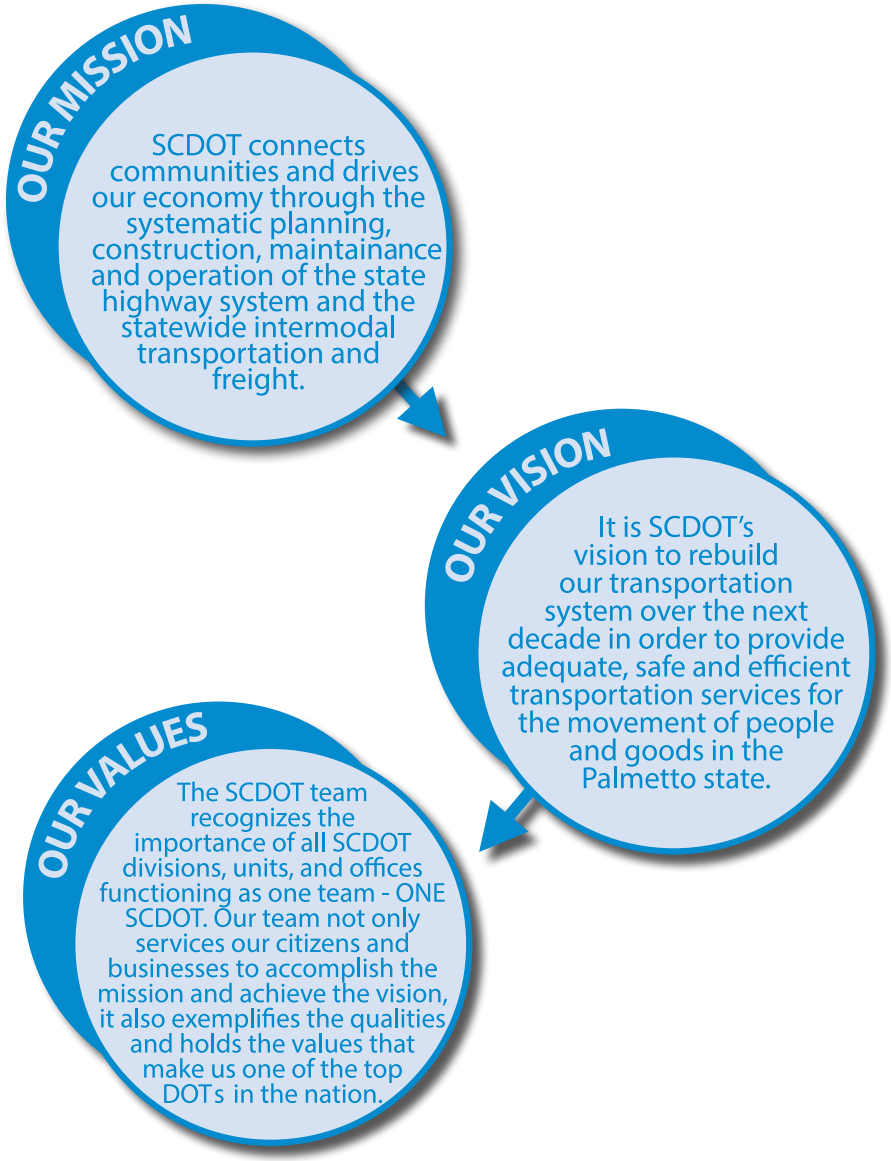
2.0 SCDOT Strategic Plan

2.1 Strategic Plan Mission, Vision, Values

The SCDOT leadership team developed the agency wide Strategic Plan, which has been updated in 2022, that reflects the current priorities, aligns the entire organization towards these priorities, and instills accountability for achieving mission critical goals. The Strategic Plan was built considering the Governor's vision for South Carolina's infrastructure: to build a world-class and safe public infrastructure to enhance the quality of our citizens and to promote the state in global competitiveness as a location for business, investment, talent, innovation, and visitors. Goals identified in the Strategic Plan are consistent with the policy desires of the SCDOT Commission.

The agency is positioned to make dramatic improvements in the condition and performance of the existing road and bridge network over the 10-Years and beyond. With increased funding from the "Roads Bill", Infrastructure Investment and Jobs Act (IIJA) and one time appropriations from the state and federal government SCDOT must ensure that these funds are put to good use and a sound return in investments is provided to our citizens.

The Strategic Plan serves as the roadmap for success and has been carefully crafted to clearly articulate our highest priorities, mesh with our desire to continue our migration towards performance-based management, follow principles of asset management, formulate our budget policies and establish SMART (specific, measureable, achievable, realistic, and time-bound) objectives. Through regular assessment of these measures and associated trend lines, the leadership team will be able to determine if resource allocation or other adjustments are needed in order to achieve the overall goals and hold ourselves accountable to the taxpayers of South Carolina.



2.2 Strategic Plan Goals, Objectives, Measures and Targets

Improve Safety Programs and Outcomes in our High-Risk Areas

- Focus on vulnerable road users with an emphasis on targeted pedestrian and bicycle safety projects throughout the State
- Improve selected intersections and other high risk locations with tailored and targeted safety projects throughout the State
- Develop and implement a data-driven, rural road safety program to address roadway departure incidents throughout the State

Maintain and Preserve our Existing Transportation Infrastructure

- Improve SCDOT's reliability on resolving reported maintenance issues
- Utilize the STAMP to drive outcomes on the road and bridge system and asset condition
- Improve statewide routine maintenance investment through mowing, sweeping and litter pickup on the state system
- Increase competition by growing the number of South Carolina contractors capable of bidding on road and bridge work
- Decrease the number of mass transit vehicles in poor condition on or roadway

Improve SCDOT Program Delivery to Increase the Efficiency and Reliability of our Road and Bridge Network

- Improve the reliability of the movement of people and goods across the major portions of our road network targeting three (3) specific bottlenecks at system to system interchanges, utilizing Transportation System Management Operations (TSMO) and targeting known congestion areas
- Improve interstate capacity through the Rural Interstate Freight Network Mobility Improvement Plan
- Deliver projects on-time and on-budget in accordance with the 10-Year Program Delivery Plan
- Revision and implementation of the MPO/COG Program to the Regional Mobility Program to drive performance based planning for regional project selection
- Provide safe multimodal travel options for all users in accordance with SCDOT's Complete Streets Policy
- Expedite the environmental permitting process for road and bridge projects by increasing SCDOT's reliability of delivering projects on-time and on-budget

Goal 1: Improve Safety Programs and Outcomes in our High Risk Areas

South Carolina has the highest fatality rate in the nation with approximately 1,100 people dying on our roads annually. Based on historical trend line analysis the agency is projecting increasing traffic fatalities with statistical models indicating traffic deaths could be as high as 1,400 in the five-year period ending in 2026. Analysts can estimate the programmatic impacts of Safety projects and make reductions from the forecasted figures. Revised calculations indicate a new target of 1,139 deaths for the five-year period ending in 2026.

Strategy:	
Improve Non-Interstate rural roads with tailored and targeted safety solutions to address roadway departure incidents throughout the State	
Division(s) Responsible	Traffic Engineering
Performance Measure	Miles of Rural Roads treated
Target	1250 miles of rural roads treated by close of calendar year 2027

Strategy:	
Improve selected intersections and other high risk locations with tailored and targeted safety projects throughout the State	
Division(s) Responsible	Traffic Engineering
Performance Measure	Number of Intersections and/or High Risk Locations addressed
Target	125 Intersections and/or High Risk Locations addressed by close calendar year 2027

The Rural Road Safety Program (RRSP) purpose is to improve safety on SC's rural roadways through engineering solutions identified to reduce the frequency of fatal and serious injury crashes occurring on these roadways. Rural roads account for 30% of the fatalities and serious injuries, which represents only 5% of the network or 1900 miles. These 1900 miles are being broken down into 10-mile segments and are expected to be improved over a 10-Year program. The types of improvements include rumble strips, wider and brighter pavement markings, brighter signs, High Friction Surface treatments, wider paved shoulders, improved clear zones, guardrail/cable barrier and safety edges.

Strategy:	
Focus on vulnerable road users with an emphasis on targeted pedestrian and bicycle safety projects throughout the State	
Division(s) Responsible	Traffic Engineering
Performance Measure	Number of Pedestrian and Bicycle Safety Projects completed
Target	100 Pedestrian and Bicycle Safety Projects completed annually by close calendar year 2027

Goal 2: Maintain and Preserve our Existing Transportation Infrastructure

The transportation system is among South Carolina's largest capital investments and preserving these assets and increasing their value to the public is critical for the state's economic health and safety. Maintenance costs are only a part of the total asset management costs of keeping the transportation system in a state of good repair. Increasing pavement condition ratings in "good" condition and decreasing the number of "poor" rated bridges are a top priority for the agency. SCDOT has dramatically increased its work program by tripling its construction program. To increase competition and the number of contractors available to do road and bridge work the agency will assist DBE and SBE firms through assistance programs

In addition to asset management strategies and the construction program to maintain and preserve our transportation system, the agency is also focused on decreasing the number of mass transit vehicles in poor condition to provide alternative transportation options in "good" condition for the traveling public.

Strategy:	
Increase responsiveness to customer service requests for routing maintenance by improving SCDOT's reliability on resolving reported maintenance issues.	
Division(s) Responsible	Maintenance
Performance Measure	Annual average of percentage of routine maintenance work requests resolved within 30 days
Target	75% resolved within 30 days in each county, each state fiscal year

Strategy:	
Increase the % of Good Pavements on the road network across the state by utilizing the STAMP to drive outcomes on system and asset condition.	
Division(s) Responsible	Maintenance
Performance Measure	Percentage of Pavements in Good Condition
Target	Interstates to 92% Good by end of year 2027 Primary System to 53% Good by end of year 2027 FA Secondaries to 40% Good by end of year 2027 NFA Secondaries to 25% Good by end of year 2027

Strategy:	
Delivery of the bridge program and prioritization of the load restricted bridge list by utilizing the STAMP to drive outcomes on system and asset condition.	
Division(s) Responsible	Maintenance, Pre-Construction and Alternative Delivery
Performance Measure	Reduce the number of closed bridges on all networks, Reduce the number of posted bridges on Interstate and Primary Routes and Address the number of posed bridges on the Secondary System
Target	Drive the number of closed bridges to zero on all networks Drive the number of posted bridges to zero on Interstate and Primary Routes Reduce the number of posted bridges on the Secondary System

Strategy:	
Improve the statewide routine maintenance investment through mowing, sweeping and litter pickup on the state system.	
Division(s) Responsible	Maintenance
Performance Measure	Cycles of maintenance investment on our transportation system
Targets	12 cycles of litter pick up on interstate routes annually 6 cycles of mowing on interstate and primary routes annually 4 cycles of mowing on secondary routes annually 12 cycles of interstate barrier wall sweeping annually

Strategy:	
Increase competition by growing the number of South Carolina contractors capable of bidding on road and bridge work by enhancing the network of small business that are ready and willing to assist the agency to meet its infrastructure goals.	
Division(s) Responsible	Minority & Small Business Affairs
Performance Measure	Number of certified Disadvantaged Business Enterprises (DBEs) and Small Business Enterprises (SBEs) that receive technical training, business development, management assistance through SCDOT on an annual basis
Target	Serve a minimum of 125 DBE and SBE firms that align with the Agency's needs annually

Strategy:	
Decrease the number of mass transit vehicles in poor condition on our roadways by utilizing the STAMP to drive outcomes on system and asset condition.	
Division(s) Responsible	Intermodal & Freight Plans
Performance Measure	Number of SCDOT titled public transit vehicles operating past their useful life
Target	Maintain the number of SCDOT titled public transit vehicles operating past their useful life at 40% or less

Goal 3: Improve SCDOT program delivery to increase the efficiency and reliability of our road and bridge network

A key component to keeping our state's economy moving is addressing the pinch points that most significantly affect the movement of freight and goods across the state. SCDOT's multimodal plan identified key freight bottlenecks in the state that are primarily associated with system to system connection points in the urban areas of the state and align with SCDOT's highest priority interstate widening projects. In addition, the agency has restructured the MPO/COG program to the Regional Mobility Program and is focusing on congested corridors, safety and multimodal transportation with an increase in funding available. To deliver projects the agency is focused on delivering projects on-time and on-budget and expediting the permitting process.

Strategy:	
Improve the reliability of the movement of people and goods across the major portions of our road network by targeting three (3) specific bottlenecks at system to system interchanges.	
Division(s) Responsible	Planning, Construction, Pre-Construction, Alternative Delivery
Performance Measure	On-time delivery of critical interstate-to-interstate interchanges improvement projects
Target	I-385/85 System to System Interchange is completed Carolina Cross Roads I-26/I-126/I-20 System to System Interchange is under construction I-526/26 System to System Interchange has completed environmental permitting by close of 2023

Strategy:	
Improve interstate capacity by widening interstates in rural areas for economic development, evacuation purposes and reliability through the Rural Interstate Freight Network Mobility Improvement Plan.	
Division(s) Responsible	Planning, Pre-Construction, Construction and Alternative Delivery
Performance Measure	Implement the Rural Interstate Freight Network Mobility Improvement Plan
Target	Deliver the Rural Interstate Freight Network Mobility Improvement Plan through completion of interstate capacity widenings in rural areas of the state

Strategy:	
Increase SCDOT's reliability of delivering projects on-time and on-budget in accordance with the Agency's 10-Year Program Delivery Plan.	
Division(s) Responsible	Pre-Construction
Performance Measure	Percent of available funding authorized within the Fiscal Year for Interstate Widening and Bridge projects
Target	100% of available funding authorized within the Fiscal Year for Interstate Widening and Bridge projects on an annual basis
Division(s) Responsible	Construction
Performance Measure	Percent of projects completed on time and within construction budget annually
Target	80% or more of all contracts that have completed construction are within the contract time on an annual basis 90% or more of all contracts that have completed construction are within budget on an annual basis

Strategy:	
Improve the reliability of the movement of people and goods across the major portions of our road network by utilizing Transportation System Management and Operations (TSMO).	
Division(s) Responsible	Traffic Engineering
Performance Measure	Number of miles addressed for the Statewide ITS (Fiber, Cameras, Message Boards) to support Traffic Management Centers (TMC) through TSMO to address congestion management
Target	30 miles of roadway addressed annually for Statewide ITS Program through TSMO to address congestion management

Strategy:	
Improve the reliability of the movement of people and goods across the major portions of our road network by targeting known congestion areas.	
Division(s) Responsible	Traffic Engineering
Performance Measure	Average time to clear travel lanes for traffic incidents along our Incident Management Zones (IMZ)
Target	Average time to clear lanes for traffic accidents along our Incident Management Zones (IMZ) 20 minutes or less

Strategy:	
Revision and implementation of the MPO/COG Program to the Regional Mobility Program to drive performance based planning for regional project selection.	
Division(s) Responsible	Planning
Performance Measure	Update LRTPs for all MPOs and COGs with a data driven, performance based Regional Mobility Program Process
Target	Delivery of updated LRTPs for all MPOs and COGs with a data driven, performance based Regional Mobility Process
Target	Produce and implement a regional bike and pedestrian plan for all MPO's and COG's

Strategy:	
Provide safe multimodal travel options for all users in accordance with SCDOT's Complete Streets Policy	
Division(s) Responsible	Planning
Performance Measure	Incorporate the Complete Streets Policy to provide multimodal travel options for all users through Regional Bike and Pedestrian Plans for all MPO's and COG's
Target	Produce and deliver Regional Bike and Pedestrian Plans for all MPO's and COG's

Strategy:	
Expedite the environmental permitting process for road and bridge projects by increasing SCDOT's reliability of delivering projects on-time and on-budget.	
Division(s) Responsible	Environmental Management
Performance Measure	Statewide Implementation of SCDOT's Advanced Mitigation Strategy
Target	Secure mitigation availability for 80% of all projects within the 10-year plan by June 30, 2027

3.0 SCDOT's 10-Year Plan (2018-2027)

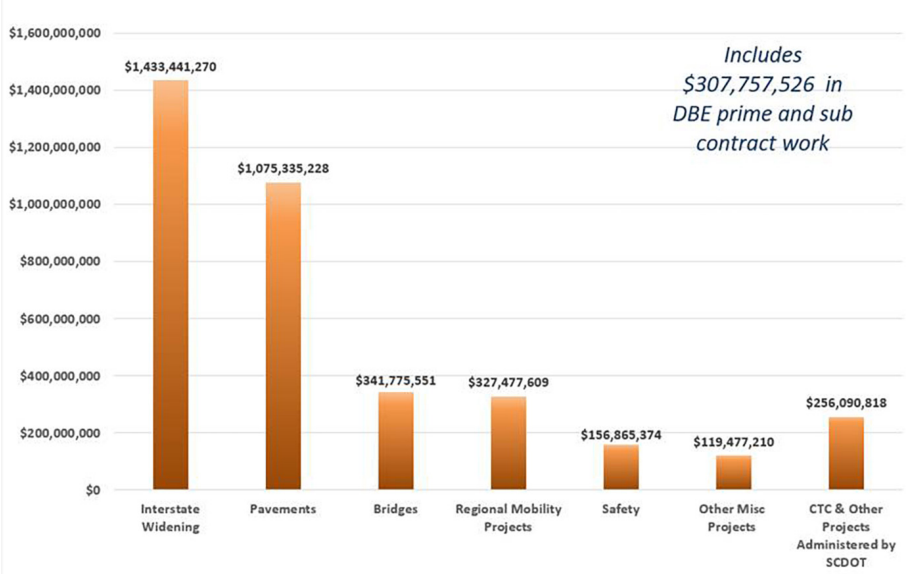
SCDOT's 10-Year Plan is the primary means for achieving the agency's asset management objectives. Since the implementation of the 10-Year Plan unprecedented progress has been made possible through Act 40 of 2017. SCDOT has strategically aligned all infrastructure repair and improvement efforts in the plans and programs of the 10-Year Plan (2018-2027) through action of the South Carolina General Assembly and passage of the landmark legislation. Infusion of approximately $2.45 billion (cumulative since July 1, 2017, net amount available for road projects, as of May 31, 2022) in new state funding dedicated to SCDOT, County Transportation Committee (CTC) and State Infrastructure Bank (SIB) also contributed to this achievement. This action by legislature has allowed SCDOT to succeed by:

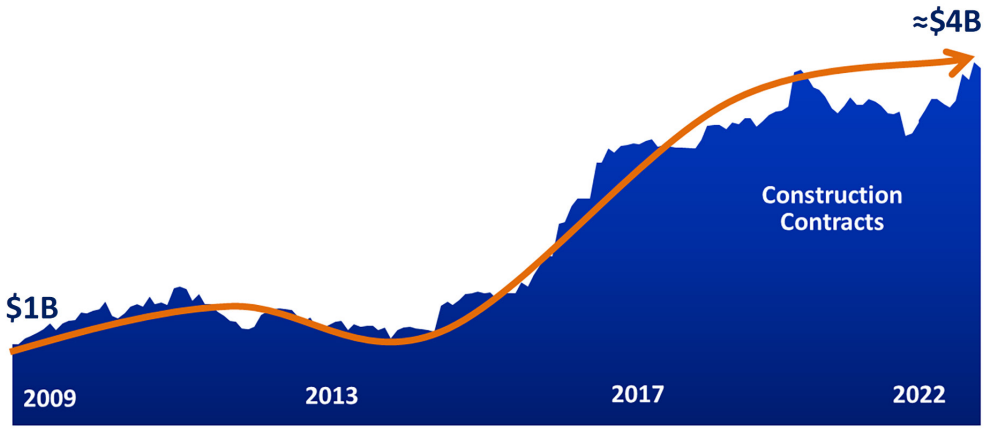
Diversifying SCDOT's revenue stream to not be over-reliant on federal funds, and allowing projects to be streamlined.

- Phasing in of Gas Tax increase to allow ramping up of industry
- Implementing a strategic targeted plan to rebuild and improve the transportation network.
- Putting SCDOT in a position to maintain a robust construction program, despite external impacts.
- Adding one-time appropriations from the Capital Improvements Joint Bond Review Committee of $435 million to accelerate planned widening projects on Interstate 26.
- Approving $120 million per year for 5-years to provide a match to fully capture the IIJA funds available to South Carolina, by the South Carolina Legislature.

SCDOT has dramatically increased its work program by quadrupaling its construction program to a record breaking $4.0 billion level by September of 2022. The transportation industry has responded by completing record breaking levels of work as shown in the figures on the right.

$4.0 Billion Construction Program





SCDOT's 10-Year Plan Accomplishments to Date (2018 - September 2022)

The largest single area of the 10-Year Plan investment is paving. South Carolina has a large network of roads that had been neglected for thirty years resulting in billions of dollars in deferred maintenance. A performance based approach has been used to complete over **5,800** lane miles with a focus on primary routes that carries 47% of the state's traffic on a daily basis.

The vital links in the transportation system in and across South Carolina are the bridges. SCDOT has targeted load restricted bridges, and bridges in poor condition on the network that create inefficiencies and unnecessary delays in the movement of people and goods across the vast network. To date **274** bridges of the original 465 have been completed, or under contract. The bridge program has been restructured since the 2018 TAMP was published, and is described in detail throughout this document.

South Carolina is booming and the economy is dependent upon good interstates to feed the economic engine. SCDOT has established an aggressive interstate widening program that will improve mobility and capacity by widening more than 100 centerline miles of interstate, targeting bottlenecks in urban areas and key rural sections. The 10-Year objective of improving 140 miles of interstate is on target with approximately **82.5** miles completed or advanced to construction.

South Carolina ranks #1 for Rural Fatality Rates in the nation. Nearly 30% of the state's fatalities and serious injury crashes occur on rural roads which makes up 5% of the network. The 10-Year target to address 1,000 miles of rural roads is ahead of schedule at **793** miles completed to date.

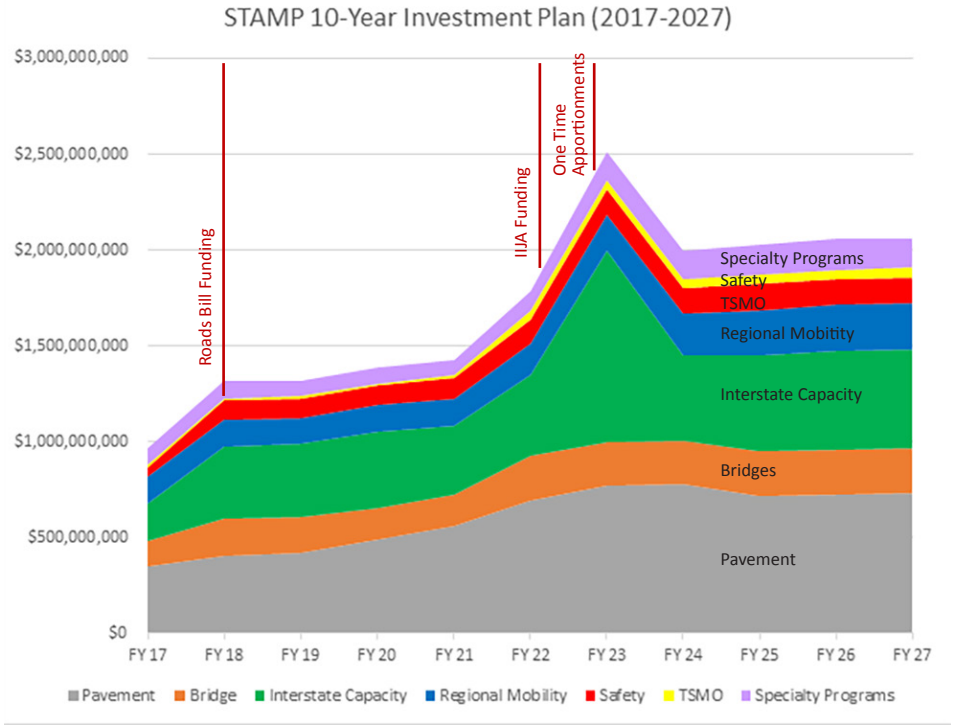
Transformative Opportunities – SCDOT's Updated 10-Year Plan

SCDOT has made excellent progress towards accomplishing the objectives in the 10-Year Plan. South Carolina has a transformative opportunity in the remaining years of the current 10-Year Plan to incorporate and accelerate projects to tackle the continued growth and economic development needs of the state. With foresight from the SC Legislature has created a diversified revenue stream. With additional federal funding through the Infrastructure Investment and Jobs Act (IIJA), recurring matching state funds, one-time funding to accelerate significant Interstate projects and potential federal grant opportunities the agency is well positioned to deploy additional projects, and expand the scope of the 10-Year Plan to include more programs. The updated plan now includes:

Program Element	Program Description
Safety	Improve 1,250 miles of non-interstate rural roads with tailored safety solutions with a targeted solution to address road departure incidents throughout the State.
Pavements	More paving projects using a performance-based approach through a blend of preservation, rehabilitation and reconstruction. Elimination and replacement of Open Graded Friction Course (OGFC) on interstates to continue efforts to meet and exceed current planned goals
Bridges	Refocus the bridge program with three priorities to: (1) drive the number of closed bridges to zero on all networks, (2) drive the number of posted bridges to zero on interstate and primary routes, and (3) reduce the number of posted bridges on the secondary system.
Interstate Capacity	Improve major bottlenecks on interstates in urban and rural areas for economic development, evacuation purposes, and address major freight pinch points at interstate-to-interstate interchanges
Regional Mobility Program (Formerly MPO/COG Program)	Refocusing on corridor congestion management, multimodal mobility and alternative transportation. Ramping up of funding increase from $138 million to $238 million to provide minimum distribution to all Metropolitan Planning Organizations (MPOs) and Council of Governments (COGs)
Transportation System Management & Operations (TSMO)	Program will aim to reduce idling and emissions through retimed signals, intelligent transportation systems, intersection improvements, and other strategies.
Specialty - Rest Areas	Rest area upgrades across the state with an initial focus on the I-26 evacuation corridor
Other Specialty Programs	Includes Transportation Alternatives Program (TAP), Planning, Electrical Vehicles, Capital Drainage,and State Infrastructure Bank (SIB) One-Cent Contribution

SCDOT's Ten-Year Investment Plan

South Carolina continues to attract new residents, tourists, and businesses. This growth has influenced SCDOT's ability to maintain and operate the nation's fourth largest state-owned transportation network in the country. SCDOT has in turn focused its efforts to getting the system to a state of good repair through the development and implementation of an aggressive 10-Year Plan to drive investments towards projects that aid in recovering the system from the past three decades of underfunding. The 10-Year Plan combines all state and federal funding into a comprehensive investment strategy based on SCDOT's strategic priorities. The 10-Year Plan was developed by SCDOT in order to align all of the agency's infrastructure repair and improvement efforts and effectively deploy a significant infusion of approximately $910 million annually in new state funding dedicated to SCDOT through the passage of Act 40 of 2017 by the General Assembly. In addition to the increase in state funding SCDOT has received an increase of approximately 34.6% in federal funding to approximately $1 billion through the IIJA, with additional federal funds tied specifically to bridges, electric vehicle charging, and discretionary grant programs. The impact of the Gas Tax can be seen in FY 2018, and the IIJA in FY 2022, with an increase to all program categories. Further breakdown of categories can be found in Chapter 7, Investment Strategies.



Program Category	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Pavement	$348,280,000	$401,800,000	$417,000,000	$487,000,000	$562,000,000	$695,030,000	$768,969,001	$774,620,582	$719,000,000	$726,000,000	$734,000,000
Bridge	$130,500,000	$199,250,000	$189,250,000	$164,250,000	$164,254,330	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672
Interstate Capacity	$199,704,050	$375,100,001	$379,948,410	$403,124,034	$355,361,454	$424,235,493	$1,001,190,210	$450,525,950	$501,096,034	$519,327,810	$522,183,031
Regional Mobility	$138,000,001	$138,000,001	$138,000,001	$138,000,001	$138,000,001	$163,916,072	$188,000,000	$213,000,000	$238,000,000	$238,000,000	$238,000,000
Safety	$46,768,651	$97,704,024	$98,658,105	$99,631,267	$115,597,172	$129,386,984	$131,525,198	$133,152,105	$134,811,550	$136,504,183	$136,504,183
TSMO	$14,319,000	$12,434,956	$12,500,655	$12,567,668	$12,558,350	$40,592,223	$46,392,126	$47,299,519	$48,225,059	$49,169,111	$49,169,111
Specialty Programs	$87,827,717	$89,461,749	$82,263,169	$83,677,727	$81,980,221	$102,998,389	$145,480,342	$149,224,933	$158,612,091	$159,472,138	$153,793,794

SCDOT's Commitment to Safety

South Carolina has the highest fatality rate in the nation. Recent fatality trends indicate approximately 1,100 people are dying on our roads annually. SCDOT's rural roads are some of the deadliest roads in the State with approximately 30% of fatalities and serious injuries occurring on these roads, which represent only 5% of the network. The SCDOT Traffic Safety Office is allocating $130 million annually with the goal of reducing fatalities and serious injuries on the state's roads.

Based on historical trend line analysis, SCDOT is projecting increasing traffic fatalities in South Carolina through 2026. Traffic fatalities reached a historic high in the state in 2021 with nearly 1,200 deaths. Given the recent rise in traffic deaths, the state reevaluated its 10-year target of 886 deaths (based on a five-year average) and approved by the SCDOT Commission on March 17, 2022. If the upward trend were to continue, statistical models indicate traffic deaths could be as high as 1,400 in the five-year period ending in 2026. Analysts can estimate the programmatic impacts of safety projects and make reductions from the forecasted figures. Revised calculations indicate a new target of 1,139 deaths for the five-year period ending in 2026.

Contradictorily, serious injuries in SC have declined over the last 15 years, with one exception. In 2019, serious injuries increased 23% compared to the previous year. The state has attributed this outlying data point to a change in the serious injury definition that occurred that year. The number of serious injuries declined significantly in 2020 before stabilizing the following year. Consequently, the revised target for serious injuries is only slightly higher than the original 10-Year target. The table below displays the 2016 baseline condition, the 2016-2020 actual figures, the original 10-Year target, and the revised 10-Year target. Note also the increase in annual funding allocations as a result of the passage of the Infrastructure Investment and Jobs Act (IIJA) in November 2021.

Safety	2016 Baseline Condition[1]	2020 Actuals[1]	Original 10-Year Target[1]	Original Funding Allocation (in millions)	Revised 10-Year Target[1]	Revised Funding Allocation (in millions)
Fatalities	890	1,023	886	$99	1,139	$130
Fatality Rate	1.75	1.84	1.34		1.90	
Number of Serious Injuries	3,194	2,876	2,573		2,731	
Serious Injury Rate	6.30	5.16	3.89		4.56	
Vulnerable Roadway User Fatalities & Serious Injuries	376	441	351		469	

SCDOT's 10-Year Asset Condition Performance Targets

The 10-Year Plan has enabled SCDOT to dramatically improve the condition and operation of the backbone of the State's infrastructure network: the National Highway System (NHS). The improvement of asset condition has been made possible by the enactment of Act 40 in 2017, by the South Carolina State Legislature, which has provided dedicated funding to improve transportation infrastructure through incremental increase in the State's gas tax and other fees over a six- year period. At full implementation in the summer of 2022, the agency is poised to receive nearly a doubling of state resources. The increased funding has created a unique opportunity for SCDOT to turn around the downward trend in the condition of the state-owned highway system and further demonstrates the need for effective asset management.

The table shows the condition at the end of year five (2021) for pavement and bridge condition. Pavement condition has improved in all systems. The bridge program has been completely restructured since the start of the 10-Year Plan as the agency works to turn around three decades of underfunding. A team of bridge engineers, completion of the Load Rating Program and implementation of a new Bridge Rehabilitation Program has reprioritized the bridge list. Additional information on the restructuring of the bridge program can be found in Chapter 4.5.

	2016 Actual % Good	2016 Actual % Poor	2021 Actual % Good	2021 Actual % Poor	Ten-year Target % Good	Ten-year Target % Poor	Average 10Year Allocation (in millions)
Pavements (PQI Metric)							
Interstate[1]	65%	11%	78%	8%	92%	3%	$166
Non-Interstate NHS	28%	45%	52%	30%	72%	16%	$113
Non-NHS Primaries	20%	61%	38%	47%	48%	37%	$235
Federal Aid Secondary	19%	52%	31%	43%	40%	35%	$140
Non-Federal Aid Secondary[2]	15%	55%	22%	45%	25%	45%	$82
Bridges (by count)							
NHS	48%	6%	44.3%	3.4%	66%	0%	$58
Non-NHS Federal Aid	46%	11%	37.9%	5.7%	41%	11%	$30
Off System	40%	9%	44.3%	6.3%	36%	10%	$27
Bridges (by deck area) (Overall sq. ft. deck area Federal Metric)							
NHS	42%	4%	38.5%	4.4%	60%	0%	$58
Non-NHS Federal Aid	50%	10%	48.0%	5.8%	41%	15%	$30
Off System	51%	7%	47.4%	4.6%	44%	10%	$27

* Pavement condition based on Pavement Quality Index (PQI) scale;. Bridge condition is based on the federal NBI scale.

Unprecedented COVID-19 Challenges

The COVID-19 pandemic created unprecedented challenges for all government, business, communities, and families. While most state DOTs slowed down, suspended projects, and laid off staff, SCDOT navigated this challenge and kept the state road and bridge programs moving forward. SCDOT offered in-office and telework/telecommute to employees and implemented extra preventative safety measures to protect the health and well-being of the workforce to meet the agency's mission.

SCDOT saw a sharp drop (40-45%) in "Gas Tax" revenues due to reduced traffic during the pandemic "stay-at-home" orders. The Agency's finances were carefully balanced on a daily basis, tracking actual performance of the revenues and expenditures as well as, aligning lettings and project authorizations to revenues received. In preparation for fiscal year 2021, SCDOT cut 12% of the internal operating budget. No road or bridge projects were cut or delayed. Contractors were able to take advantage of the lighter traffic to keep projects on schedule.

During the global pandemic and continuing currently, contractors and their sub-contractors have been facing challenges with material shortages and labor inefficiencies. Key components of the 10-Year Plan's success is to ensure that there are enough contractors to complete the work and enough materials to complete the projects.

Risk Assessment

With assistance from the Internal Audit Services Office, risk was assessed and compiled by SCDOT leadership to highlight areas that need to be managed. The top three concerns were related to Personnel, External Partners and Disasters as shown on the right. For a comprehensive review of risk and mitigation strategies see Chapter 5.

- Personnel issues including the loss of key staff and the inability to recruit and retain staff
- Perpetual challenge of our external partners to effectively ramp up. The agency continues to work with its partners to promote increased capacity. The industry has responded to the increase in projects.
- Response to man-made or natural disasters. SCDOT continually responds statewide to calamities, such as hurricanes, floods, tornadoes, earthquakes, fires, winter storms, etc. Our employees go above and beyond to assist during such times. There is also a financial risk implied with disasters.

Awards and Recognition

- Upgrade of the 511 System in July 2020 with enhancements to download maps faster, and for travelers to access information on construction, lane closures, crashes, congestion and sever weather affecting traffic
- The I-85/I-385 Gateway Interchange wins SASHTO Award in the category of "Operations in Excellence in Major Highway Project" in September 2020. The project's design, engineering and construction was recognized for delivering a "more reliable, well-functioning and safer transportation system".
- The Minority & Small Business Affairs Division hosted Bridging the Gap Forums in October 2020 and January 2021 to provide DBE/SBE firms with an opportunity to engage with SCDOT leadership.
- SCDOT won the AASHTO President's Award in November 2020, for transparency and accountability measures allowing the public to follow the monthly collection of new revenues through the completion of projects by tracking every dollar.
- On June 30, 2021, SCDOT discontinued toll collections on Hilton Head's Cross Island Parkway. Opened in 1998, this road connected the north end (US 278) of the island with the south end. The tolls have repaid the bonds that were issued to build the road, collect the tolls and maintain the roadway. SCDOT will continue to maintain the Parkway as part of its statewide road system.
- Carolina Crossroads Groundbreaking Ceremony on November 8, 2021, Governor McMaster joined SCDOT, FHWA and other elected officials for the groundbreaking of the Carolina Crossroads project in Columbia. The project is South Carolina's larges interstate improvement project to date and will improve 14 miles of I-20, I-26 and I-126. Pictured below.
- SCDOT won a regional transportation award for technology used in the US 21 over Harbor River Bridge Replacement Project i Beaufort County. SCDOT won in the "Best Use of Technology & Innovation, Medium Project" category. The winning project consisted of a 3,353-foot long fixed -span Harbor River bridge to provide uninterrupted access for shrimping and sailing vessels along the river below as well as improved safety for motorist. The new bridge replaced a swing-span bridge that was deteriorating and required ongoing repairs and maintenance. **The project is now one of the finalists for the national award and competing for the Grand Prize and People's Choice Award.**

South Carolina STAMP and Improving Asset Management Practice

SCDOT has embraced transportation asset management in its business practices, the agency constantly strives to improve its efficiency, transparency and accountability. The South Carolina STAMP describes the strategic goals, mission and vision for how asset management is used to deliver transportation goals and objectives supported by data collection on asset condition, desired state of good repair, risk assessment and funding scenarios.

The STAMP is federally required by (23 CFR 515) with an updated plan to be completed every four years from the initial date of STAMP certification for pavements and bridges on the NHS. Additional reporting requirements associated with performance measures are required on a biennial basis.

Transportation Asset Management (TAM) is an on-going systematic process of recommending the most timely and cost-effective way of preserving, replacing, upgrading and operating the transportation system. TAM is data-driven with a continuous update of the inventory and condition of pavements and bridges which results in an organized and logical approach to decision-making. Opportunities for continuous improvements of asset management practice at SCDOT include:

- Identifying communication strategies to disseminate transportation asset management information to key stakeholders;
- Increasing the use of Whole Life Management principles in the pavement, bridge, and maintenance management processes;
- Conducting a risk assessment of key assets;
- Creating a comprehensive inventory of transportation infrastructure assets;
- Developing a data governance plan for assets;
- Evaluating securing analytical tradeoff decision-support tools to support transportation asset management decision making.
- Enhancing of asset modeling capabilities;
- Establishing/Implementing Enterprise Asset Management System (EAMS); and
- Strengthening local, regional, state and federal coordination

SOUTH CAROLINA ASSET MANAGEMENT

CHAPTER 2

2. Asset Inventory and Conditions

2.1 Overview

This chapter reviews the state of SCDOT's highway transportation system. In a broader transportation asset management context, the State of the System provides information regarding the trend of system demands, physical infrastructure inventory, and existing condition. Asset inventory and condition data are the foundation for managing transportation assets. This information is vital in system and financial planning to meet current and future needs of the State's highway system. The subsections in this chapter review the demand for transportation, asset inventory, and condition.

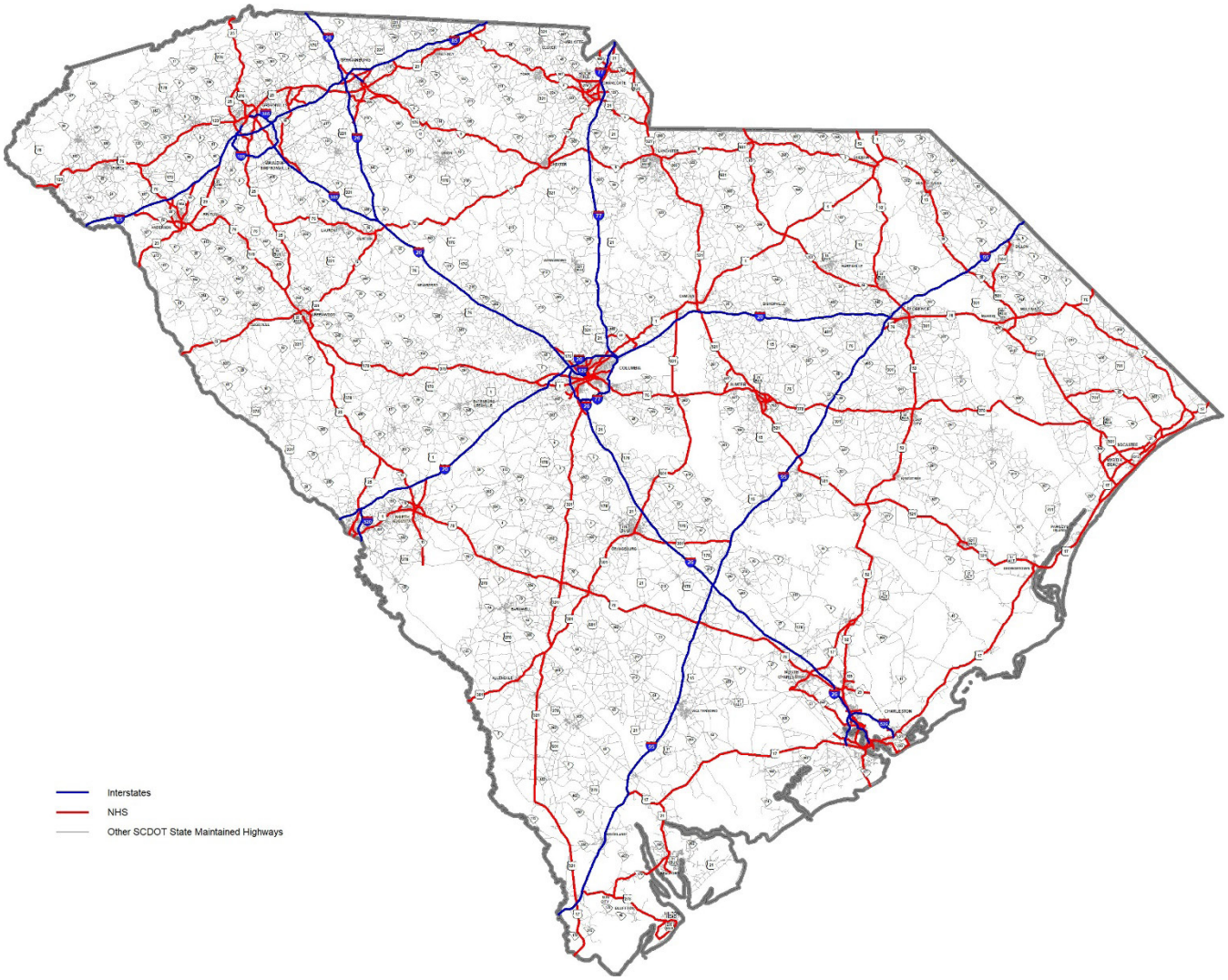
2.2 South Carolina Transportation System

The STAMP addresses assets in two overlapping highway systems: the National Highway System (NHS) and the State Highway System (SHS). The NHS includes interstates, principal arterials, the Strategic Highway Network (STRAHNET), major strategic highway connectors and intermodal connectors that are defined by FHWA to be important to the nation's economy, defense and mobility. The SHS includes all assets that are within the boundary of South Carolina and maintained by the SCDOT. Figure 2-1 shows the interstate and NHS system highlighted along with other state maintained roadways. The agency manages the vast majority of both of these systems. It is important to note that SCDOT does not manage certain sections of the non-interstate NHS, totaling approximately 0.1 percent of the non-interstate NHS mileage within the State, or 2.6 centerline miles of road. SCDOT does collect condition data on these locally owned NHS sections and their condition values are incorporated into the data presented in this report. Even though SCDOT maintains almost all of the interstate and non-interstate NHS in the State, ensuring the smooth operation and better preservation of the NHS requires effective coordination and efficient collaboration with the Metropolitan Planning Organizations (MPOs) and the Council of Governments (COGs), who typically program capacity, access management, and similar projects on the non-interstate NHS system. The approach to include both systems in the STAMP is to provide a complete picture of the system as a whole to aid in planning decisions. In addition to including all assets on the NHS and SHS, the agency has elected to include the Department's 10-Year Plan, Safety Targets and Objectives. The inclusion of these additional elements gives a comprehensive view of the 10-Year STAMP planning period (2018-2027) to repair and rebuild our transportation network ensuring our citizens and businesses can travel on a safe and reliable system.

Table 2-1 Strategic 10-Year Asset Management Plan Elements

System	Pavement	Bridge	10-Year Plan	Safety Objectives & Targets
NHS – Federal Requirement	✓	✓		
SHS	✓	✓	✓	✓

Figure 2-1. Strategic 10-Year Asset Management Plan Elements



Continual changes in demographics and socioeconomic characteristics in South Carolina, coupled with aging transportation infrastructure, have increasingly overburdened the State's highway transportation system. In times of declining and limited resources, the issue is amplified. These trends inform the process of forecasting future system demands and planning for these demands. For enhanced decision making as it relates to transportation infrastructure investment, SCDOT relies upon quality information derived from important historic trends, such as population, employment, and traffic growth. South Carolina was 10th in the nation for population growth between 2010 and 2020 according to the US Census Bureau and the State's population increased by 10.7% over this period. South Carolina ranks 2nd in the region in annual growth rate, ranking only behind Florida. South Carolina's population is expected to grow an additional 37% by 2040, with a corresponding household growth of 39% over that same period. South Carolina experienced 2.5% job growth in 2021 according to the Bureau of Labor Statistics Quarterly Census of Employment and Wages. In addition to the annual growth rate in population and jobs, South Carolina has over 30 million visitors that come to enjoy its rich history, charming cities, beautiful beaches and mountains.

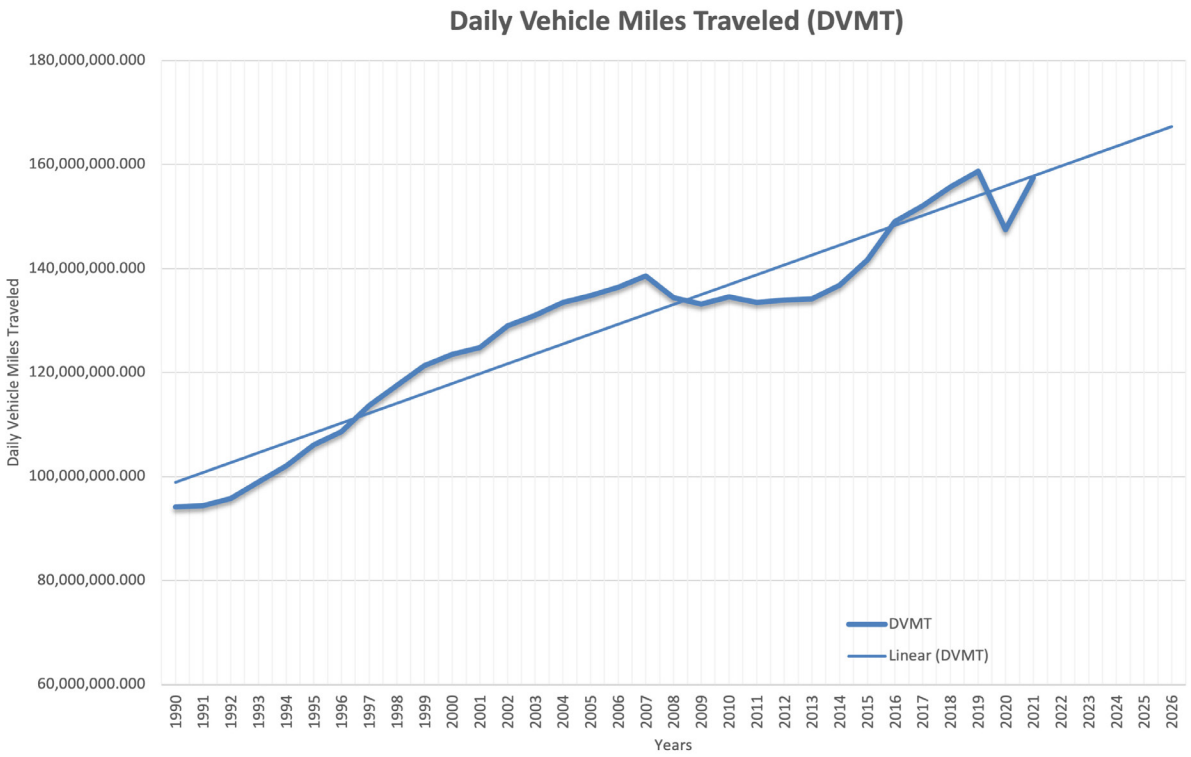
Table 2-2 shows a breakdown of population growth in South Carolina. A correlation exists between household and employment growth and trip generation. As population and the number of households increase, more trips are generated through commuting, shopping, and other day-to-day activities. SCDOT considers these forecasted growth numbers on future demands on the system and accordingly plans to manage the impacts on the transportation network.

Table 2-2. Population Growth in South Carolina

Demographic	Base Year (2020)	Forecast Year (2040)	Forecast Growth (%)	Annual Growth (%)
Population	**5,118,425**	**6,352,000**	**37%**	**1.02%**
Household	**2,344,963**	**2,504,923**	**39%**	**1.18%**
Employment	**2,037,000**	**2,800,016**	**25%**	**0.8%**

The change in Daily Vehicle Miles Traveled (DVMT) over the years in South Carolina is similar to trends exhibited nationwide. DVMT in South Carolina stayed consistent between 2009 and 2013, which was largely attributable to the recession between 2007 and 2009. Figure 2-2 shows the DVMT trends in South Carolina between 1990 and 2021 and forecast out to 2026. The figure shows that DVMT has sharply risen since 2013 and peaked in the year 2019 with over 158 million DVMT, which is the most daily miles traveled since SCDOT began tracking the measure. In 2020 the effects of the COVID-19 pandemic can be seen with a steep drop in DVMT to 147 million; by 2021 DVMT has recovered to 157 million back to the projected trend line. In addition to traffic growth demands, SCDOT will experience system demands due to factors such as aging infrastructure and extreme weather conditions. SCDOT has enhanced its practice of keeping good inventory and condition data for the system in order to facilitate efficient and effective asset management practices.

Figure 2-2 Historical Trend of DVMT



2.3 Pavements

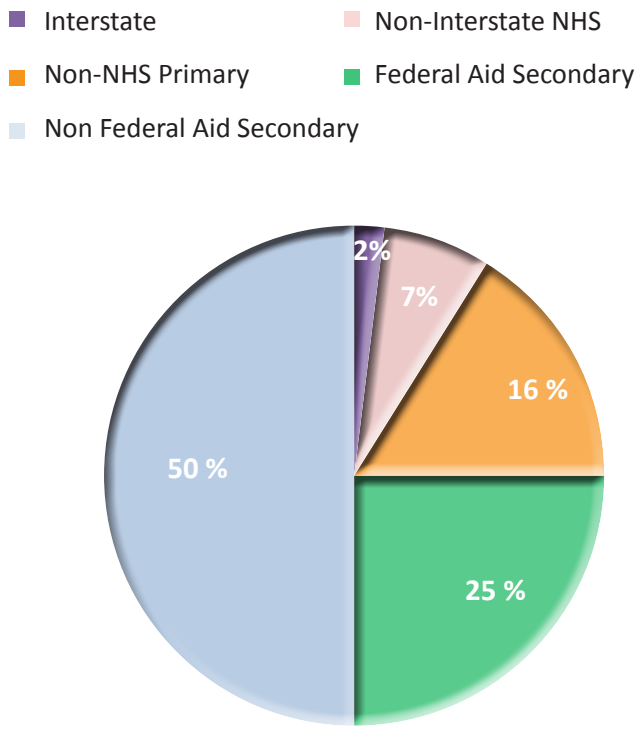
SCDOT owns and maintains over 41,000 centerline miles encompassing over 90,000 lane-miles of roadway. This inventory of roadway mileage makes SCDOT's highway system the fourth largest state-owned system in the United States. Over half of the state-maintained system is not eligible for federal funds. For the purpose of efficient asset management, SCDOT categorizes the State's highway system into five different tiers: 1. Interstate, 2. Non-Interstate National Highway System (NHS), 3. Non-NHS Primary (U.S. highways and SC designated routes), 4. Federal Aid Secondary, and 5. Non-Federal Aid Secondary highways. Table 2-3 shows a breakdown and description of each category maintained by the State Highway System. By centerline miles, the NHS accounts for 8.6% of the road network maintained by SCDOT. Traffic distribution was an important factor in SCDOT's determination of investment and strategic priorities. With 58% of all vehicle miles traveled occurring on the Interstate and Non-Interstate NHS system, effective maintenance and operation of this portion of the state's network is critical to meeting the needs of the traveling public, business and fostering continued economic prosperity within the Palmetto state. It is important to note that 31% of the VMT occurs on the interstate system, even though interstates account for only 2% of the public roads in the state. This statistic reinforces the need to invest in the maintenance and operation of the interstate system in South Carolina

Table 2-3. SCDOT Roadway Inventory

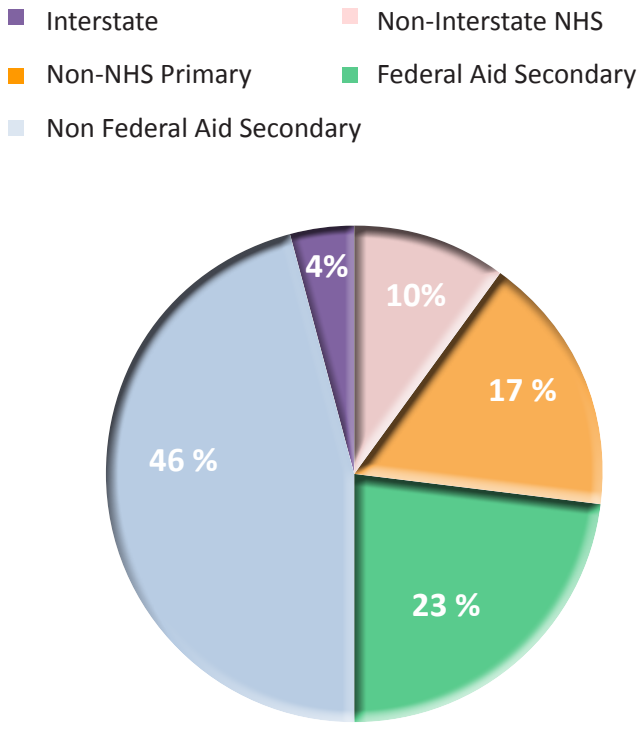
System Functional Tier	State-maintained Centerline-miles	State-maintained Lane-miles	Daily Vehicle Miles Traveled (DVMT)
Interstate (NHS/SHS)	851 (2.0%)	3,866 (4.2%)	45,575,948 (31%)
Non-Interstate NHS (NHS/SHS)	2,749 (6.6%)	9,391 (10.4%)	39,868,469 (27%)
Non-NHS Primary (SHS)	6,765 (16.4%)	14,930 (16.5%)	30,201,491 (20%)
Federal Aid Secondary (SHS)	10,349 (25.1%)	21,270 (23.4%)	23,707,180 (16%)
Non-Federal Aid Secondary (SHS)	20,591 (49.95)	41,271 (45.5%)	8,946,010 (6%)
TOTAL	41,295 (100%)	90,728 (100%)	148,299,098 (100%)

Figures 2-4 and 2-5 display the percentage breakdown of roadway centerline and lane miles of the SCDOT Roadway inventory.

ROAD INVENTORY % STATE MAINTAINED CENTERLINE MILES



ROAD INVENTORY % STATE MAINTAINED LANE MILES



2.3.1 Pavement Data

SCDOT collects pavement inventory and condition data for all NHS and SHS pavements through an annual automated process.

SCDOT reports the pavement data collected to the national data base Highway Performance Monitoring System (HPMS) that is maintained by FHWA. For the 2022 STAMP pavement data is reflective of end of the calendar year 2021.

2.3.2 Pavement Performance Measures

The Federal Highway Administration (FHWA) published in the Federal Register (82 FR 5886) a final rule establishing performance measures for State Highway Agencies (SHA) to use in managing pavement performance on the NHS. SCDOT is required to:

- Set targets for the full extent of the interstate and non-interstate NHS, regardless of ownership.
- Establish statewide 2-year and 4-year targets for the non-interstate NHS and 4-year targets for the interstate and report on the status of those targets on a biennial basis.
- Adjust targets at the Mid-Performance Period Progress Report (if necessary).
- Measure pavement performance measures are detailed in 23 CFR Part 490 Subpart C: Measures for Assessing Pavement Condition. The regulation also establishes minimum condition requirements for interstate pavements.
- Measure percentage of pavements on the Interstate System in Good Condition.
- Measure percentage of pavements on the Interstate System in Poor Condition (If 5% of interstate pavements are in poor condition then the agency must oblige NHPP funds on interstate pavements).
- Measure percentage of pavements on Non-Interstate NHS in Good Condition.
- Measure percentage of pavements on Non-Interstate NHS in Poor Condition.

2.3.3 Pavement Performance Metrics, PQI and Federal Metric

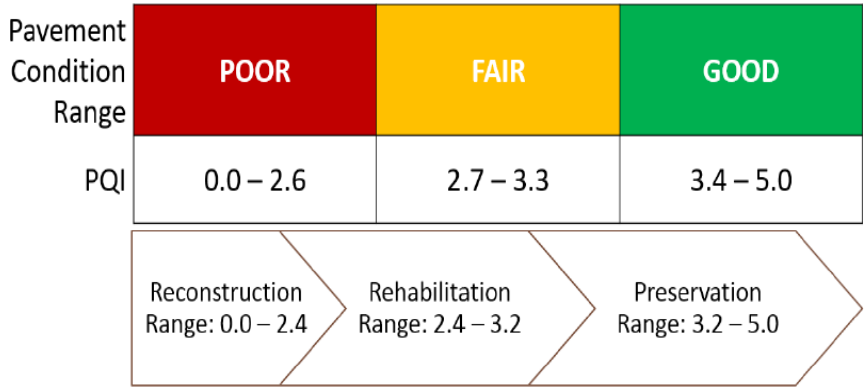
Since its inception in 1978, FHWA's Highway Performance Monitoring System (HPMS) has evolved into a robust national repository of data on the extent, condition, performance, use, and operating characteristics of the nation's highways. States report a variety of pavement condition statistics to HPMS each year for roads on the NHS. Prior to MAP-21, each State decided on its own index on pavement quality measure. When SCDOT began collecting pavement condition data in 2000 the agency developed a unique pavement index. Pavement Quality Index (PQI) is used to evaluate pavement surface characteristics and conditions as part of the pavement preservation/rehabilitation project programming selection criteria. Since the establishment of MAP-21, state DOTs are required to report the performance measures in Section 2.3.2 in the Federal Pavement Metric. This metric is calculated to determine whether the section is good, fair or poor with respect to: Pavement Roughness, Rutting, Cracking and Faulting (concrete pavements only). The thresholds for good, fair and poor condition are established by federal regulation, See Figure 2-6 for federal threshold metrics. Conditions are assessed for 0.1 mile long pavement sections using the criteria. An individual section is rated as being in good overall condition when all metrics are good. An individual section is rated as poor overall condition when two or more metrics are poor. Any other combinations would fall in the fair category. Lane miles are tabulated for all sections to determine the overall percentage of good, fair and poor for each pavement system.

The agency developed the 10-Year Plan and targets based on PQI prior to the promulgation of the federal metrics. PQI incorporates roughness, rutting, cracking, patching, and raveling, and was developed for South Carolina to reflect the types of pavement deterioration typically found within the State. The PQI metric is the preferred performance metric for reporting throughout the agency and for project selection criteria.

Figure 2-6. Federal Pavement Metric

Rating	Good	Fair	Poor
IRI *(inches/mile)*	<95	***95-170***	***>170***
PSR* *(0.0-5.0 value)*	≥4.0	2.0-4.0	≤2.0
Cracking Percent *(%)*	<5	***CRCP: 5-10 Jointed: 5-15 Asphalt: 5-20***	***>10 >15 >20***
Rutting *(inches)*	<0.20	0.20-0.40	>0.40
Faulting *(inches)*	***<0.10***	0.10-0.15	>0.15

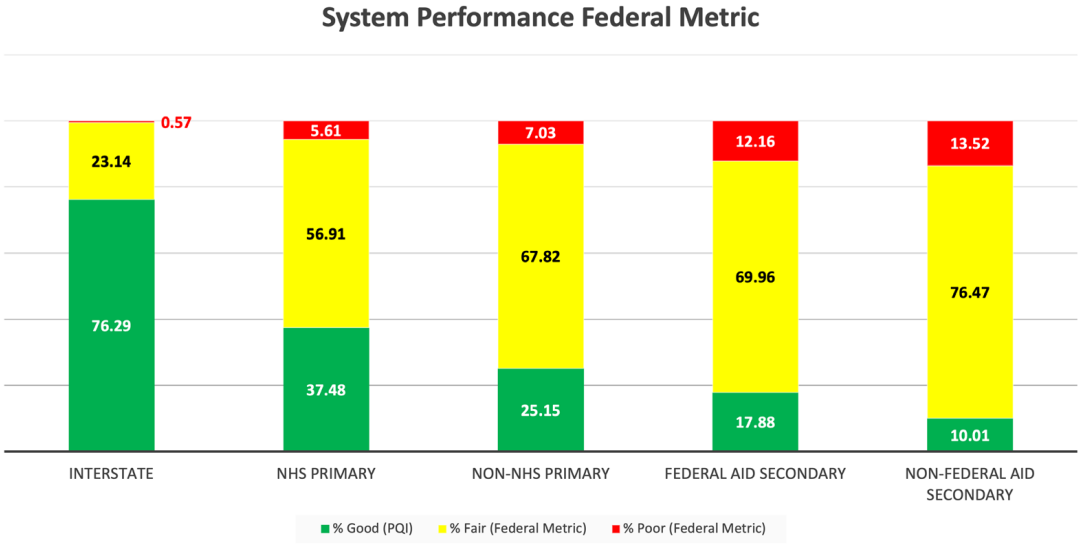
Figure 2-7. SCDOT Pavement Quality Index (PQI) Metric

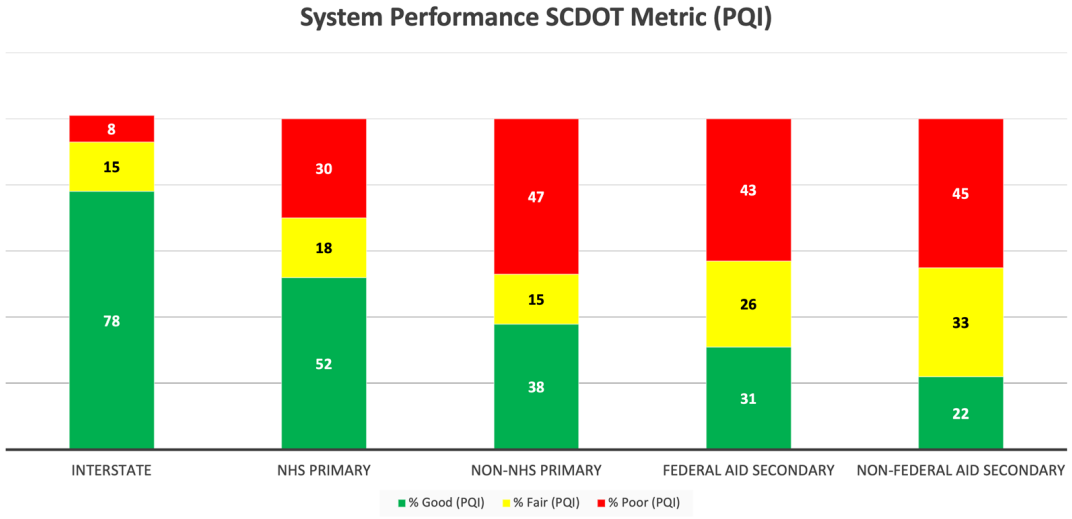


While SCDOT has historically collected the components of the federal metric, the agency's collection method was not aligned with the federal standards. See Figure 2-7 for PQI threshold metrics.

SCDOT has developed a comparison chart between the agency's PQI metric and the federal metric which is outlined in Figure 2-8. Based on the data, the PQI measure shows a higher percentage of pavements in good and poor condition than the federal measures across all pavement systems; however, the percentage of interstate pavements in good condition is comparable using either PQI or the federal measure. Based on a number of factors, including decades of historical pavement condition data, which includes patching and raveling, SCDOT staff has recommended presenting the 10-Year pavement condition targets in the PQI performance measure for the 2022 STAMP Update, rather than the federal metric as the current prudent choice for the agency. The agency has listed PQI vs. Federal metric as an item that needs further action in Chapter 8. TAMS Process Enhancements.

Figure 2-8. Comparison between Federal Metric and PQI





2.3.4 Pavement Inventory and Condition

SCDOT tracks and maintains pavement conditions using a Pavement Management System (PMS) and a Road Inventory Management System (RIMS). These systems support the agency in making informed, strategic investment decisions relating to pavement maintenance and programming. Table 2-4 shows the current inventory and condition of the State Highway System by functional class based on PQI for the end of calendar year 2021. SCDOT generates these results using the Department's PMS.

On the pages that follow the historical trends and mapping of Interstate (Figure 2-9 & 2-10), Non-Interstate NHS (Figure 2-11 & 2-12), Non-NHS Primary (Figure 2-13 & 2-14), Federal Aid-Secondary (Figure 2-15 & 2-16) and Non-Federal Aid Secondary (Figure 2-17 & 2-18) are presented. These figures show that SCDOT is incrementally improving all pavement systems. SCDOT has managed these conditions through the use of risk-oriented planning and programming by focusing its maintenance efforts on preservation and maintaining mileage quantified in good condition. The data reveals the returns on the agency's efforts to provide quality ride experiences on the most traveled portions of the pavement network. While interstate pavements comprise 2.0% of the road network system, measured by centerline miles, they carry approximately 31% of the DVMT as of 2021.

Until the passage of Act 40 of 2017, the "Roads Bill", SCDOT had historically insufficient funds to maintain its system and had to strategically focus its maintenance projects in certain areas. With the increased state revenues, SCDOT has made marked improvements on all pavement systems and intends to prevent further deterioration through the investment strategies discussed further in Chapter 7.

Table 2-4. Pavement Condition (Q4 2021 in PQI)

System Functional Tier	State-maintained Centerline-miles	State-maintained Lane-miles	Daily Vehicle Miles Traveled (DVMT)	Percent Good	Percent Fair	Percent Poor
Interstate (NHS/SHS)	**851 (2.0%)**	**3,866 (4.2%)**	**45,575,948 (31%)**	**78%**	**15%**	**8%**
Non-Interstate NHS (NHS/SHS)	**2,749 (6.6%)**	**9,391 (10.4%)**	**39,868,469 (27%)**	**52%**	**18%**	**30%**
Non-NHS Primary (SHS)	**6,765 (16.4%)**	**14,930 (16.5%)**	**30,201,491 (20%)**	**38%**	**15%**	**47%**
Federal Aid Secondary (SHS)	**10,349 (25.1%)**	**21,270 (23.4%)**	**23,707,180 (16%)**	**31%**	**26%**	**43%**
Non-Federal Aid Secondary (SHS)	**20,591 (49.9%)**	**41,271 (45.5%)**	**8,946,010 (6%)**	**22%**	**33%**	**45%**
TOTAL	**41,295 (100%)**	**90,728 (100%)**	**148,299,098 (100%)**			

Figure 2-9. Historical Trend of Pavement Condition (PQI) for the Interstate Pavement System

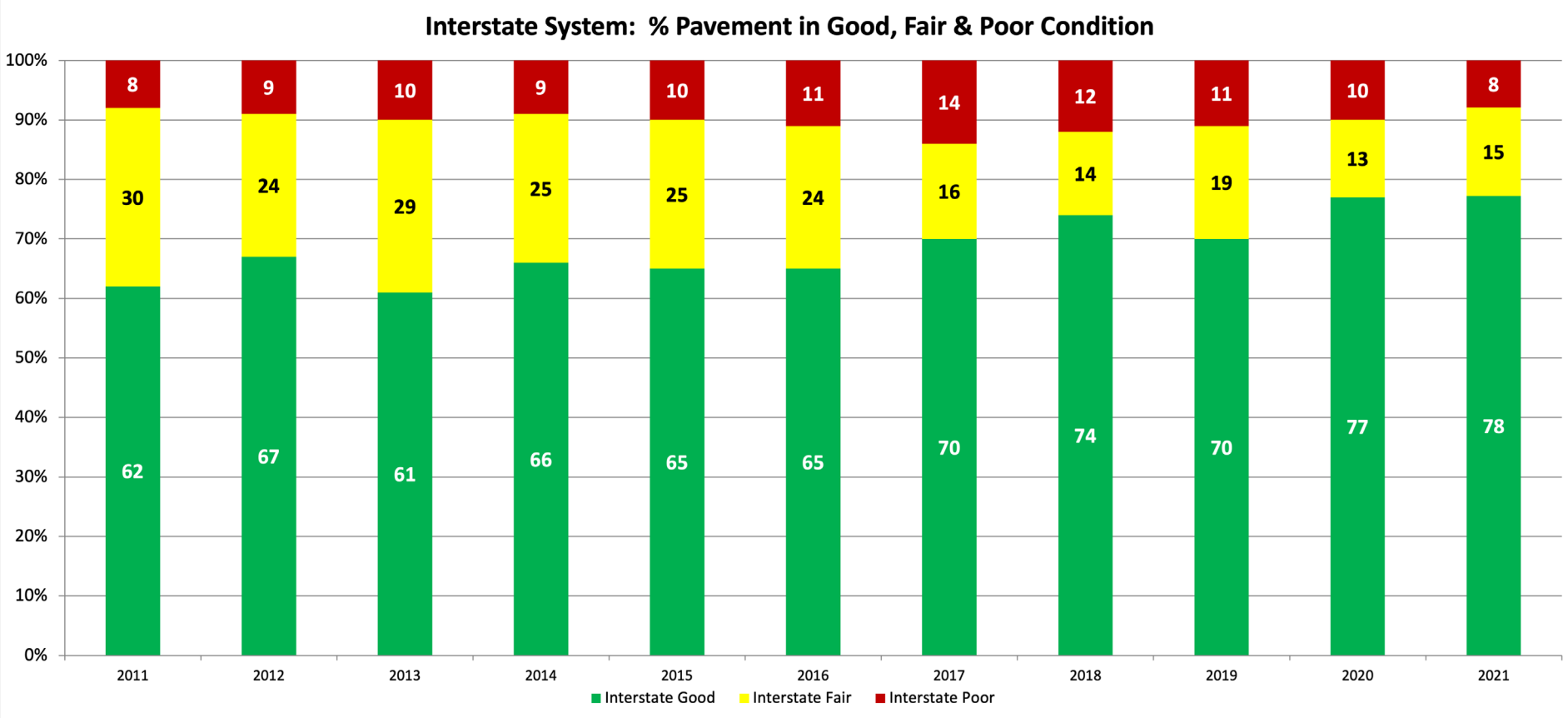


Figure 2-10. 2021 Statewide Map Interstate Pavement System Condition

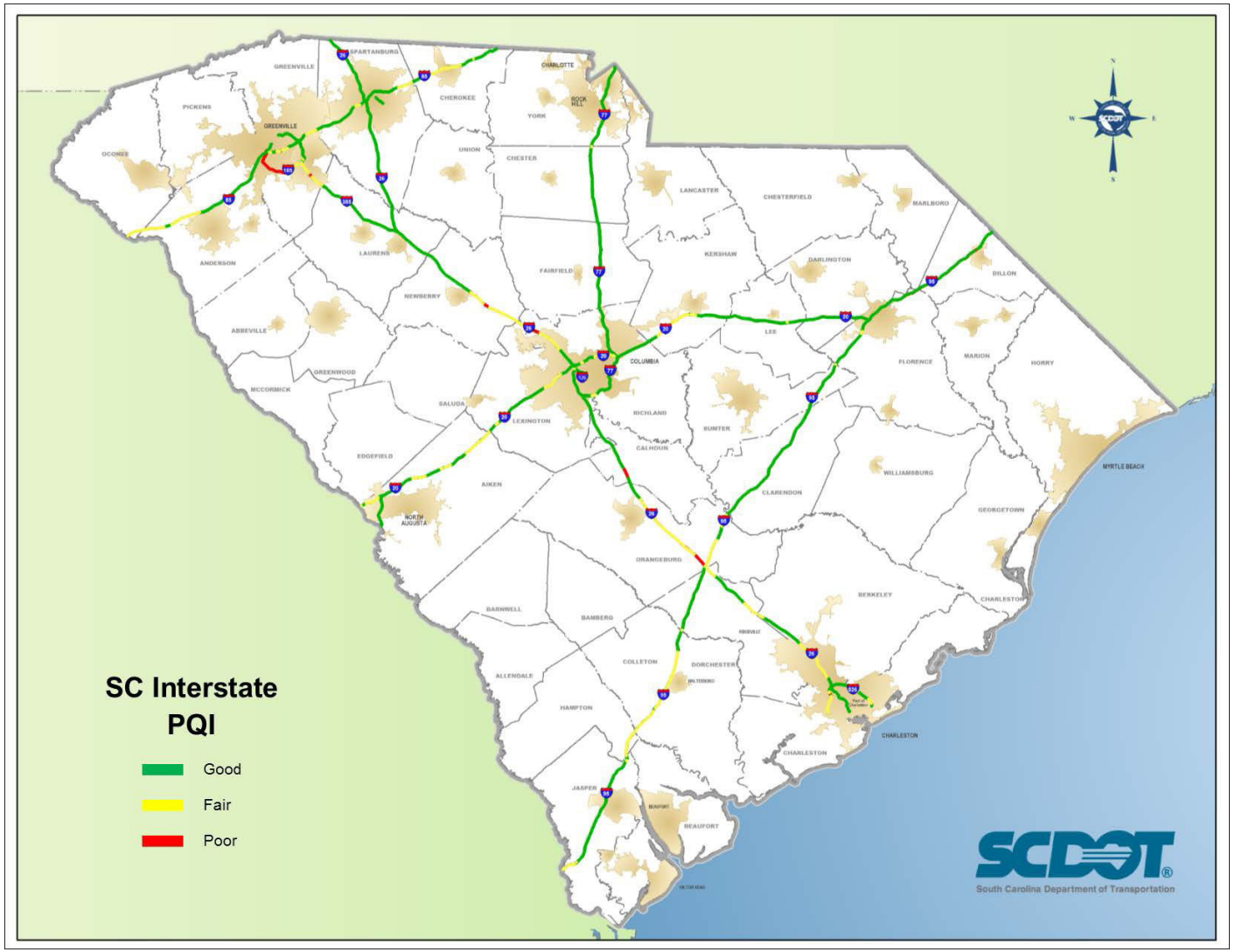


Figure 2-11. Historical Trend of Pavement Condition (PQI) for the Non-Interstate NHS (Primary)

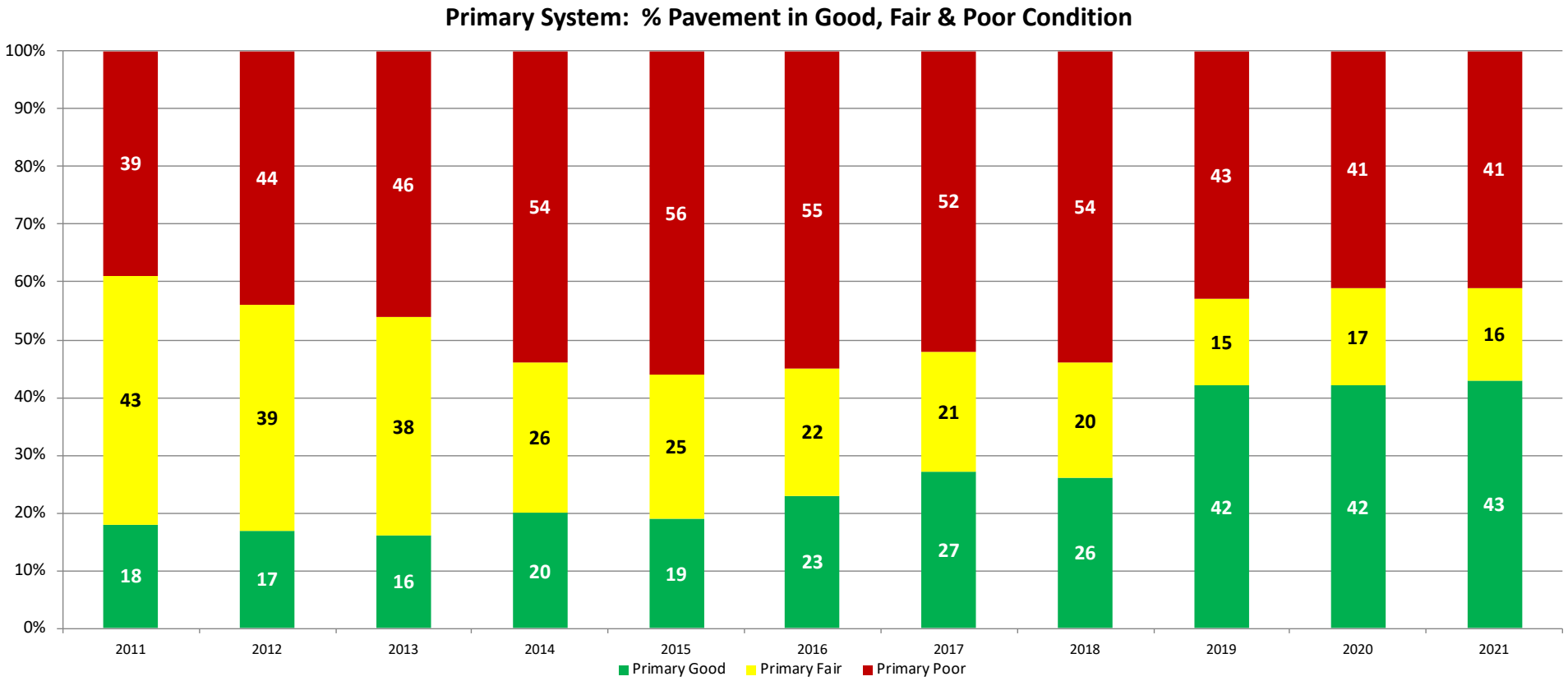


Figure 2-12. 2021 Statewide Map Non-Interstate NHS (Primary) Pavement System Condition

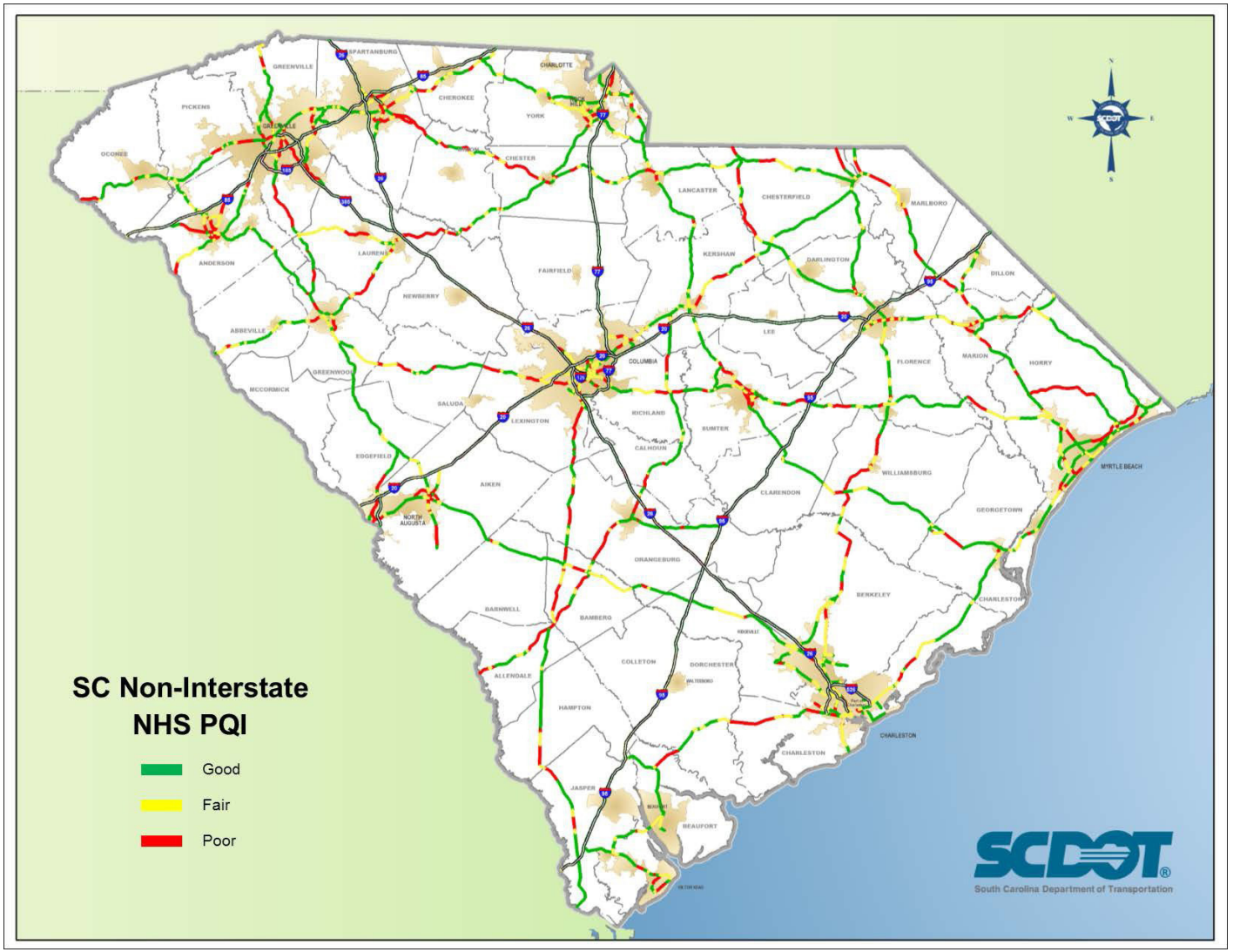


Figure 2-13. Historical Trend of Pavement Condition (PQI) for the Non- NHS Primary System

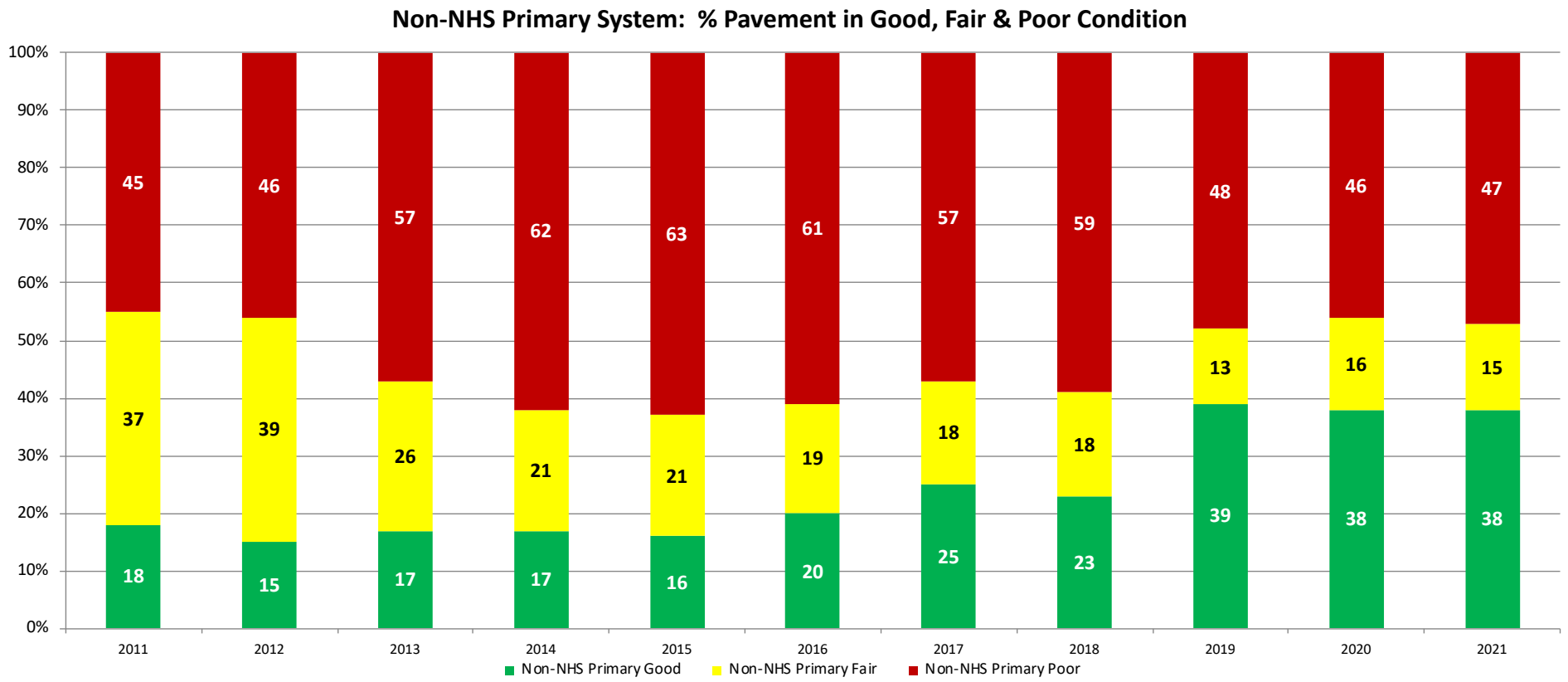


Figure 2-14. 2021 Non-NHS Primary Pavement System Condition Map

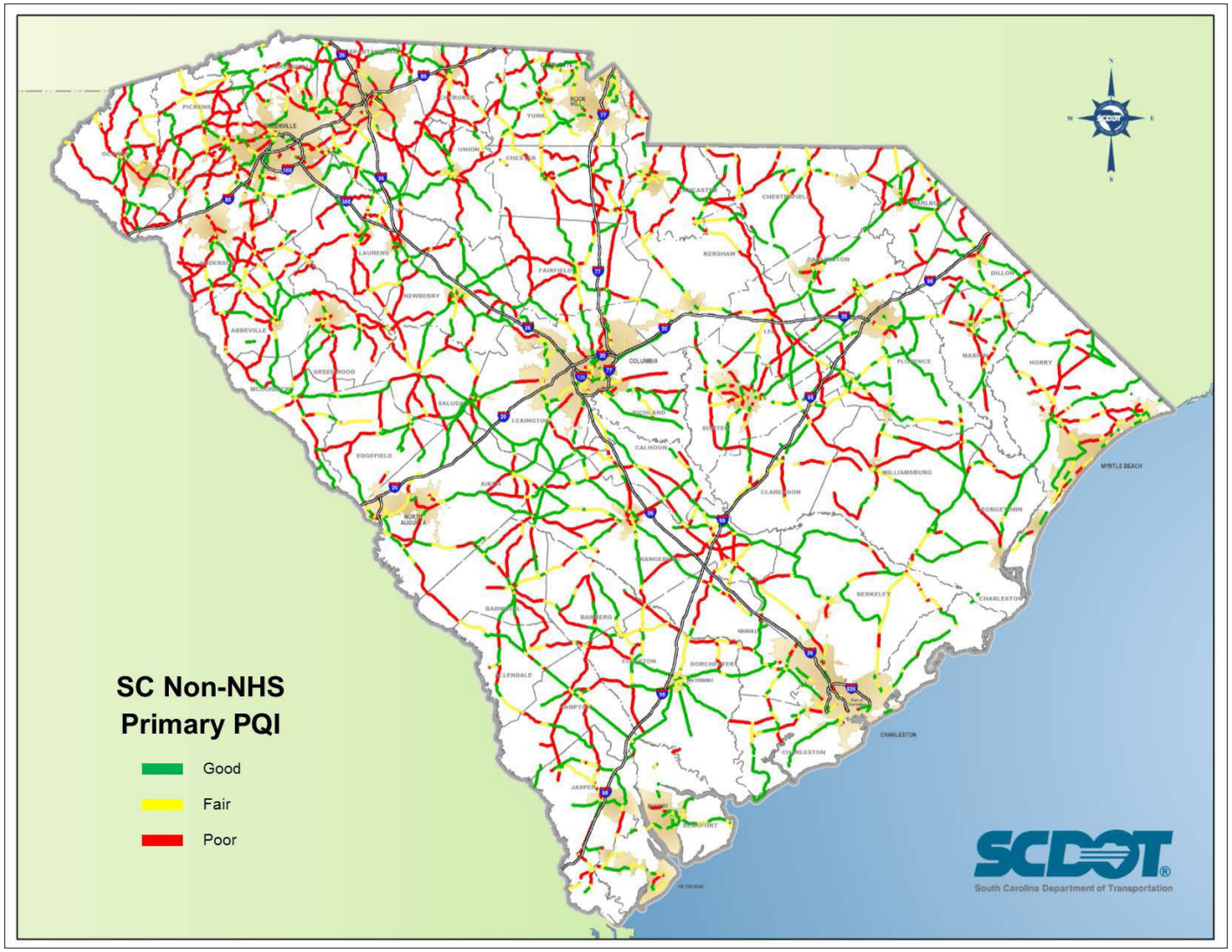


Figure 2-15. Historical Trend of Pavement Condition (PQI) for the Federal Aid Secondary System

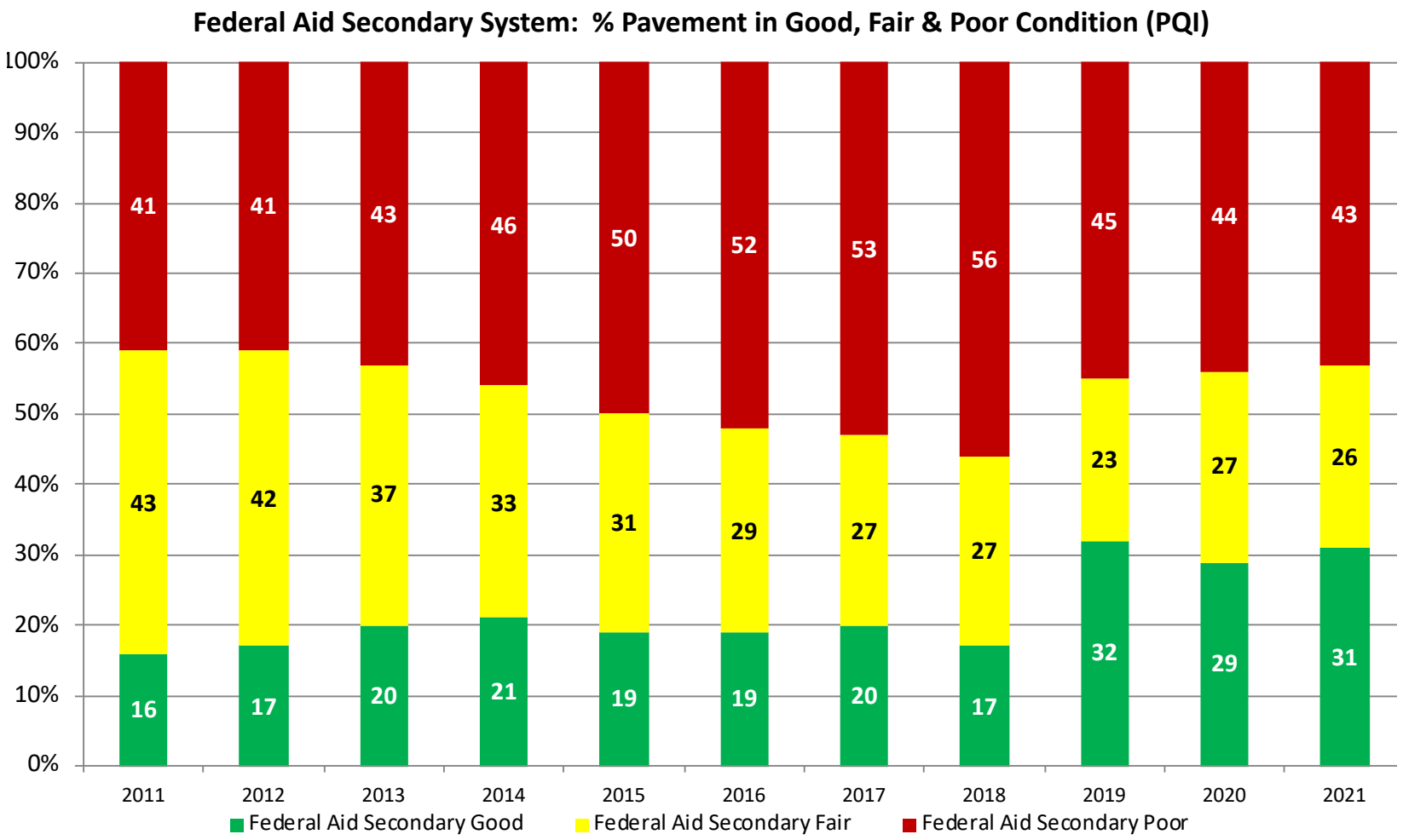


Figure 2-16. 2021 Federal Aid Secondary Pavement System Condition Map

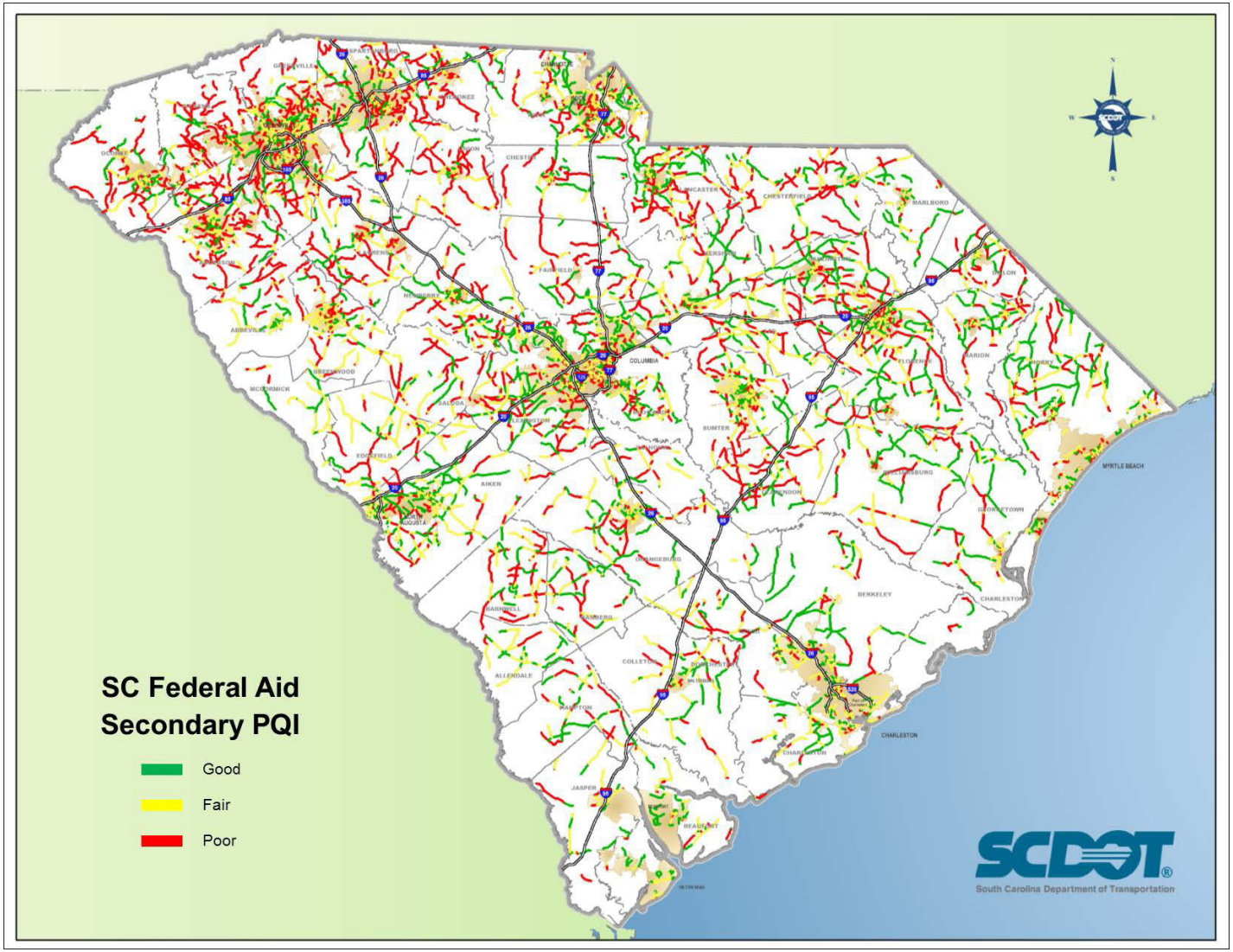


Figure 2-17. Historical Trend of Pavement Condition (PQI) for the Non-Federal Aid Secondary System

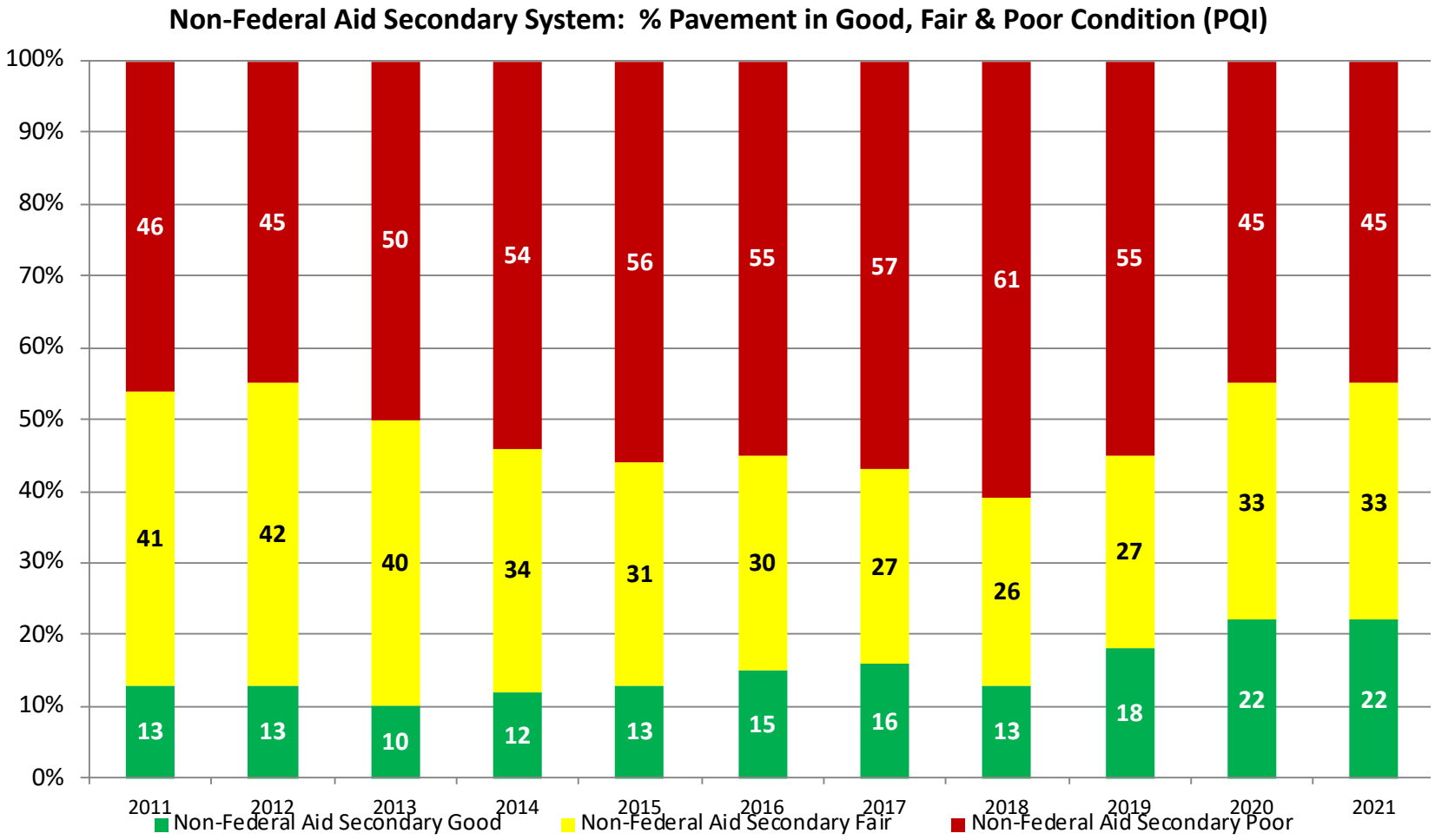
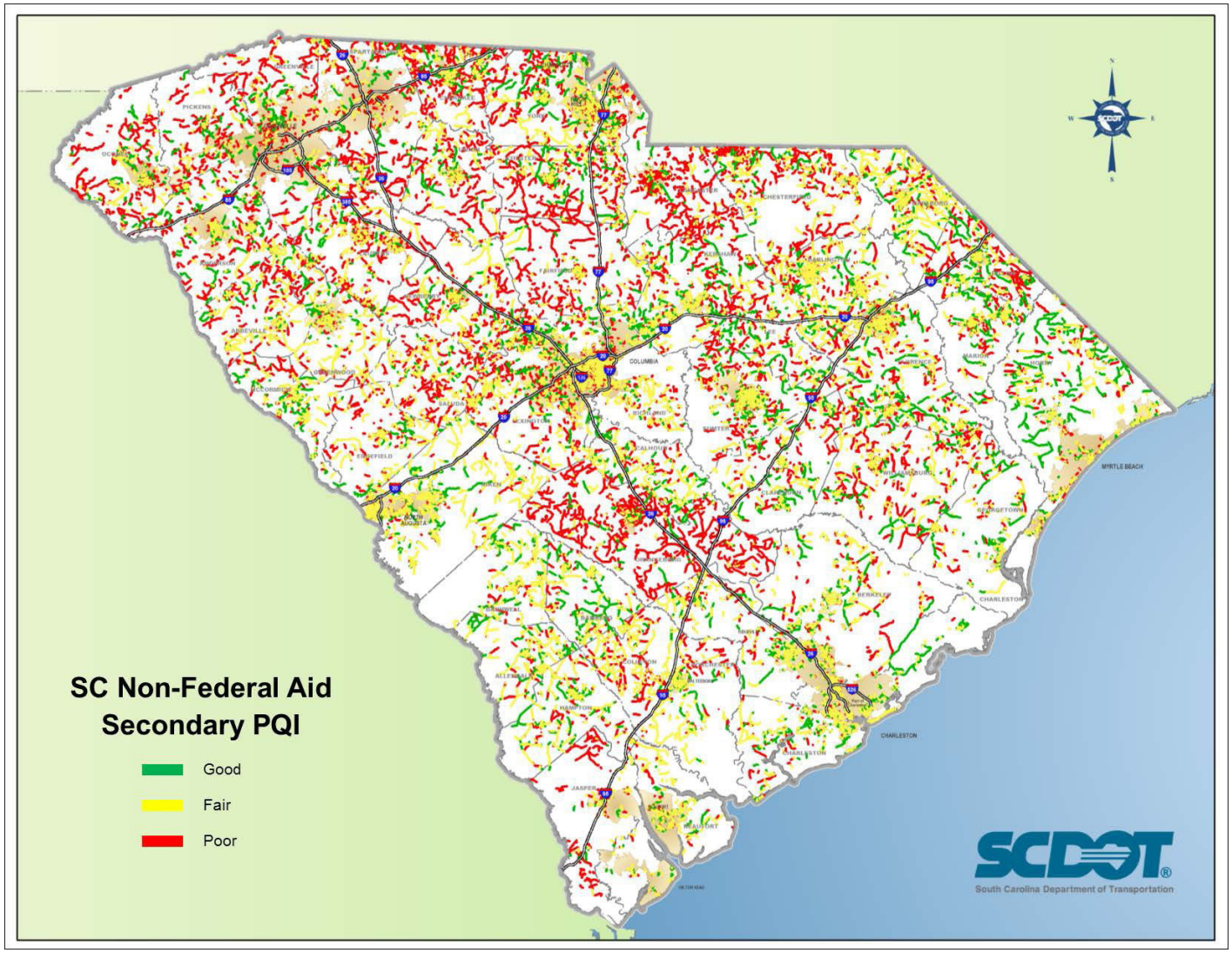


Figure 2-18. 2021 Non-Federal Aid Secondary Pavement System C



2.4 Bridges

As shown in Table 2-5, SCDOT owns, operates, and maintains 8,443 bridge structures with an average age of about 40 years. These structures include over 1,000 large culverts, that fall under the National Bridge Inspection Standards. SCDOT inspects all bridges, including locally-owned bridges, which are located on public roads. The inspection frequency is based on both the National Bridge Inspection Standards (NBIS) and SCDOT policy. Inspection data collected includes both the National Bridge Inventory (NBI) and the National Bridge Elements (NBE). SCDOT categorizes the State's highway system into three different tiers: NHS, Federal Aid Secondary, and Off-System. The Off-System category shown in Table 2-5 refers to bridges that are part of the state highway system but not federal aid eligible. Figures 2-19 and 2-20 shows the relationship of functional class in relationship to bridges by count and by deck area. Even though the NHS makes up 21% of the inventory, the deck area to maintain NHS bridges makes up 55% of the total.

Table 2-5. Bridge Inventory (Q4 2021)

Functional Class	Count	Bridge Deck Area (square feet)
NHS	1,771	40,688,354
Federal Aid	3,871	25,630,928
Off System (Non-Federal Aid)	2,801	7,812,859
Total	**8,443**	**74,132,141**

Figure 2-19. Percent of SC Maintained Bridges by Count

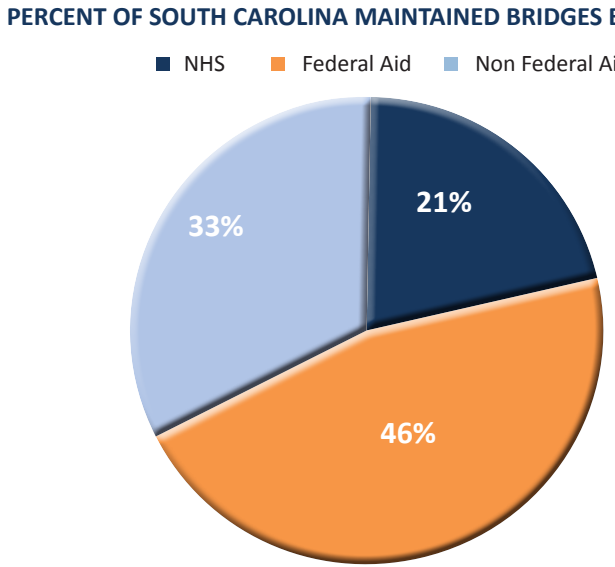
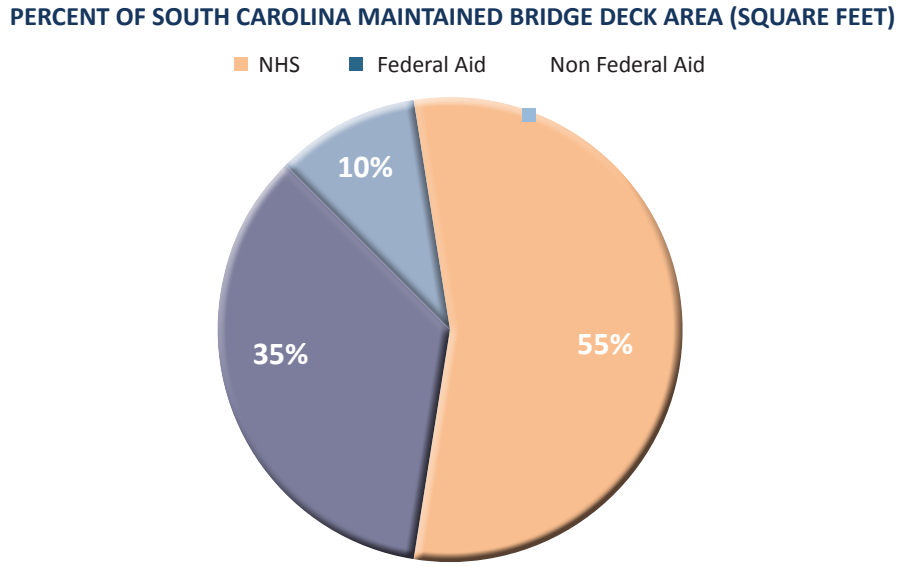


Figure 2-20. Percent of SC Maintained Bridges by Deck Area



2.4.1 Bridge Data

The National Bridge Inspection Standards (NBIS) were established as part of the Federal Aid Highway Act of 1970 and set standards for bridge inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and maintenance of bridge inventory. SCDOT performs bridge inspections in accordance with the NBIS and is stored in the National Bridge Inventory (NBI) database. The database is maintained by FHWA on all bridges and culverts longer than 20 feet on public roads in the United States. SCDOT's bridge inspection program started in the 1970's in the Bridge Maintenance Office. SCDOT conducts routine inspections at intervals no greater than 24 months. In South Carolina any bridge with at least one NBI Condition Rating of 4 or less shall have a routine inspection performed at intervals no greater than 12 months. All bridges with a load posting or weight restriction shall be evaluated for a reduction of the inspection duration. The bridge inspection data is housed in the Roadway Information Management System (RIMS) and the SCDOT Bridge Management System (BrM).

2.4.2 Bridge Performance Measures

FHWA published in the Federal Register (82 FR 5886) a final rule establishing performance measures for State Highway Agencies (SHA)s to use in managing bridge performance on the NHS. SCDOT is required to:

- Set targets for all bridges carrying the NHS, which includes on- and off-ramp connected to the NHS within a State, and bridges carrying the NHS that cross a State border, regardless of ownership.
- Establish statewide 2-year and 4-year targets for NHS bridges and report on the status of those targets on a biennial basis.
- Adjust targets at the Mid-Performance Period Progress Report (if necessary).
- Bridge performance measures are detailed in 23 CFR Part 490 Subpart D: Measures for Assessing Bridge Condition. The regulation also establishes minimum condition requirements for NHS bridges.Percentage of NHS bridges classified in Good Condition.
- Measure percentage of NHS bridges classified in Poor Condition.
- If more than 10% of total deck area of NHS bridges are classified as poor for three consecutive years then NHPP funds need to be obligated for eligible bridge projects on the NHS

Bridge condition ratings are used to classify the bridge in good, fair or poor condition. The lowest of the three ratings determines the overall rating of the bridge. Bridge major components including the deck (58), superstructure (59), substructure (60) and culvert (62) are used to determine the classification of the bridge. See Figure 2-21 for location of bridge deck, superstructure and substructure elements. When the lowest rating of any major bridge components is 7 or greater the bridge is classified in good condition; between 5 and 6, receives a classification of fair, and 4 or lower is a classification of poor. A bridge classified in poor condition is considered structurally deficient (23 CFR 490.411 provides the definition of structurally deficient: "beginning with calendar year 2018 and thereafter, a bridge will be classified as Structurally Deficient when one of its NBI items, 58-Deck, 59-Superstructure, 60-Substructure, or 62-Culverts, is 4 or less" Table 2-6 illustrates the NBI ratings for bridge conditions.

The condition values are weighted by the respective deck area of each bridge and express condition totals as a percentage of the total deck area of bridges in a State. Deck area is calculated based on length from NBI item 49 (structure length) and width from NBI item 52 (deck width) or item 32 (approach roadway width).

Figure 2-21. Bridge Elements for Rating

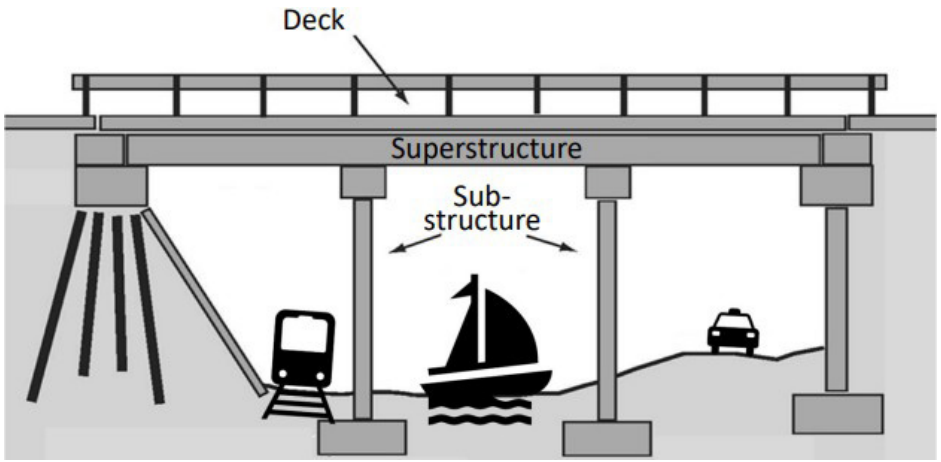


Table 2-6. NBI Rating Scale

NBI Rating Scale (from 0 – 9)	9 - 8 - 7 Good	6 - 5 Fair	4 - 3 - 2 - 1 - 0 Poor	
Deck (Item 58)	≥ 7	5 or 6	≤ 4	If:
Superstructure (Item 59)	≥ 7	5 or 6	≤ 4	Min ≥ 7 → Good
Substructure (Item 60)	≥ 7	5 or 6	≤ 4	Min ≤ 4 → Poor
Culvert (Item 62)	≥ 7	5 or 6	≤ 4	

2.4.3 Bridge Inventory and Conditions

SCDOT tracks and maintains bridge conditions using the Bridge Inspection Online (BIO) and Bridge Management (BrM) software. In addition, the SCDOT Highway Maintenance Management System (HMMS) complements the BrM in tracking maintenance activities on bridges. This facilitates the annual NBI reporting requirements and in the future will support the agency in making informed decisions relating to bridge maintenance and programming. The BIO is a software program specifically developed for the SCDOT. The tablet compatible program is used to update NBI data, take notes, upload photos and other documentation during inspections. It also routes the report to the appropriate staff for Quality Assurance/Quality Control Reviews; stores the historic inspection data; and can be used to aid in the scheduling of inspections. To ensure public safety, SCDOT has adopted a bridge inspection policy that sets standards for training, inspection frequencies, data collection, and reporting. The bridge program policy is used in conjunction with the national bridge inspection standards. SCDOT uses both in-house inspectors and consultants to perform routine bridge inspections and ensure bridge inspection deadlines are met. Additionally, SCDOT uses consultants to perform all underwater inspections.

In 2017, with the passage of the "Roads Bill" by the SC Legislature the agency's 10-Year Plan was initiated which identified 465 bridges across the state for replacement. The bridges were spread out over three systems (NHS/Interstate, Non-NHS Federal Aid, Non-Federal Aid/Off-System) and funded at $135 million per year. Since the start of the 10-Year Plan over 200 bridges have been advanced to construction. As the 10-Year Plan has progressed with completion of the Statewide Load Rating effort in 2021 and new funding, the Bridge Program has been revised. SCDOT has expanded the scope of the bridge program and has increased the number of bridges delivered from 465 to 500. Moving forward bridges will be evaluated for the possibility of repairs or rehabilitation being performed before full-scale replacement. The restructured bridge program will be a holistic approach combining bridge reactionary maintenance, preservation, inspection and compliance, repair and preventative maintenance and replacement. For expanded details about the bridge program see Chapter 4.5.

In Table 2-7 below is the current inventory and condition at the end of Quarter 4 for 2021. In the pages that follow, charts and figures for each of the three bridge systems that are maintained by SCDOT are presented. The agency remains well below the 10% threshold of bridges on the Interstate/NHS system in poor condition.

Table 2-7. Bridge Inventory and Asset Condition (Metric is Overall bridge deck area (sq. feet))

System Functional Tier	Bridge by Count	Bridge Deck Area (square feet)	Percent Good	Percent Fair	Percent Poor
NHS	**1,771**	**40,688,354**	**38.5%**	**57.1%**	**4.4%**
Non-NHS Federal Aid	**3,871**	**25,630,928**	**48.0%**	**46.2%**	**5.8%**
Off System	**2,801**	**7,812,859**	**47.4%**	**48.0%**	**4.6%**
TOTAL	**8,443**	**74,132,141**			

Figure 2-22. Historical Trend of Bridge Condition for the Interstate/NHS System

Figure 2-23. 2021 NHS/Interstate Bridge System Condition Map

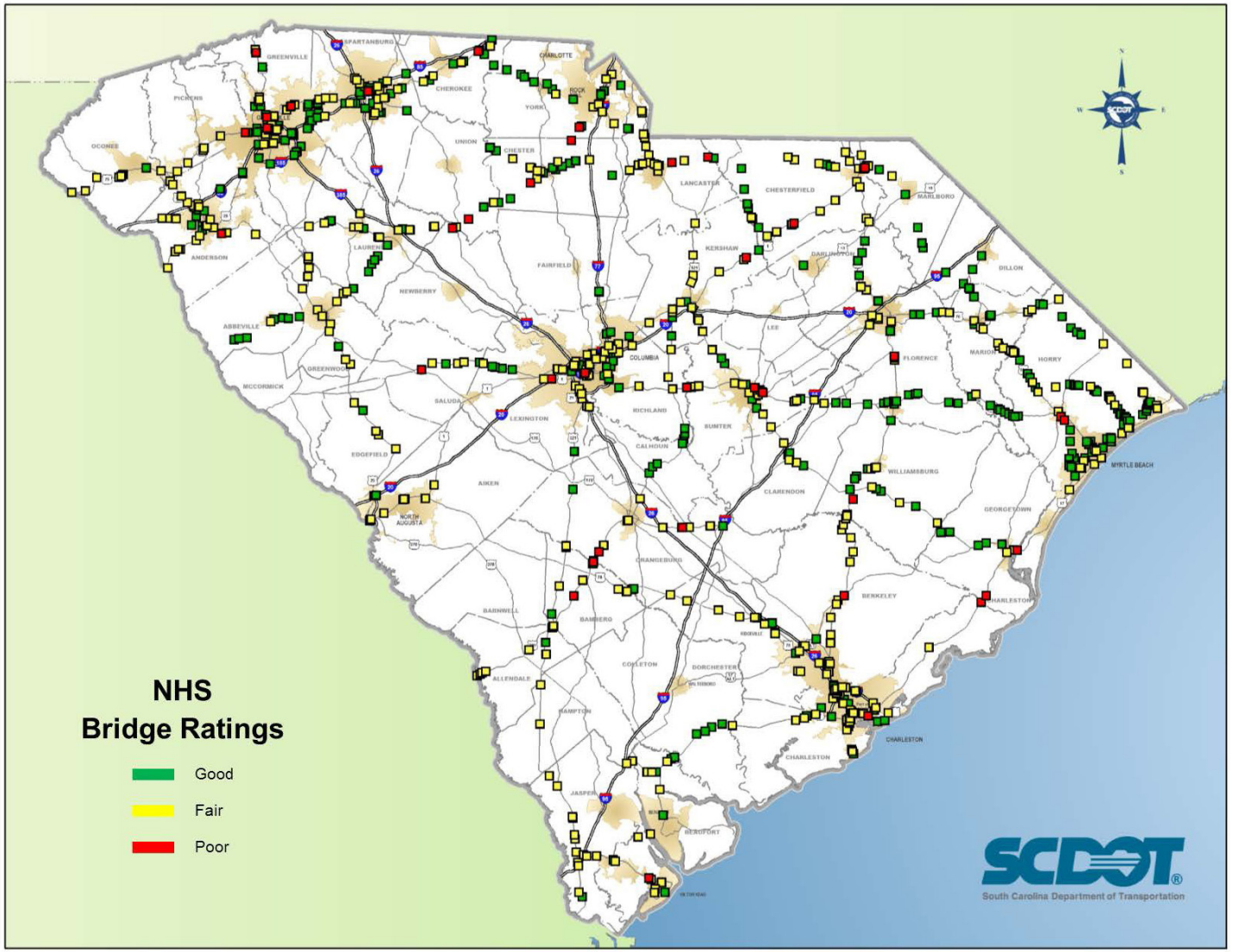


Figure 2-24. Historical Trend of Bridge Condition for the Federal Aid (Excluding NHS/Interstate) Bridge System

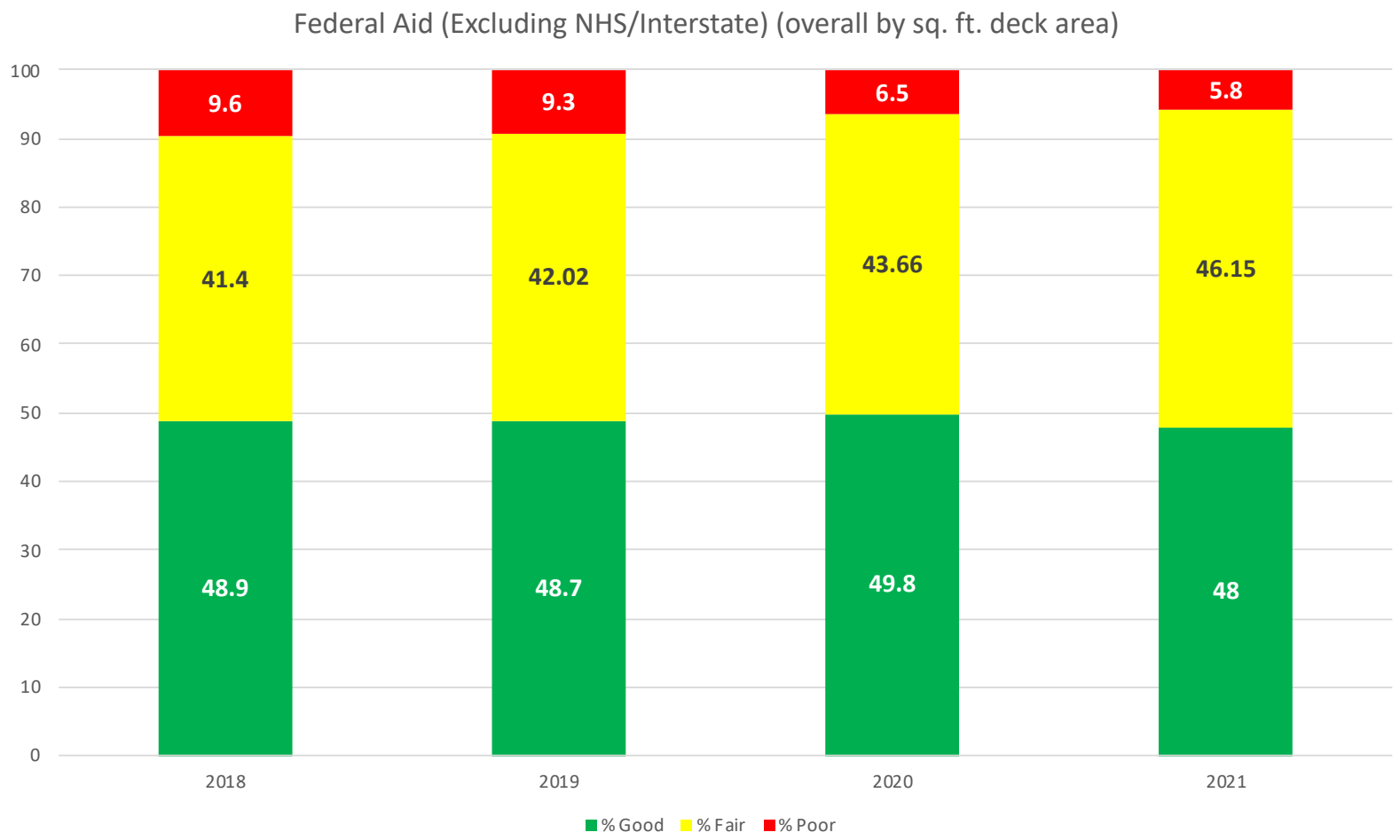


Figure 2-25. 2021 Federal Aid Eligible (Excluding Interstate/NHS) Bridge System Condition Map

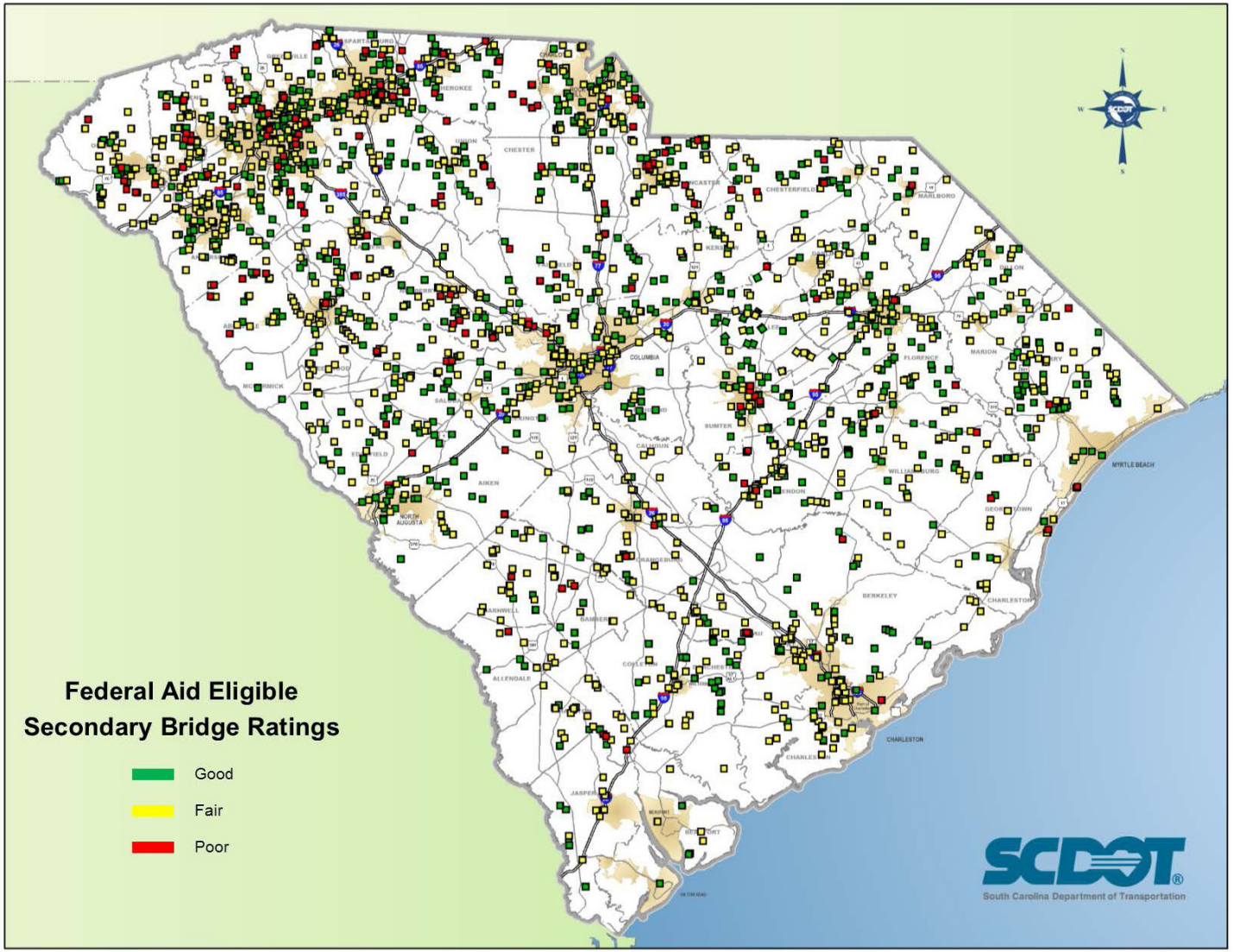


Figure 2-26. Historical Trend of Bridge Condition for the Non-Federal Aid (Off System) Bridge System

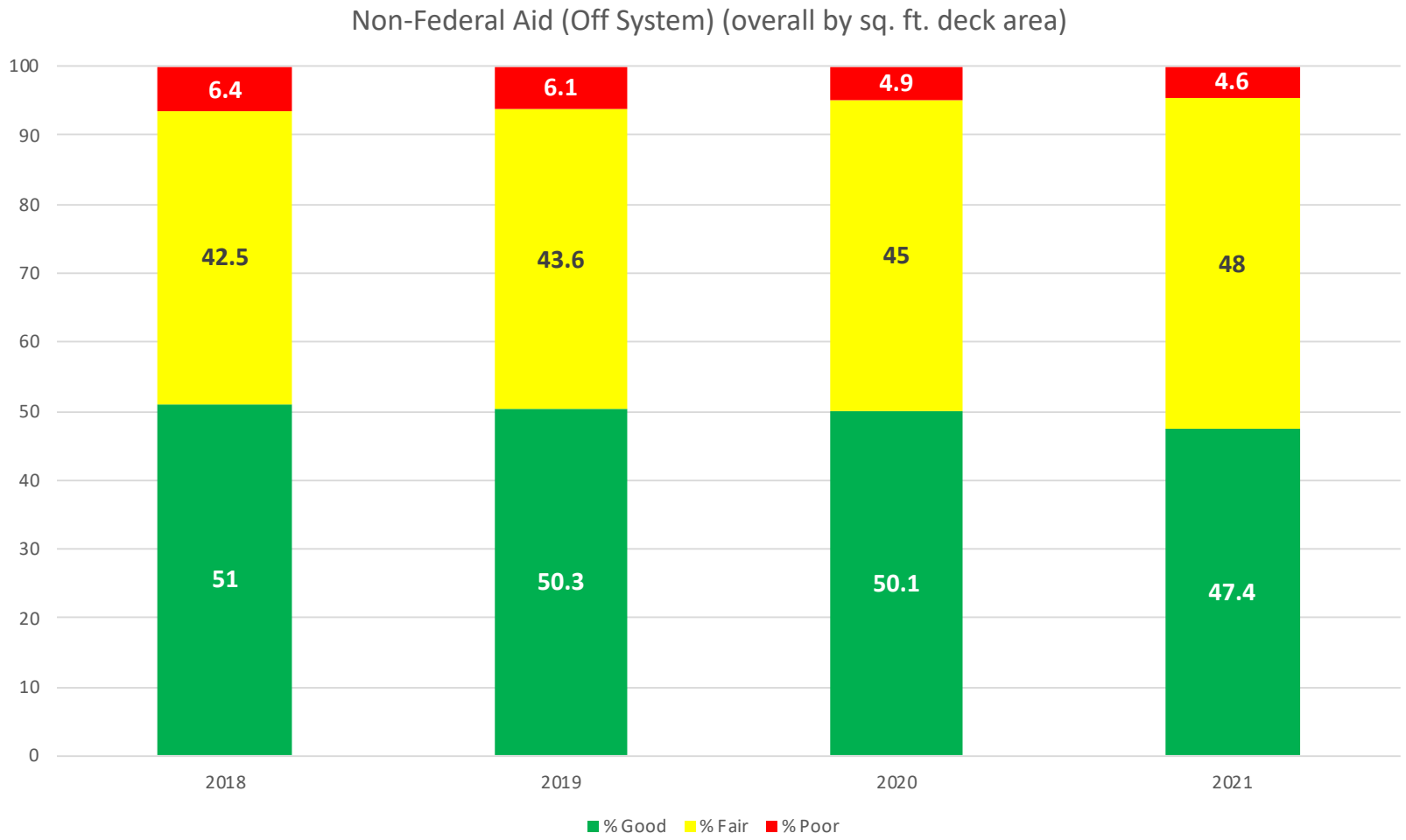
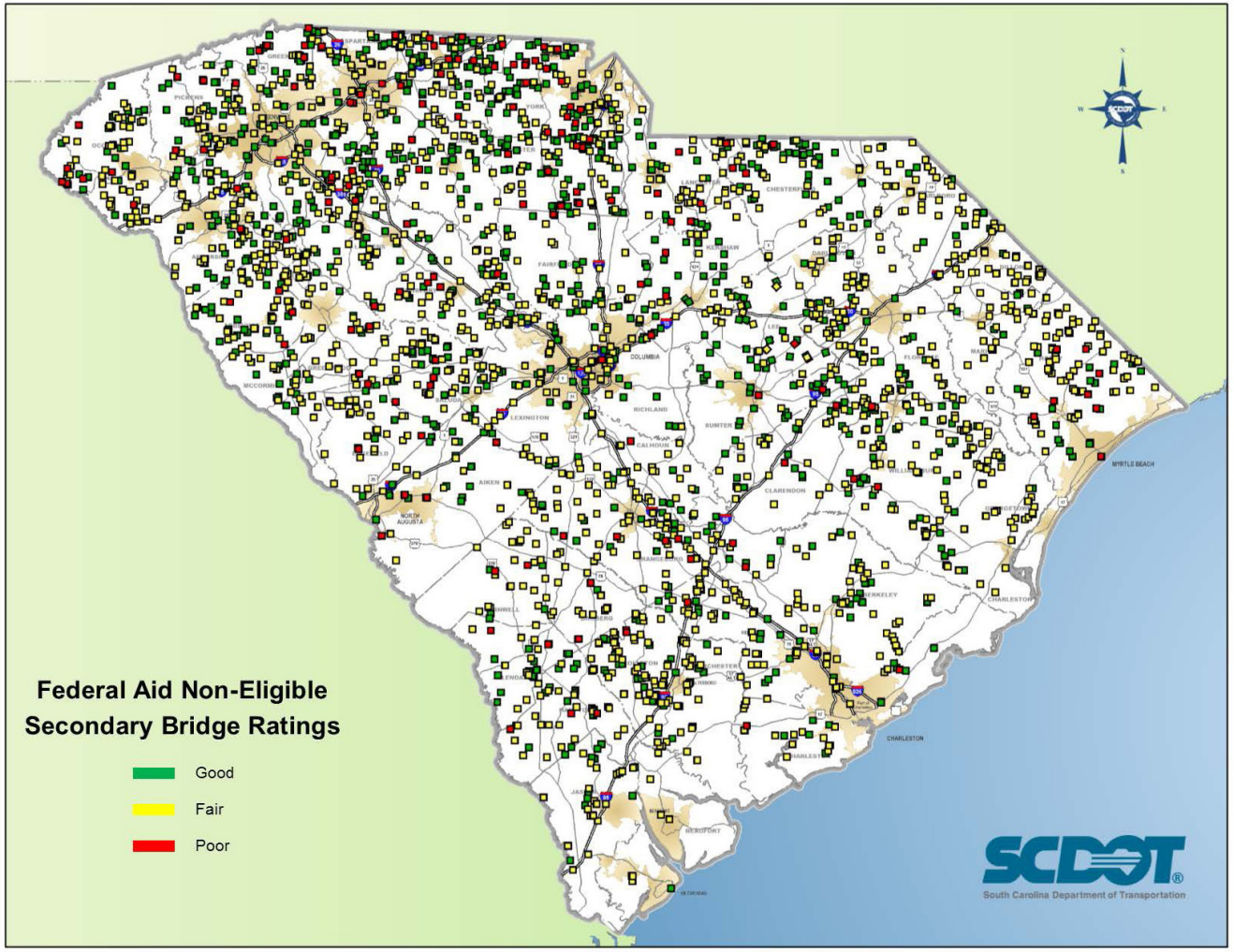


Figure 2-27. 2021 Non-Federal Aid Eligible (Off-System) Bridge System Condition Map



2.4.4 Load Restricted Bridges

SCDOT completed a three-year state-wide bridge load rating effort in 2021. The $75 million effort provided the agency with invaluable new data points and initiated the revision of the Bridge Program and 10-Year Plan. The results of the load rating exposed areas of critical need on the Primary system, that if left unaddressed could dramatically impact the ability to move people and goods around the state, thus negatively affecting commerce and economy.

Of the original 465 bridges that were included in the 10-Year Plan, 325 of those were posted for load with the large majority being on the Secondary system. With the completion of the load rating program the number of posted bridges on the Primary system increased dramatically from only 21 bridges to 132 bridges, See Figure 2-28. The list of Primaries was further reduced to 124 bridges. The results worked in conjunction with the inspection program and highlighted additional rehabilitation and replacement needs (old design standards versus new design standards). Bridges designed in the 1950's and 1960's were not designed to handle current truck loads.

The Primaries are our major roads in the state and carry over half of all traffic on a daily basis and serve as the main arteries, driving commerce. A load restriction on a primary route is a significant impact to mobility in the region. To meet the changing needs across the state, SCDOT became more flexible and dynamic by adjusting the bridge program list every two years, improving the static list that was previously updated only every ten years. For an expanded review of the Bridge Program See Chapter 4.5.

In December of 2021, SCDOT presented a new list of prioritized bridges that would blend the original 465 in the 10-Year Plan and addresses the most pressing needs revealed through the completion of the load rating effort. The newly prioritized bridge list includes 187 new priorities which were presented to Commission for approval in December of 2021. The new 187 priorities will be blended into the original 465 based on new prioritization with lower priority bridges being pushed out beyond the horizon of the 10-Year Plan. Figure 2-28 displays the number of load restricted bridges on the State Highway System with the results of the 2021 load rating program, the majority of which are on the Secondary system. There are no load restricted bridges on the Interstate system. Figure 2-29 displays the location of the load restricted and closed bridges on the Primary and Secondary systems.

Figure 2-28. Statewide Bridge Program Load Rating Effort

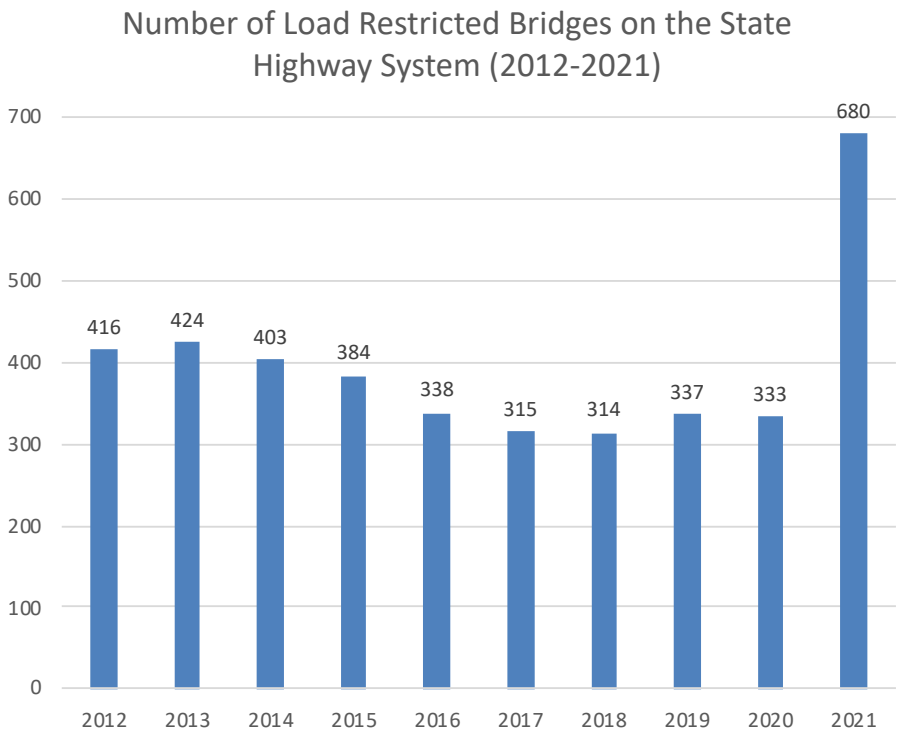
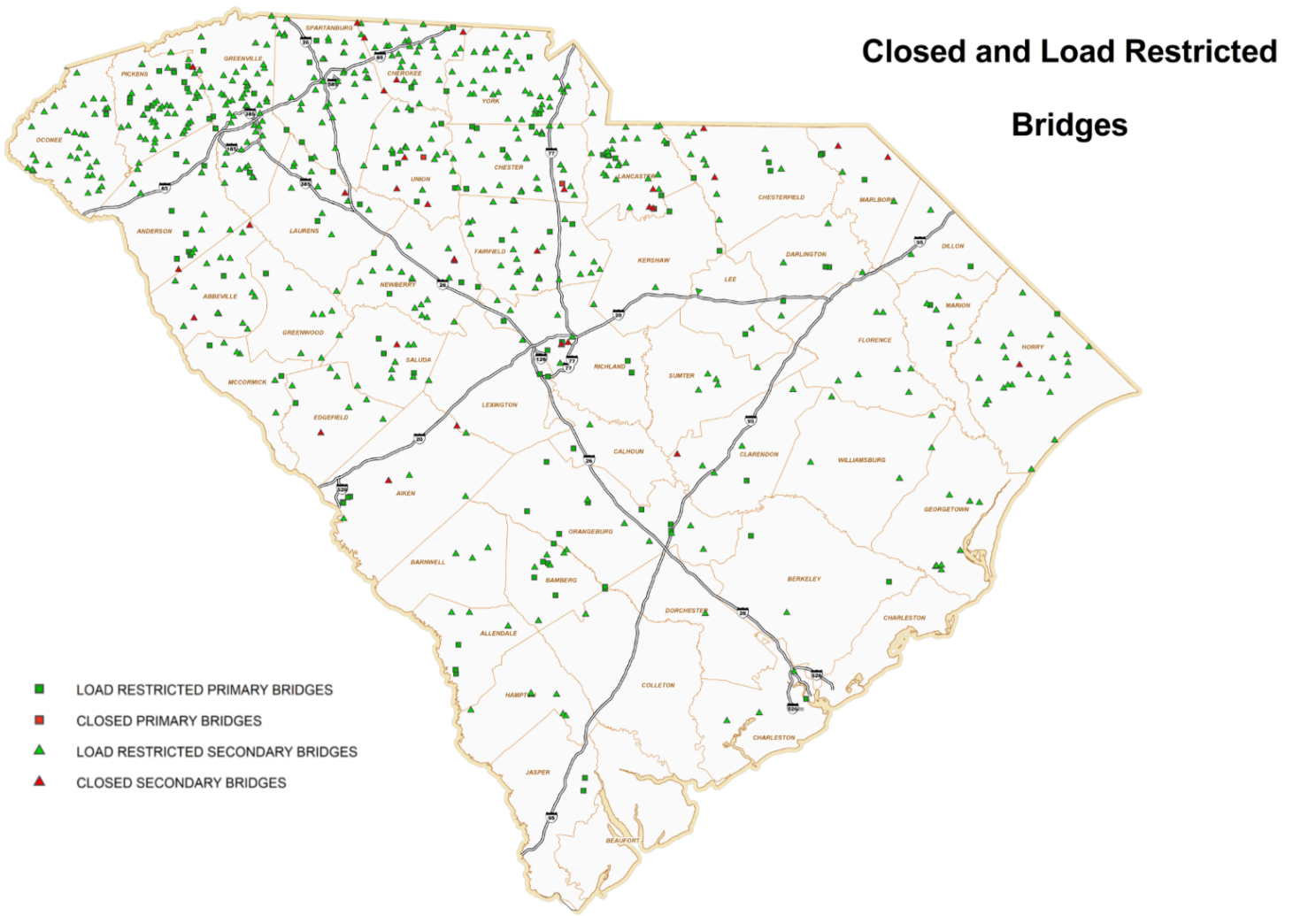


Figure 2-29. December 2021, Statewide Closed and Load Restricted Bridges



2.5 Asset Valuation

SCDOT uses a modified Governmental Accounting Standards Board (GASB) Statement No. 34 approach to value its pavement and bridge assets, with a straight-line method, assuming an asset life of 50 years for roads and 75 years for bridges. Currently, these values are reported in South Carolina's Combined Annual Financial Report (CAFR), but the level of detail is not by functional class. As of June 30, 2020, SCDOT's road and bridge networks were valued at $10.6 billion net of depreciation according to the CAFR. The agency is revising its process of estimating the asset value by functional class and will include valuation estimates in future revisions to its STAMP, which will also detail the annual investment needed to maintain the asset value over a ten-year period. The Department's investment in capital assets for its governmental activities as of June 30, 2020, amounts to $21.4 billion, less accumulated depreciation of $4.8 billion, leaving a net book value of $16.6 billion. This investment in capital assets includes land, buildings, improvements, equipment, infrastructure and construction in progress. Infrastructure assets are items that are stationary in nature and can be preserved for a significantly longer period than most capital assets. In the case of the Department, infrastructure assets are classified into three networks: road, bridges and right-of-ways. The Department has chosen to depreciate infrastructure assets (excluding right-of-ways). Table 2-7 below summarizes South Carolina's CAFR capital assets for fiscal year 2019-2020 with comparative figures for the prior year.

Table 2-7. SCDOT Capital Assets (In Millions) from CAFR 2019 - 2020

SCDOT Capital Assets	Year 2020	Year 2019
Land	$4.7	$4.7
Buildings and Improvements	$93.9	$91.7
Furniture, Vehicles and Equipment	$319.5	$303.9
Infrastructure – Right-of-Ways	$1768.1	$1702.3
Infrastructure – Road and Bridges	**$15,407.6**	**$15,219.5**
Construction in Progress	$3,794.0	$3,221.2
Total Cost	$21,387.8	$20,543.3
Less Accumulated Depreciation	$4,770.3	$4,540.5
Net Capital Assets	$16,617.5	$16,002.8

ASSET PERFORMANCE TARGETS

CHAPTER 3

3. Asset Performance Targets

3.1 Overview

Asset management integrates performance management into the decision making process, tracking progress towards agency goals through an outcome based measure that provides data to guide decisions regarding goals, targets and investment levels. Establishing performance measures and asset management principles to drive the allocation of funding was a transformational policy change within SCDOT that has brought clarity, accountability and transparency to the agency's operations.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) included provisions to make Federal surface transportation more streamlined, performance-based, multimodal, and to address challenges facing the U.S. transportation system. The FAST Act continued the transition, started by MAP-21 in which resources are invested in projects to achieve targets toward regional, state and national goals. The bill established seven (7) national goals described in (23 USC 150(b)), and shown to the right.

The national goals are broken into three different performance management areas, Performance Management 1 (PM-1), Performance Management 2 (PM-2) and Performance Management 3 (PM-3). The STAMP primarily focuses on PM-2 which is infrastructure condition of NHS pavements and bridges.

1. **Safety – Achieve a significant reduction in traffic fatalities and serious injuries on all public roads**
2. **Infrastructure Condition – Main the highway infrastructure asset system in a state of good repair**
3. **Congestion Reduction – Achieve a significant reduction in congestion on the National Highway System**
4. **System Reliability – Improve the efficiency of the surface transportation system**
5. **Freight Movement and Economic Vitality – Improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development**
6. **Environmental Sustainability – To enhance the performance of the transportation system while protecting and enhancing the natural environment**
7. **Reduced Project Delivery Delays – To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices**

3.2 Performance Measures and Targets

One of the fundamental underpinnings of Transportation Asset Management (TAM) is the use of performance measures to inform decision making to invest available resources. Performance measures track the impacts of program investments, maintenance and improvements, providing quantifiable evidence capturing engineering and operational attributes of the transportation system. SCDOT uses performance measures to make well-informed decisions to monitor progress towards objectives and goals of the 10-Year Plan. Performance measures are valuable and provide many useful benefits including (NCHRP Report 551):

- Greater accountability to policy-makers, the agency's customers, and other stakeholders
- Improved communication of information about the transportation system to customers, political leaders, the public, and other stakeholders
- Increased organizational efficiency in keeping agency staff focused on priorities and enabling managers to make decisions and adjustments in programs with greater confidence that their actions will have the desired effect
- Greater effectiveness in achieving meaningful objectives that have been identified through long-range planning and policy formulation
- A better understanding of the impacts of alternative courses of action that performance measures can provide
- Ongoing improvement of business processes and associated information through feedback

South Carolina evaluates and reports on the State's measures in addition to federal performance requirements. The presented targets reflect current inventory condition (Chapter 2) and desired state of good repair of the 10-Year Plan. Incrementally, 2-year and 4-year asset performance targets are set as benchmarks to evaluate progress towards 10-Year performance targets. These targets are found in Section 3.5. and are reported to FHWA on a biennial basis on even years in October. Maintaining a focus on performance measures provides SCDOT stakeholders and customers a better understanding of the investments and performance of the transportation system.

3.3 Transportation Performance Management (TPM)

Transportation Performance Management (TPM) federal regulations (23 CFR 490) defines national performance measures that address:

- PM-1: Highway Safety (23 CFR 490 Subpart A & B)
- PM-2: Infrastructure Condition (23 CFR 490 Subpart A, C & D)
- PM-3: Reliability, Freight, Congestion Mitigation and Air Quality (23 CFR 490 Subpart A, E, F, G & H) (Not included in the STAMP)

Targets for these performance measures are required to be developed for each state DOT and MPO in the United States and are then reported to FHWA and monitored for progress on a biennial basis. PM-2 targets are federally required to be included in the STAMP. South Carolina also reports PM-1 (Safety) in the STAMP. PM-3 measures such as reliability, congestion and freight bottlenecks are considered in the financial plan and investment strategy portion of the STAMP. In addition, since the 2018 STAMP was certified, SCDOT has since published the South Carolina Statewide Freight Plan Update for 2020. It includes strategies to reduce freight bottlenecks and improve emissions. The plan can be found at the following link: SCDOT Statewide Freight Plan. SCDOT is federally required to submit a variety of reports to monitor progress towards achieving TPM targets which include:

- Baseline, Mid-Performance, and Final Biennial Reporting (due every even year in October)
- System Performance Report (due every even year after October reporting has been filed)
- Consistency Determination (due every year on July 1)

3.4 PM-1 / Safety Performance Targets

Effective April 14, 2016, FHWA established the highway safety performance measures (PM-1) to carry out the Highway Safety Improvement Program (HSIP). Safety performance targets are developed in coordination with the South Carolina Department of Public Safety (SCDPS) and reported annually to FHWA in the state's Highway Safety Improvement Program (HSIP) Annual Report and to the National Highway Traffic Safety Administration (NHTSA) in the State's Highway Safety Plan (HSP) developed by SCDPS. Current statewide safety targets address calendar year 2022 and are based on an anticipated five-year rolling average (2016-2020). South Carolina statewide safety performance targets have been updated along with the 10-Year safety target and are included in Table 3-1. Each MPO and COG within the State of South Carolina is required to adopt the annual safety targets with their Long Range Transportation Plan (LRTP) within 180 days of the State setting their targets (August 31st – February 27th). The MPO or COG may adopt their own targets, but must coordinate their findings with SCDOT. The performance measures are:

- Number of fatalities
- Rate of fatalities per 100 million vehicle miles traveled
- Number of serious injuries
- Rate of serious injuries per 100 million vehicle miles traveled
- Number of combined non-motorized fatalities and non-motorized serious injuries

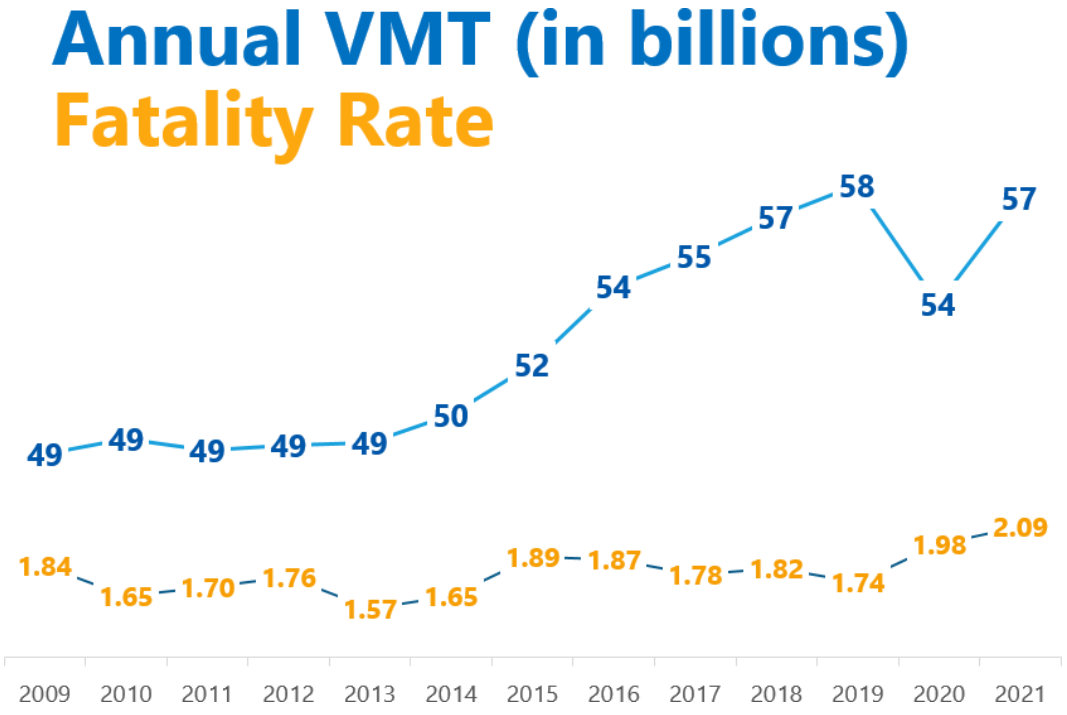
SCDOT recognizes the importance of linking goals, objectives and investment priorities to stated performance objectives, and that establishing this link is critical to achievement of national transportation goals and statewide performance targets. As stated earlier, SCDOT's approach to establishing performance measures and asset management principles is a transformational policy change within SCDOT that has brought clarity, accountability and transparency to the agency's operations. This should be extended to each MPO and COG, as they directly reflect these performance measures and targets within their planning processes and inclusion with the Transportation Improvement Program (TIP) and the Long Range Transportation Plans (LRTP).

South Carolina has the highest fatality rate in the nation. Recent fatality trends indicate approximately 1,100 people are dying on our roads annually. SCDOT's rural roads are some of the deadliest roads in the State with approximately 30 % of fatalities and serious injuries occurring on these roads, which represent only 5 % of the network. The SCDOT Traffic Safety Office is allocating $130 million annually with the goal of reducing fatalities and serious injuries on the State's roads. In Figure 3-1 the relationship between fatality rates and vehicle miles traveled (VMT) had been improving since 2015; however, in 2020 SCDOT saw the biggest spike in fatality rates versus annual vehicle miles traveled, since the agency has been tracking this data.

SCDOT is projecting increasing traffic fatalities in South Carolina through 2026 based on historical trend line analysis. Traffic fatalities reached a historic high in the state in 2021 with nearly 1,200 deaths. Given the recent rise in traffic deaths, the state reevaluated its 10-Year target of 886 deaths (based on a five-year average). If the upward trend were to continue, statistical models indicate traffic deaths could be as high as 1,400 in the five-year period ending in 2026. Analysts can estimate the programmatic impacts of Safety projects and make reductions from the forecasted figures. Revised calculations indicate a new target of 1,139 deaths for the five-year period ending in 2026.

Contradictorily, serious injuries in SC have declined over the last 15 years, with one exception. In 2019, serious injuries increased 23% compared to the previous year. The state has attributed this outlying data point to a change in the serious injury definition that occurred that year. The number of serious injuries declined significantly in 2020, before stabilizing the following year. Consequently, the revised target for serious injuries is only slightly higher than the original 10-Year target. Table 3-1. displays the 2016 baseline condition, the 2016-2020 actual figures, the original 10-Year target, and the revised 10-Year target. Note also the increase in annual funding allocations as a result of the passage of the federal infrastructure.

Figure 3-1. South Carolina Annual VMT and Fatality Rate



As noted, the agency is also prioritizing improving safety in its investment strategies. Table 3-1 highlights SCDOT's original 10-Year safety targets compared to the recently revised targets. The revised targets take into account the steady uptick in the number of traffic deaths in the state since the original 10-Year targets were set in 2017. These targets were developed to mirror FHWA's five safety performance measures: number and rate of traffic deaths, number and rate of serious injuries, and number of non-motorized user fatalities and serious injuries combined.

Compared to the most recent five-year period (2016-2020), SCDOT is forecasting an 11% increase in the number of traffic deaths, a 3% increase in the fatality rate and a 5% decrease in the number of serious injuries, totaling a 12% decrease in the rate of serious injuries on its road and bridge systems by 2026. SCDOT developed its 10-Year safety targets based on projected improvements from tailored safety initiatives, including its rural road safety program, and safety initiatives operated by the South Carolina Department of Public Safety.

In October 2021, the Safety Office increased the annual funding allocation for safety investments from $99 million to $130 million. Additionally, SCDOT increased the allocation for safety projects related to non-motorized users from $5 million to $10 million. South Carolina completed its first Pedestrian and Bicycle Safety Action Plan (PBSAP) in early 2022. The Safety Office will conduct Road Safety Audits (RSA) at locations identified in the PBSAP. The results of the individual RSAs will be reviewed and evaluated for implementation.

Table 3-1. SCDOT's 10-Year Safety Performance Targets Based on a five year rolling average.

Safety	2016 Baseline Condition	2020 Actuals	Original 10-Year Target	Original Funding Allocation (in millions)	Revised 10-Year Target	Revised Funding Allocation (in millions)
Fatalities	890	1,023	886	$99	1,139	$130
Fatality Rate	1.75	1.84	1.34		1.90	
Number of Serious Injuries	3,194	2,876	2,573		2,731	
Serious Injury Rate	6.30	5.16	3.89		4.56	
Vulnerable Roadway User Fatalities & Serious Injuries	376	441	351		469	

3.5 PM-2 / Infrastructure - Pavement and Bridge Performance Targets

Effective May 20, 2017, FHWA established performance measures to assess pavement condition (23 CFR Part 490, Subpart C) and bridge condition (23 CFR Part 490, Subpart D). This second FHWA performance measure rule (PM-2) established six performance measures for infrastructure condition. MAP-21 requires SCDOT to develop a STAMP for all NHS pavements and bridges within the state.

Pavement and bridge condition is assessed and reported over a four-year performance period:

1. The first performance period began on January 1, 2018, and runs through December 31, 2021. SCDOT reported baseline PM-2 performance and targets to FHWA on October 1, 2018, mid-point on October 1, 2020 and updated performance at the end of the performance period in October 2022.
2. The second four-year performance period will cover January 1, 2022, to December 31, 2025, with additional performance periods following every four years.

The PM-2 rule requires states and MPOs to establish two-year and four-year performance targets for each PM-2 measure. Current two-year targets represent expected pavement and bridge condition at the end of calendar year 2023, while the current four-year targets represent expected condition at the end of calendar year 2025. Tables 3-2 and 3-3 display both the federally required PM-2 Performance Measures and Targets, as well as the state specific measures and targets established by SCDOT for South Carolina. PM-2 targets are set on October 1, for two-year/four-year targets. The State's 11 MPOs and 10 COGs have 180 days to adopt state targets or coordinate with the state to adopt their own targets. (Ex. August 1, 2022 to February 27, 2023).

3.5.1 Pavement Condition Measures and Targets

The pavement condition measures represent the percentage of lane-miles on the Interstate or non-Interstate NHS that are in good condition or poor condition. FHWA established five metrics to assess pavement condition: International Roughness Index (IRI); Cracking Percent; Rutting; Faulting; and Present Serviceability Rating (PSR). For each metric, a threshold is used to establish good or poor condition. SCDOT also established pavement condition measures representing the lane-miles on the Non-NHS Primary, Federal Aid Eligible Secondaries, Non-Federal Aid Eligible Secondaries. The pavement condition measures are expressed as a percentage of all applicable roads in good or poor condition. Pavement in good condition suggests that no major investment is needed, except for preservation treatments in order to keep the good pavements good. Pavement in poor condition suggests major reconstruction investment is needed due to either ride quality or a structural deficiency.

The target setting process included internal staff meetings from Planning, Road Data Services, and Maintenance. SCDOT analysts used collected data for the International Roughness Index, Cracking Percent, Rutting, and Faulting based on whether the pavement was asphalt, continuously Reinforced Concrete Pavement (CRCP), or Jointed Concrete Pavement (JPCP). Using historical data, staff developed deterioration models for the different pavements by segment. Over the 4-year period, staff also examined whether there were any planned improvements made to the pavements that would be inspected and reported to HPMS based on SCDOT's investment strategies. The aggregated data was presented to a workgroup of internal experts. Based on the methodology, the workgroup chose a median deterioration model that resulted in a projected good and poor value, taking into account improvements made on the Interstate and non-interstate NHS, as described in Table 3-2 on the next page. See Appendix G for methodology. The table illustrates that it is anticipated that both the two-year and four-year targets for Interstate Pavements will remain below the maximum 5% poor rating.

Table 3-2. 2-year and 4-year Targets for Pavement System, Federally Required (Federal Metric)

Performance Measure	South Carolina Performance Baseline (2021)	South Carolina 2-year Target (2022-2023)	South Carolina 4-year Target (2022-2025)
Percent of pavements of the Interstate System in Good Condition	75.8%	77.0%	78.0%
Percent of pavements of the Interstate System in Poor Condition	0.2%	2.5%	2.5%
Percent of pavement of the Non-Interstate NHS System in Good Condition	38.8%	36.0%	38.0%
Percent of pavement of the Non-Interstate NHS in Poor Condition	1.6%	10.0%	10.0%

3.5.2 Bridge Condition Measures and Targets

The bridge condition measures represent the percentage of bridges, by deck area, on the NHS that are in good condition or poor condition. The condition of each bridge is evaluated by assessing four bridge components: deck, superstructure, substructure, and culverts. FHWA created a metric rating threshold for each component to establish good or poor condition. Every bridge on the NHS is evaluated using these component ratings. Deck area is computed using structure length and either deck width or approach roadway width. While good condition bridges may not require major investment, bridge presentation techniques and actions may be appropriate to maintain condition levels. Bridges in poor condition are safe to drive on; however, they are nearing a point where substantial reconstruction or replacement is needed. SCDOT also established bridge condition measures representing the number of structurally deficient bridges on the NHS and the number of load-restricted bridges in South Carolina.

The National Bridge Inspection Standards (NBIS) apply to all publicly owned highway bridges longer than twenty feet located on public roads. NBIS are federal regulations (23CFR 650) establishing requirements for bridge inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and maintenance of bridge inventory. Information from these inspections is stored in the National Bridge Inventory (NBI) database, created in 1972.

The NBI database contains condition information on four aggregate structural units (deck, superstructure, substructure, and culvert) by assigning a condition rating to each of these components of a bridge on a scale from 9 (perfect) to 1 (severe deterioration/failure). SCDOT Staff analyzed historic NBI submittal data from 1992 through 2021 and developed a Trendline analysis with modeling scenarios to forecast the bridges that would move from Good to Fair or Fair to Poor during the 2 and 4-year target window. Staff then collected data from our construction and maintenance offices to determine the number of bridges, and corresponding deck area that were to be improved in the same window of time. See Appendix F for methodology. Table 3-3 clearly illustrates that both the 2021 baseline, 2 and 4 year targets are projected to fall below the maximum 10% of deck area that can be rated in poor condition for bridges on the NHS.

Table 3-3. 2-year and 4-year Targets for Bridge System, Federally Required

Performance Measure	South Carolina Performance Baseline (2021)	South Carolina 2-year Target (2022-2023)	South Carolina 4-year Target (2022-2025)
Percent of NHS bridges classified as in Good Condition	38.5%	35.0%	34.0%
Percent of NHS bridges classified as in Poor Condition	4.3%	6.0%	6.0%

WHOLE LIFE MANAGEMENT

CHAPTER 4

4. Whole Life Management

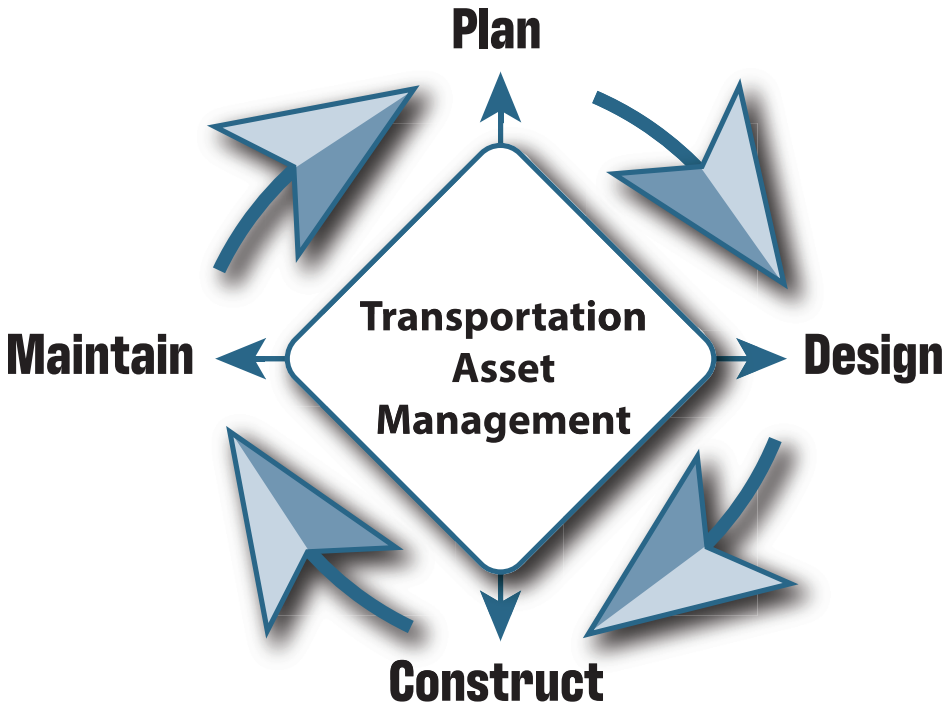
4.1 Overview

This chapter reviews the practice of Whole Life Management (WLM) of assets at SCDOT. WLM embodies quality management of physical infrastructure. It is a practice that utilizes the principles of engineering economics to evaluate the overall long-term economic efficiencies between competing alternative investments. The practice allows for cost comparison of alternatives across an extended time horizon needed to achieve defined levels of performance. WLM is analogous with the concept of Life-Cycle Planning (LCP), as it considers costs associated directly with constructing and operating an asset, as well as other costs over the full service life of the asset, such as preservation, repair, and preventative maintenance costs.

As shown in Figure 4-1, the transportation asset management lifecycle spans four distinct stages: plan, design, construct, and maintain. In each phase of the lifecycle, a variety of treatments, analysis methodologies, data, and assumptions impact the specific asset. As a result, WLM practices will differ across these phases.

WLM promotes the proactive management of physical infrastructure assets across their lifespans. Incorporating WLM principles can replace the ”worst-first” approach of transportation infrastructure decision making in favor of a realistic, informed, long-term series of actions that extend the life of the asset, and improve the resilience of the asset to threats. Taking a worst-first approach results in an ever- increasing number of pavements in poor condition because focusing on resource-intensive reconstruction projects diverts resources from more cost-effective preservation treatments that maintain pavements in a good condition. Worst-first is a never-ending cycle and creates a heavy financial burden that most state transportation agencies cannot bear.

Figure 4-1. The Asset Life Cycle



Life-Cycle Cost Basics

Figure 4-2 shows a graphical representation of the WLM of a physical infrastructure asset from Acquisition, when an asset is conceived, scoped, designed, and constructed, to Replacement/Disposal, when an asset is replaced or retired, decommissioned, or demolished. The time period between deployment and replacement/disposal can be envisioned as the actual service life of an asset. Information gathered throughout these phases provides relevant insight to the timing and selection of appropriate interventions. It should be noted that while this figure accurately depicts the life cycle of assets, it is SCDOT's goal to strategically prolong its other assets' lives by optimizing a combination of preservation and rehabilitation activities to achieve the best asset conditions possible.

The relationship between age and intervention type in achieving a targeted or desired operation condition is vital to WLM. Each time SCDOT undertakes a particular intervention method, such as maintenance, preservation, or rehabilitation, during the operation phase the remaining service life (RSL) of the asset is improved or the asset is delayed from moving into the disposal stage. Furthermore, Figure 4-3 (adopted from Galehouse et al. 2003) shows that each time a timely intervention is applied, the RSL of the asset is extended. On the other hand, if an asset is allowed to deteriorate past specific trigger points, by delaying maintenance or intervention for example, the results in cost can increase significantly.

Figure 4-2. Representation of Whole Life Asset Management Approach

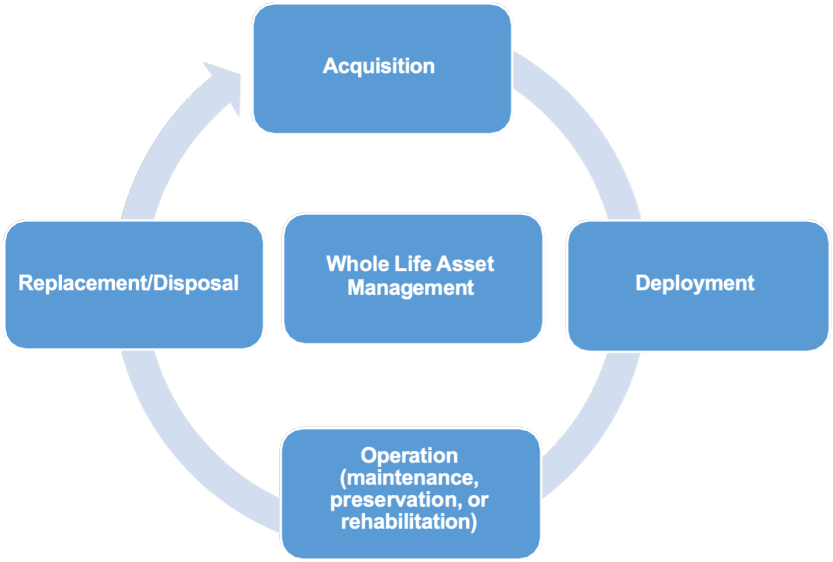
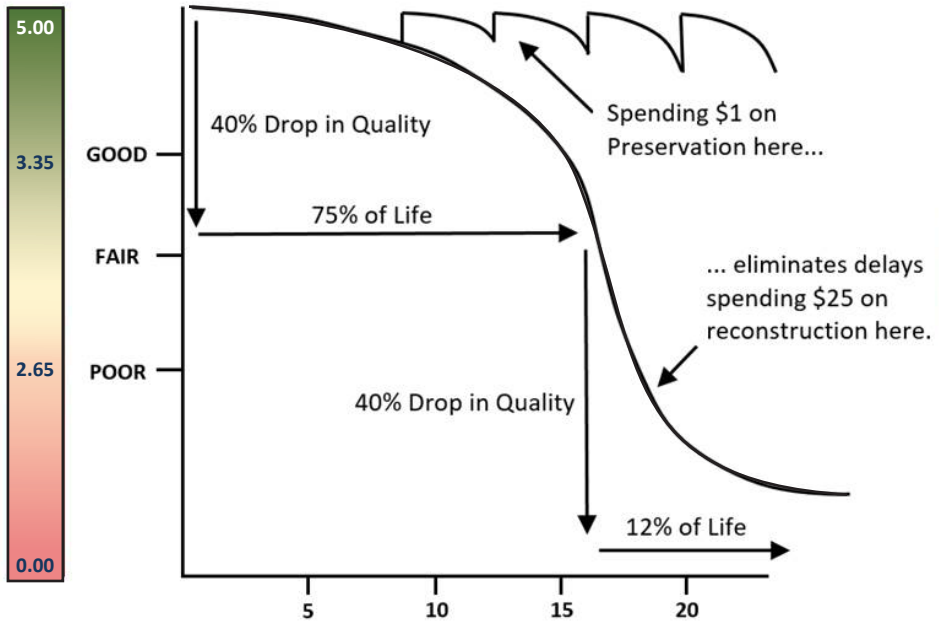


Figure 4-3. Example Deterioration Curve of a Pavement Asset



CONDITION CATEGORY	PAVEMENT QUALITY INDEX (PQI)
GOOD	5.0 - 3.4
FAIR	3.3 - 2.7
POOR	2.6 - 0.0

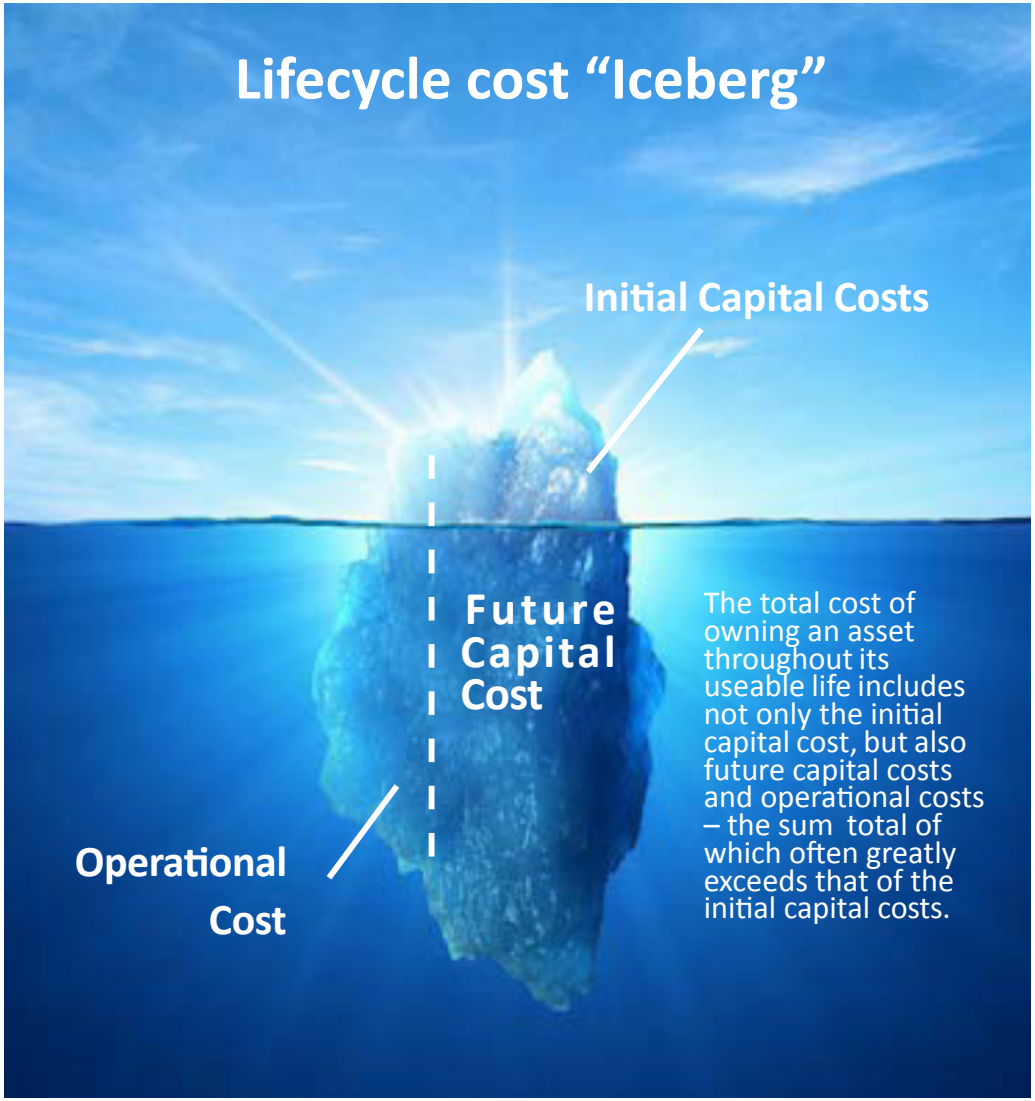
FHWA report FHWA-SA-98-079, Lifecycle Cost (LCC) Analysis in Pavement Design, defines LCCA as:

"[A]n analysis technique that builds on the well-founded principles of economic analysis to evaluate the over-all-long-term economic efficiency between competing alternative investment options." The report further states that "[LCCA] does not address equity issues. It incorporates initial and discounted future agency, user, and other relevant costs over the life of alternative investments. It attempts to identify the best value (the lowest long-term cost that satisfies the performance objective being sought) for investment expenditures."

To estimate LCC, an agency has to account for how the value of money changes over time, including:

- Discounting: A dollar today is worth more than a dollar next year because it can be invested and earn interest;
- Inflation: The costs of materials tend to increase over time; and
- Depreciation: The value of an asset tends to decline over time.

Figure 4-4. The Iceberg Concept in Lifecycle Cost



Estimating LCC requires the tracking of all asset operational costs (maintenance, preservation, and rehabilitation); the change in asset condition over time based on geography, climate, and climate change, extreme weather impacts, resilience of interacting infrastructure (culverts, landsides, etc.), substructure, and vehicle loading; and the impact of operational costs on condition. LCC resembles an iceberg; the vast majority of cost is in the future, or "below the surface", as shown in Figure 4-4.

Multiple data sources are used to compare alternatives by expressing each alternative using a common metric that rolls the entire LCC into a single number such as Net Present Value or Benefit-Cost Ratio, allowing for an "apples to apples" comparison. Alternatives could also include projects addressing resilience and extreme weather like scour criticality and design storms for culverts. Based on this analysis, an alternative with better cost-effectiveness or greater improvements to resilience may be chosen over the initial design. In addition, life cycle approaches not only provide for a justified selection between competing alternatives, but also provide for a greater understanding of the factors that influence cost effectiveness including design, construction, maintenance, and operational costs.

4.2 Current Application of LCCA Considerations at SCDOT

LCCA relies on complete, consistent, and quality data to generate useful information. SCDOT makes the best use of limited available data in conjunction with expert knowledge to generate a fair estimate of long-term costs required for asset sustainability.

Once a project has been selected, such as adding capacity or reconstructing an existing asset, SCDOT engineers explore a variety of pavement design options, which includes the type of pavement materials, design storms, extreme temperatures, drainage, etc. For most pavement projects on non-National Highway System (NHS) Primary and Secondary systems, SCDOT engineers look at a variety of factors, giving high weight to lowest initial cost and constructability. This includes such factors as the practical use of the pavement and the design and material of adjacent pavements. Choosing the same pavement design utilized for an adjacent road reduces future maintenance costs by allowing SCDOT to use the same pavement treatment methods on both road segments. Based on conditions in South Carolina, the main pavement type on Primary and Secondary systems is asphalt pavement.

For interstate widenings and reconstruction projects, in addition to calculating initial construction costs, the engineers calculate the cost of managing an asset over a period of 50 years under each design option. The analysis incorporates the present value of future costs associated with asset maintenance and preservation, modeling its projected deterioration based on forecast traffic conditions and proposed treatment types.

For cases in which different designs are projected to cost similar amounts in terms of present value, the engineers also consider user costs under each scenario associated with projected delay during periods of maintenance and reconstruction. After performing this scenario analysis, an advisory committee consisting of representatives from offices of the Directors of Construction and Maintenance convene to determine what design should be bid for contract. Engineering Directive (ED) 15 outlines the pavement selection process described above and is included as Appendix A.

The Department of Maintenance and Office of Construction are required to use WLM principles to select asset preservation projects in a given budget year. To help inform their decision, they use a table of expected service life of pavement treatments for planning analysis. Current service life expectations for selected rehabilitation and preservation treatments are shown in Table 4-1, which also highlights the wide range of treatments and their performance for planning purposes. SCDOT continues to refine the expected life characteristics of several treatments to better inform decision making. For example, SCDOT is working with researchers from Clemson University and the National Center for Asphalt Technology to develop more accurate deterioration curves for different treatment types.

Table 4-1. Expected Service Life of Selected Treatments

Treatment	Years (Pavement Service Life)	
	Low	High
Crack Seal	2	3
Chip Seal	4	6
Microsurfacing	5	7
Open Graded Friction Course	6	8
General Rehab	7	20
Mill & Replace 1”- 2”	8	10
Overlay < 200 PSY	9	12
Mill & Replace 2”- 4”	10	12
Overlay 400 PSY	10	30
Overlay > 400 PSY	10	30
Reconstruction	10	30
Mill & Replace 2”- 4” + Overlay 200 PSY	11	15
Section Reclamation	12	15
Mill & Replace 1”- 2” + Overlay 400 PSY	17	20
Mill & Replace 2”- 4” + Overlay 400 PSY	17	20
IC 2”- 4” + Overlay 150-200 PSY	17	20
IC 4”- 6” + Overlay 150-200 PSY	17	20

Note: PSY = pound per square yard; IC = Intermediate Course

Ideally, SCDOT would apply preservation treatments to assets in good condition to maintain their level of service. However, there are times when SCDOT must balance selecting projects using WLM principles with the need to fix some roadways or bridges that are in such disrepair that they may become a safety hazard to the traveling public. In other instances, the routes that are important to the State as a strategic corridor or freight network may require higher prioritization to ensure the efficient movement of goods. As a result, SCDOT implements a balanced approach that considers risks and asset performance in selecting projects for preservation, rehabilitation, or reconstruction.

4.3 Impact of Adding Capacity and Design Characteristics

Effective asset management practice and transportation planning take into consideration future demands and system needs. However, with added capacity come increased maintenance costs. This presents a continuous business challenge that requires SCDOT to balance between competing demands, needs, and associated risks.

The Agency realizes that by adding capacity future maintenance costs increase in kind, however, it is not a significant determinant whether or not the agency moves forward with a capacity building project. Factors such as rapid growth in the major urban centers, emerging land use patterns, public safety, mobility level of service, air quality, and freight needs play a greater role in the agency's determination as to whether or not it will pursue a capacity project.

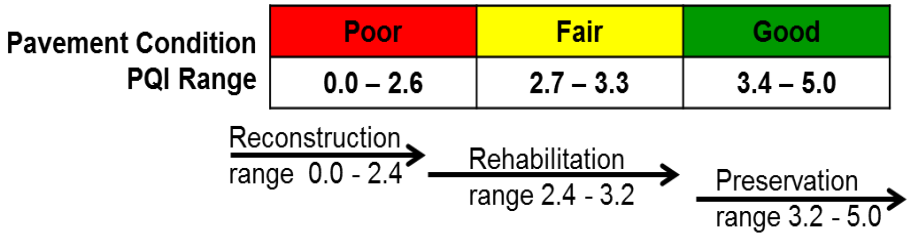
4.4 Pavement Management

SCDOT developed a dedicated Pavement Management Office and began the collection of pavement condition data in the early 1990s. The Road Data Services Department within SCDOT's Division of Intermodal Planning includes the Pavement Management and Inventory sections. These sections are responsible for the collection, processing, analyzing, and reporting of pavement condition and traffic counts for over 41,000 centerline miles of interstate, non-interstate NHS, non-NHS primary, Federal Aid secondary, and Non-Federal Aid secondary roads within the State.

SCDOT uses a semi-automated methodology for pavement data collection and a proprietary system (Highway Pavement Management Application) for its pavement management software. Observed pavement conditions and computer-assisted programs combined with the data recorded through profiling equipment produce a representation of the pavement surface condition. Pavement condition is reported in a pavement quality index (PQI), incorporating roughness, rutting, cracking, patching, and raveling, which was developed for South Carolina to reflect the types of pavement deterioration typically found within the State.

The PQI consists of two components: Pavement Serviceability Index (PSI) and Pavement Distress Index (PDI) – the former measures rutting and roughness and the latter measures pavement distress (cracking, raveling). PQI is first used to determine pavement treatment candidates based on the scale shown in Figure 4-5. However, project selection for interstate rehabilitation projects is based on approved criteria and the components that make up the PQI, which is outlined in Appendix B.

Figure 4-5. PQI Ranges Suitable for Treatment Types



The treatment types are defined as:

- Reconstruction – usually involves the complete replacement of the pavement structure. May include additional activities to improve resilience such as raising the road elevation or improvements to drainage.
- Rehabilitation – structural enhancements to improve a pavement's load carrying capability – e.g., adding additional layers of asphalt.
- Preservation – low cost treatments such as chip seal, crack sealing, or ultrathin asphalt overlays placed on a pavement asset to sustain it at or improve it to a good condition.

The current pavement management system (PMS) has over 20 years of collected data on the interstate system. Since 2007, a dedicated effort to improve the quality of data on the other tiers of the state-maintained system has been underway. Data are updated quarterly to reflect completed construction projects that changed pavement conditions. The SCDOT Pavement Management System provides a three-year outlook on its pavement inventory. It uses decision trees to determine the appropriate pavement treatment based on standard decision cycles accounting for typical deterioration, which may vary by system tier and pavement type.

Along with using PMS to manage its pavement asset inventories, SCDOT uses PMS to make recommendations on potential project candidates and to project future conditions based on specific funding levels. Current pavement condition data is collected and modeled for future performance based on historic pavement performance trends. The costs associated with pavement treatments are derived from SCDOT's bid history of construction lettings and updated annually. These costs are entered into the PMS and used to model an expected performance level over different periods using predefined levels of funding, which are adjusted 2.2% annually for inflation.

The goal of any pavement management effort is to systematically address the majority of roads before they deteriorate to the point that reconstruction is required. Pavement management preferred practices and the influence of WLM start with strong pavement design principles. SCDOT has outlined a primary goal for its pavement design activities: to provide the most cost-effective pavement structure while optimizing the level of service provided to road users. This goal considers multiple factors, including: construction considerations, initial cost, adjacent existing pavement, and ease of maintenance.

As noted, SCDOT uses a 50-year analysis period for benefit cost analysis for selected pavement design projects. Engineering Directives 52, 63, 64, and 65 (attached as Appendices B and C), which outline the pavement improvement project prioritizations for Interstates, Primary, federal-aid Secondary, and non-federal aid Secondary routes, allow for a point system to be used in ranking candidate projects. For non-interstate pavement projects, points are assigned based on various criteria that receive different weights, including: the condition of the pavement based on PQI and IRI, the average daily traffic, the percentage of the road that has been patched or is in need of patching, the average daily truck traffic, whether the road is part of the state freight and/or strategic corridor networks, the functional classification of the road, and whether the road is part of the state safety program. For interstates, ranking is based on:

- Pavement condition (65%);
- Average daily traffic (10%);
- Average daily truck traffic (10%);
- Pavement Maintenance costs (10%); and
- Location and significance to the community or local businesses (5%).

SCDOT applies a proactive approach in preserving its highway system by employing planned pavement maintenance strategies. In addition to other factors, projects are prioritized in terms of mobility, truck traffic, and significance to the community or local businesses to lower the risk of closures. SCDOT periodically reviews the number of miles that fall into preservation, rehabilitation, and reconstruction activities to ensure that funding is being allocated to each treatment category appropriately. Currently a minimum of ten percent of the funding is allocated for preservation with the remaining funding allocated for rehabilitation and reconstruction based on the percentage of lane miles in each category for each road system. The preservation allocation is reviewed periodically to ensure that there is adequate funding to preserve the pavements that have been reconstructed or rehabilitated. The PMS aids SCDOT in this process by helping determine how funding should be distributed among the categories and then by incorporating WLM principles in determining what projects SCDOT should undertake.

4.5 Bridge Management

SCDOT has a dedicated Bridge Maintenance Office that is responsible for the collection, processing, analyzing, and reporting of bridge condition for approximately 8,400 bridges over three categories within the State: NHS/ Interstate, Federal Aid Eligible (Non-NHS), and Non-Federal Aid Eligible (Off-System). In 2017 with the passage of the Roads Bill by the SC Legislature the agency's 10 Year Plan was initiated with one of the four main focus areas on bridges. At the time the original STAMP was published the plan identified 465 bridges across the state for replacement. Since the 10-Year Plan was initiated over 274 bridges have been advanced to construction with the original 465 bridges identified serving as the road map for the duration of the 10 year period.

In 2018 the agency began the Statewide Load Rating effort that was completed after three years in 2021. The $75 million effort provided SCDOT with invaluable new data points that exposed the vulnerability of the Primary system if left unaddressed could impact the movement of people and goods across the state impacting commerce and the economy. The results of the Statewide Load Rating along with $69 million in additional funding has restructured the Bridge Program with a balanced approach to bridge preservation, rehabilitation and replacement that was approved by Commission on December 9, 2021. The bridge program has been revised with the following priorities:

1. Insert into our existing bridge program a category specifically for Load Restricted Bridges on the Primaries and prioritize funding to drive the number posted on the critical network to zero. Develop prioritized list in 2-year increments to align to inspection cycles and to account for changing conditions over time.
2. With the updated data, reprioritize the Load Restricted Bridge category for the Secondaries and fit it back into the program behind the Load Restricted Primaries. Develop prioritized list in 2-year increments to align to inspection cycles and to account for changing conditions over time.
3. Consistent with our prior approach, any previously approved and ranked bridge projects which are included in the original "465" that are very far along in the project development pipeline or based on the re-ranking process as part of the Load Restricted Bridge Program shall continue forward for delivery.
4. Ranked Bridge Projects should be evaluated for rehabilitation versus automatic replacement
5. Additional strategies are to be developed to intercept Structurally Deficient bridges prior to them decaying to the point of needing to be Load Restricted and Federal grant opportunities should be pursued for critical interstate bridges.
6. Increase the number of bridges being delivered with the 10-Year Program for 465 to 500 in recognition of the previously approved funding boost.
7. Any closed bridge is to be immediately assessed for either permanent closure/removal or immediate repair/replacement. If it is to go back into service, it should go to the top of the work plan and be replaced via an emergency contract or otherwise expedited delivery method to ensure prompt restoration of the network.
8. While there are no Load Restricted bridges on the Interstate system today, if for any reason an Interstate bridge does become Load Restricted, it is to be immediately repaired or replaced via an emergency contract or otherwise expedited delivery method.
9. These 2 categories of bridges (Closed on any system, Load Restricted on the Interstate) are by default considered the highest priorities for repairs/ replacements and room is to be made in the program to accommodate these emergency-type situations and therefore no ranking is required.

Before the restructuring of the Bridge Program there were two main funding categories: Bridge Repair/Preventative Maintenance and Individual Specific STIP Replacements. After restructuring, the program is not only focused on replacements but has created three additional program categories to create a holistic approach including: Bridge Reactionary Maintenance, Bridge Preservation, and Inspection and Compliance.

For a bridge to be selected for a repair/rehab over replacement it must satisfy several criteria. First, the repairs must be such that the load posting is removed and repairs must be able to add at least 25 years to the structure's financial life. Second, the bridge must move from the "poor" rating category post-repair inspection.

Bridge Reactionary Maintenance is designed to address problems as they happen in real time. These are typically systems that have progressively deteriorated over time and then an event such as a storm will require repair by SCDOT maintenance crews or a project that will require engineering and design and let through the letting process. The efficient response of reactionary maintenance work contributes to the resilience of the bridge network, i.e., how quickly a bridge can return to service after an event causing closure or repair occurs. These projects are not typically declared federal or state emergency events.

Bridge Preservation is focused on extending the life of bridges and keeping them off the replacement list through maintenance of the deck, superstructure, joints and keeping other systems in a state of good repair. Project types in this category can include those such as bridge painting, deck cleaning and joint sealing.

Inspection and Compliance is an additional program category that are conducted in accordance with the National Bridge Inspection Standards (NBIS), which were established as part of the Federal-Aid Highway Act of 1970. SCDOT classifies bridge deficiencies identified during inspections according to work priority based on the impact the deficiency has on the load carrying capacity of the bridge or the safety of the motoring public. Bridgework priorities identified during inspections are entered and tracked in the Highway Maintenance Management System (HMMS) Bridge Deficiency

Module. Since these bridge safety inspections capture all of the various maintenance needs that a bridge may have, the deficiencies discovered determine the preservation and rehabilitation work needed to sustain a desired state of good repair over the lifecycle of the bridge at minimum practical cost.

In addition to new program categories, the Statewide Load Rating effort exposed the need to place a greater focus on load restricted bridges on the Primary system. The number of posted bridges increased dramatically from 21 to 132 which was reduced to 124 after analysis of recent lettings. The agency presented an updated list of prioritized bridges that blended the original 465 identified in the 10-Year Plan to the state's most pressing needs from the results of the Statewide Load Rating effort. The new rankings were determined with priority placed on Closed, Posted Primaries and Posted Secondaries. The reprioritized bridge which list includes 187 new priorities was evaluated for repair and rehabilitation versus replacement.

For bridge replacements, SCDOT prioritizes the selection of bridges following Act 114 criteria. Engineering Directives 68, 69, and 70 (attached as Appendix D), which outline bridge replacement project prioritization processes for NHS, non-NHS, and load restricted bridges, allow for a point system to be used in ranking candidate projects. Points are assigned based on objective

data, including structural condition, traffic status, Average Daily Traffic, Average Daily Truck Traffic percentage, detour length, emergency services, evacuation routes, and whether the bridge is on the Strategic or Freight networks. Points are also allocated using engineering judgment, including district repair feasibility and future industrial and housing development. Only bridges that are rated as structurally deficient based on the National Bridge Inventory (NBI) scale are considered as replacement candidates. Targeting structurally deficient bridges and closed or load restricted bridges is a strategic priority of SCDOT. Prioritization and ranking are considered every two years for approval by the Transportation Commission.

It is worth noting that considering the emergency services and evacuation routes criterion helps improve resilience of the system in terms of mobility and continuous service. These criteria ensures that emergency services such as fire and ambulance are considered and that hurricane evacuation routes are maintained to a high level, as well as primary and secondary lifeline routes for seismic response.

The prioritized list approved by the Commission is evaluated based on scope (repair vs. replacement), bundling opportunities and project priorities. There are three groups that deliver bridge projects at SCDOT which include the Director of Maintenance office, the Office of Alternative Delivery and Preconstruction. Projects are developed through various implementation strategies that best suit the characteristics and needs of the project. To successfully deliver this new portion of the program, additional staff has been added and projects have been grouped together based on location and those meeting low-volume criteria. After the delivery method and funding is identified it flows through the Preliminary Engineering (PE), Right-of-Way (ROW) and Construction phases to project completion.

Management of Coastal Bridges

To assist in management of SCDOT's complex bridges, an asset management contract is in place to inspect and maintain select fixed and movable coastal bridges in Beaufort, Berkeley, Charleston, and Horry County. Work under this contract includes maintenance activities and repairs approved by the SCDOT's Feasible Action Review Committee.

Use of Consultant Services

SCDOT has expanded its use of consultant services for the Bridge Program to balance its internal workload. The Director of Maintenance Office, Office of Alternative Delivery and Preconstruction will rely on the consulting community to assist in delivering the program. Tasks that will be included for statewide consultant opportunities include the following:

- NBIS Inspection Contract (SCDOT works closely with FHWA to ensure that the bridge inspection program meets all federal requirements.)
    - NBIS Inspections
    - Emergency Inspections
    - Inspections with access obstacles
    - Load Rating – updated ratings based on inspection findings
    - QC/QA – Inspection and load rating quality checks
    - Scour assessments
    - Plan of action development
- Project Design & Project Management Services
- AASHTO Ware BrM & BrR – Specialized Programming & Training

4.6 Maintenance Decision Making and Whole Life Management

The Director of Maintenance is responsible for the development and implementation of policy for maintenance of roads and bridges. Historically, funding for maintenance activities has been the largest obstacle for addressing maintenance in a more proactive manner using WLM. Due to past funding levels, traditionally, SCDOT reacted to pressing maintenance concerns by addressing conditions in the order of the worst first and did not have available funding to proactively maintain its assets in better condition.

Using the results of the life-cycle planning process and "performance curves (included in the Investment Strategies Chapter), the SCDOT Secretary of Transportation presented potential investment strategies to the legislature. The presentation outlined projected conditions of the state-maintained pavement and bridge systems if the agency were to receive additional revenue compared with condition targets without an increase in revenue. This life-cycle planning process was the basis for the investment strategies detailed in the Investment Strategies Chapter of this STAMP that led to the agency's ten-year condition targets. These ten-year investment strategies will help move the agency's assets toward a state of good repair.

The South Carolina General Assembly recognized the needs to maintain the agency's existing assets and dedicated approximately $600 million annually in new state funding through the passage of Act 40 of 2017. The historic legislation allowed SCDOT to strategically align the agency's infrastructure repair and improvement efforts in the plans and programs developed in the 10-Year Plan.

SCDOT is currently working with a consultant to develop an enterprise-level asset management software (EAMS) that will allow it to perform more robust analyses and more thoroughly involve life cycle planning at the network and agency level. The kick-off meeting was held in September of 2021, and will be rolled out in phases over the next 5-7 years for full implementation. Further discussion about the future of transportation asset management at SCDOT is included in Chapter 8.

RISK MANAGEMENT & MITIGATION APPROACHES

CHAPTER 5

5. Risk Management and Mitigation Approaches

5.1 Overview

SCDOT has embraced asset and performance management and is in the process of weaving these principals into everyday business practices, a process that will take time to fully implement. In simple terms, performance management is a strategic approach that requires the practitioner to use system information to set specific goals and objectives and allocate the resources necessary to achieve them. There are risks as well as opportunities involved with the achievement of all goals and objectives. Federal regulation 23 CFR part 515.5 defines risk as *"the positive or negative effects of uncertainty or variability upon agency objectives"*. The longer the time horizon, the more uncertainties and risks there are. 23 CFR part 515 defines risk management as "the processes and framework for managing potential risks, including identifying, analyzing, evaluating, and addressing the risks to assets and system performance". Therefore, asset management, performance management and risk management are used together to allow SCDOT to achieve its strategic objectives.

Figure 5.1. Risk Management Relationship

Risk Management Planning Process Requirements of 23 CFR 515.7

- Identification of risks that can affect condition of NHS pavements and bridges and the performance of the NHS, including risks associated with current and future environmental conditions such as extreme weather events, climate change, and seismic activities;
- An assessment of the identified risks in terms of likelihood of their occurrence and their impact and consequence if they do occur;
- An evaluation and prioritization of the identified risks;
- A mitigation plan for addressing the top priority risks;
- An approach for monitoring the top priority risks;
- Evaluation of risks related to reoccurring damage and costs as identified through the evaluation of facilities repeatedly damaged by emergency events (addressed in 23 CFR 667), and alternatives to mitigate or resolve their root causes;

5.2 Background and Purpose of the Risk Management Plan

There are risks involved with every aspect of owning, managing, and maintaining a transportation system. There is the risk of damage to, or loss of assets due to extreme weather events, crashes, or acts of vandalism. SCDOT's infrastructure is particularly vulnerable to flooding, tropical storms, and winter weather (see Figure 5-8). Other risks include the loss of key personnel or shortfalls in expected revenue. SCDOT classifies risks into one or more of the following areas:

- Operational (Project delays, cost overruns, waste, inefficiency)
- Safety (Employee and public well-being)
- Financial threats (Funding, liquidity, credit, reporting)
- Strategic (Resources not aligned, unclear objectives)
- Reputational (Unintentional unwanted headlines that could destroy public trust)
- Ethical (Intentional fraud, abuse, mismanagement, conflict of interest)
- Legal (law suits)
- Regulatory (Noncompliance)

Enterprise risk management is the process of integrating the management of risk into all of an agency's key programs at every level within the organization. This includes managing the risks at the agency, program, project, and activity level.

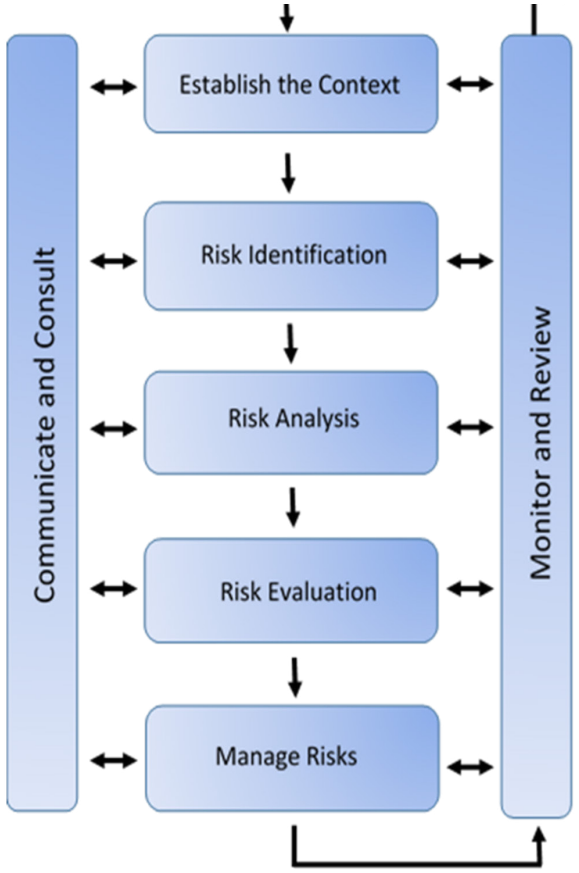
Figure 5-2. Structure of Enterprise Risk Management

SCDOT began the process of implementing an Enterprise Risk Management (ERM) program in spring of 2017. There are numerous ERM processes that have been developed, both for the public and private sector. The agency uses a cyclical framework comprised of seven components and is used in many risk management guides. The components of this process are:

- Communication and Consultation – developing a communication structure within the organization to create an understanding of the risk management process and create continuous communication between the risk manager(s) and the risk owners.
- Establish the Context – what is the mission and challenges that may be faced? Is the environment changing? What resources are available to meet the identified objectives? Are there legal, political or social environments that may impact the success of the organization?
- Risk Identification – identifying the sources of risks and opportunities, areas of impacts, events and their causes and consequences.
- Risk Analysis – understanding the risk, its consequences and the likelihood of the risk occurring.
- Risk Evaluation – risks are evaluated and prioritized based on the impact to the organization and their likelihood of occurrence.
- Managing Risks – deciding whether to tolerate, treat, transfer, terminate, or take advantage of the risk.
- Monitoring and Review – evaluation of the results of the risk process. This is a cyclical process.

This approach is used to identify enterprise, program, project and activity level risks. SCDOT manages risk at multiple levels for several reasons. The strategic objectives of the agency cannot be achieved without the coordination of functions at many levels within SCDOT. Problems that arise at the activity or project level can affect the goals set at the program and enterprise level and could therefore become a strategic risk for the agency, thus the need to employ an enterprise risk management solution at SCDOT. Each area is discussed in detail in the following sections.

Figure 5.3. SCDOT Risk Management Process Framework



5.3 Establishing the Context

To establish the overall risk management approach, it is essential to identify and understand the context in which SCDOT operates. Per FHWA, this process involves understanding and documenting the social, cultural, legal, regulatory, economic, political and natural environmental characteristics that could create risks or opportunities affecting an agency's goals and objectives. Developing a deep understanding of the context allows the preferred risk management approach to be tailored to the Department's specific needs and circumstances. This understanding enables SCDOT to develop and approve internal and external risk management communication processes to facilitate the flow of information through the Department and to key external stakeholders.

5.4 Risk Identification

Risk identification is the process of determining pertinent threats or uncertainties that can potentially impact the achievement of SCDOT's mission, goals or objectives. SCDOT undertakes this task by establishing risk teams comprised of subject matter experts and conducts workshops guided by the Office of Strategic Planning. The Office of Strategic Planning facilitates the workshop by conducting exercises such as brainstorming, scenario reviews or other group techniques to stimulate thinking. This qualitative screening process is meant to cast as wide a net as possible in order to capture all potential risks to the goal or objective under review, taking into account the categories of risk identified in section 5.2. Ultimately, through the screening of risk events, SCDOT identifies a comprehensive set of risks that are context sensitive, aligned with the strategic direction of TAM, and that address the objectives of the risk management process. SCDOT's risk identification process allows for inclusion of new emerging risks or opportunities, and the development of strategies to mitigate these risks or take advantage of the opportunities.

Table 5-1, contains the comprehensive list of bridge and pavement priority risks identified throughout Chapter 5. The risks are further designated into risk-type categories based on the nature of the risk. A more detailed description of the risks is further provided in Section 5.9, Risk Register and Appendix E.

Table 5-1. SCDOT Risks identified at the Risk Management Workshops

Risks Identified for Bridges Program	
Operational Risks	Costs inflate substantially on a program level
	Additional bridges are added to the load-restricted or structurally deficient lists
	Ability to deliver projects impacted by lack of qualified internal workforce
	Ability to deliver projects impacted by lack of qualified external contractors
Financial Risk	Low-priority bridges consume resources disproportionately
	Opportunity: Receipt of additional State funding
	Opportunity: Receipt of additional Federal funding
	State Funding Cuts
	Federal Funding Cuts
External Risk	Ability to deliver projects impacted by material shortage
	Bridges are damaged by extreme weather events
	Bridges are damaged or destroyed by Earthquakes
	Bridges are damaged or destroyed by vehicle impacts/fires
Risks Identified for Pavement Program	
Operational Risks	Project costs inflate substantially
	Ability to deliver projects impacted by lack of qualified contractors
	Loss or lack of Institutional Knowledge
Financial Risk	Opportunity: Receipt of additional State funding
	Opportunity: Receipt of additional Federal funding
	State Funding Cuts
	Federal Funding Cuts
External Risk	Ability to deliver projects impacted by material shortage
	Pavements are damaged by extreme weather events (hurricane, floods, snow/ice)
	Pavements are damaged or destroyed by Earthquakes
	Pavements are destroyed by vehicle impacts/fires
Information Risk	Inaccurate pavement condition prediction models
	Inaccurate pavement condition data

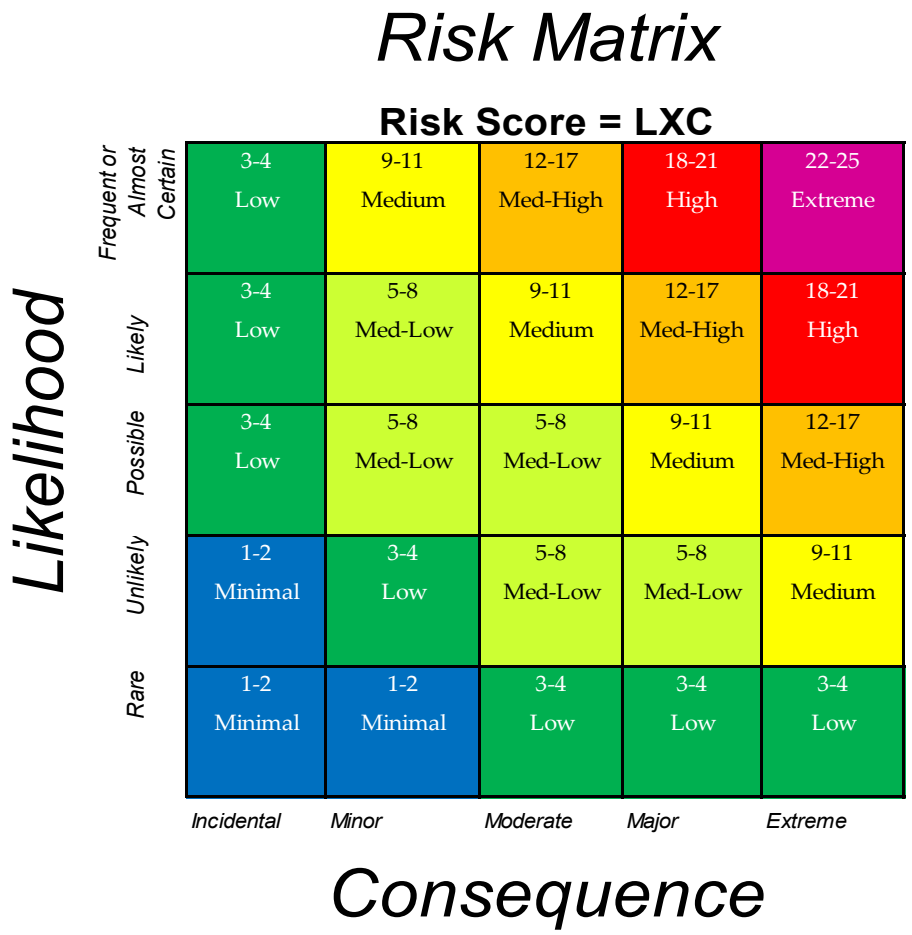
5.5 Risk Analysis

SCDOT estimates the probability and consequences of each identified threat or vulnerability to determine the magnitude of the resulting risk. This process is referred to as risk analysis. SCDOT uses a mixed process (quantitative and qualitative) in assigning probability and consequence values/ratings to each identified risk event. Specifically, the process is done during the workshop to solicit expert opinion and historic information, and then develop key indicators to estimate risk likelihood and consequence values. An overall risk score is estimated from these two risk components. The higher the risk score, the more important it is to develop risk mitigation strategies to deal with the risk (or formalize any existing strategy at the activity, asset/project, program, or agency level).

5.6 Risk Evaluation and Prioritization

SCDOT risk teams evaluate the identified risks and establish risk appetites to determine high-impact risks for prioritization. Defining the risk appetite can be a subjective or qualitative process. SCDOT has a very low risk appetite for safety and ethics related risks and a higher appetite for risks in the area of external threats and business operations. Risk evaluation and prioritization offer SCDOT the opportunity to alleviate the impact of likely threats that present higher consequences through a risk matrix. See Figure 5-4. The overall process informs resource allocation decisions with inputs from the risk information. The result of these preceding processes is a risk register, which is presented in Section 5.9 of this chapter. Each risk owner compares the magnitude of the risks with the Department's risk tolerance for prioritization and development of mitigation strategies.

Figure 5-4. SCDOT Risk Matrix that shows the expected value of likelihood and impact.



5.7 Managing Risk

Once the risk teams have scored each of the risks, they determine if and how the risk can be managed. SCDOT uses five options to manage risks known as the "the five T's" of risk management, which are to tolerate, treat, transfer, terminate, or take advantage of the risk.

Tolerating the risk means taking no action to mitigate the risk. The risk score is low enough to be within SCDOT's established risk appetite.

Treating the risk is the most common response to risk assessment. Many processes and business practices of SCDOT and other state transportation agencies were put in place to treat some type of risk. One example is the National Bridge Inspection Program that was established by FHWA in the early 1970's in response to a bridge collapse. The purpose of the program is to reduce the risk of future collapse and improve the safety of the traveling public. All risks cannot and should not be treated. SCDOT weighs the cost to the benefit when deciding on which risks to treat.

Transferring the risks shifts the responsibility for the risk to another party, but this may not always be possible. SCDOT uses performance contracts for the inspection and maintenance of its largest bridge systems. This is one of the ways that SCDOT can transfer some of the risk to another party. Once again, SCDOT considers the cost to the benefit when establishing performance contracts for the maintenance of assets.

Terminating the risk is the practice of stopping the activity or practice that is the source of the risk. An example of this would be to discontinue using a product with a questionable safety record or replacing a high-risk product with a lower risk one.

Taking advantage of an opportunity presented by the risk can take many forms such as using a new product or process that can save the agency money. Without taking well-reasoned risks, SCDOT cannot take advantage of innovation and the opportunity to maximize the return on investment for the taxpayer. One way to measure the success of an enterprise risk management system is to look at the number of innovations it produces.

Figure 5-5. "T's of Managing Risk

5.8 Sources and Types of Risk

All SCDOT activities contain risk. Risk pervades every unit, program or project within the Department. The characterization or stratification of risks allows SCDOT to better scope the risks, identify ownership, develop mitigation strategies, allocate resources, and manage and monitor the risk. Generally, SCDOT deals with both internal and external risks. Internal risks are those risks within the control of the Department and, as such, SCDOT has the capability to plan and mitigate their occurrences and impacts. While SCDOT does not have control over the occurrence of external risks, identifying these risks facilitates the development of response plans to alleviate the risk impacts upon their occurrence.

A risk assessment was originally conducted at the launch of the 10-Year Plan in 2017. A new risk assessment was conducted in 2022 to take a look at the potential items that may stand in the way of delivering the 10-Year Plan. Figure 5-6 illustrates the results of that assessment by senior leadership in the agency. Note that the size of the marker indicates the number of personnel that considered the risk as a major concern. Below is a list of the major identified risks and mitigation strategies.

<u>High Impact Threats (Red Zone - Treat)</u>

- *Inability to Recruit and Retain Staff – The internal Leadership class at the department has been tasks with working on this issue. In addition the agency has made efforts to boost pay.*
- *Failure of the Industry to Deliver & Material Shortages/Cost Escalation – the entire SCDOT team is working on this issue along with contractors and suppliers to think outside the box and find alternatives.*
- *Poor Communications, Internally & Externally – The agency recently hired a new Director of Public Relations to make improvements*
- *Interference/Distractions by Entities on non-priority projects – We recognize the potential here and will deflect this to the maximum extent possible through utilizing consultants where possible.*
- *Lack of internal controls on project delivery – Taking the opportunity here to improve visibility to the development pipeline and during construction. Ensuring issues are being resolved in a timely manner and effective communication is happening vertically and horizontally within the Department.*
- *Data Reliability and Technology Failures – Continue efforts on data governance and improved IT services along with investments into an Enterprise Asset Management Software System (EAMS)*

<u>Medium Impact Threats (Yellow Zone – Evaluate)</u>

- *Changes in State or Federal Priorities – The 10-Year Plan has been branded outside and inside the Agency as the roadmap to the future that is tied to 10-Year Plan targets and goals and is the way to measure progress on how SCDOT is utilizing tax payer funds.*
- *Loss of Key Staff – Continue efforts for succession planning, documenting procedures and staying organized*
- *Lack or Loss of Funding – The SC General Assembly has the power to add or removing funding, it is the Secretary's and collectively the Agency's responsibility to deliver results and be good stewards of the funds entrusted.*
- *Poor Customer Service, Internally & Externally – The Damage Claims process has been revamped through the internal Leadership program and has been rolled out.*
- *Loss of Trust of the Governor or Legislature – The Agency must continue above-board actions, be responsive and deliver results of the 10-Year Plan.*

Figure 5-6. SCDOT Enterprise Level Risks

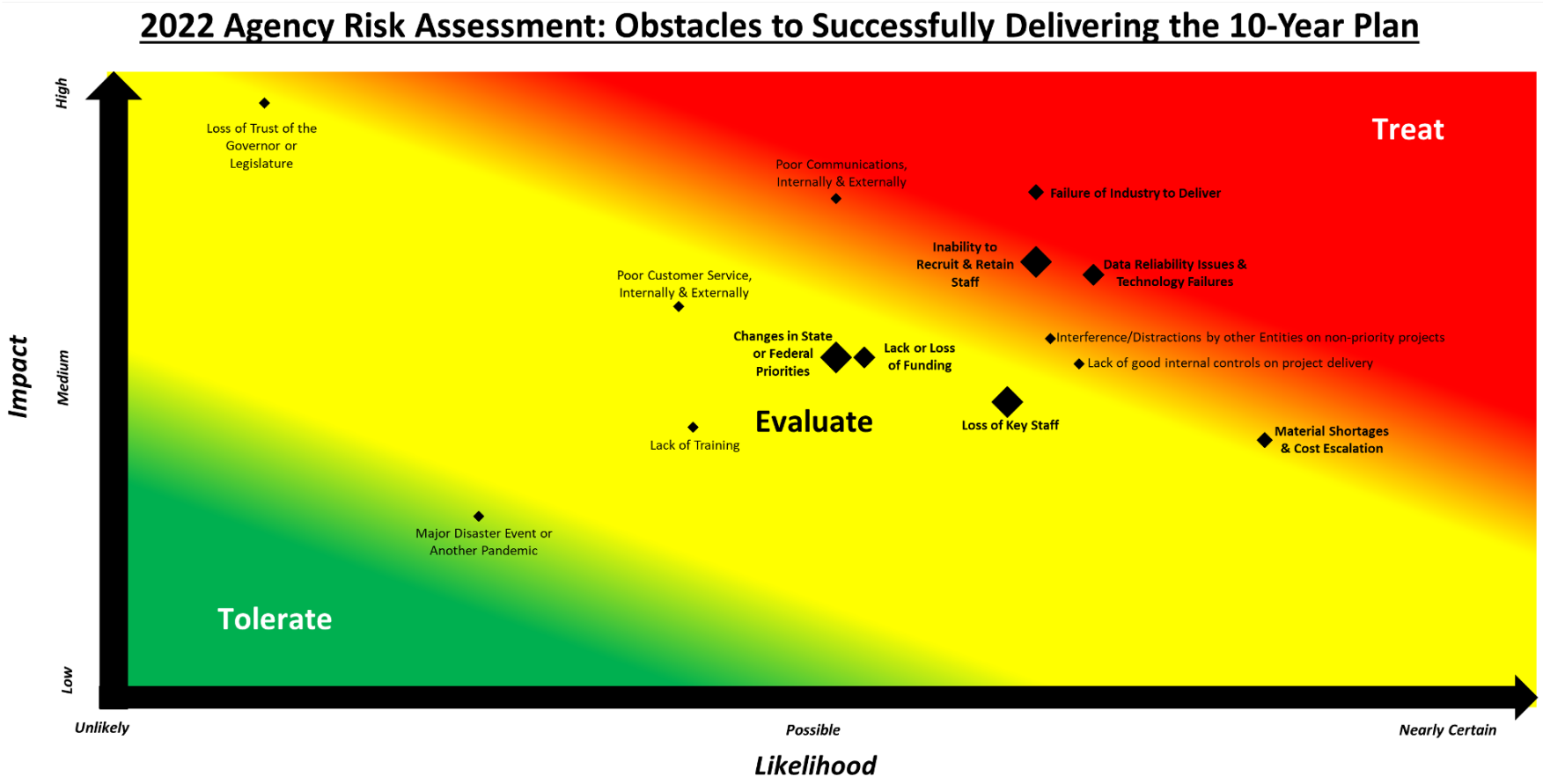
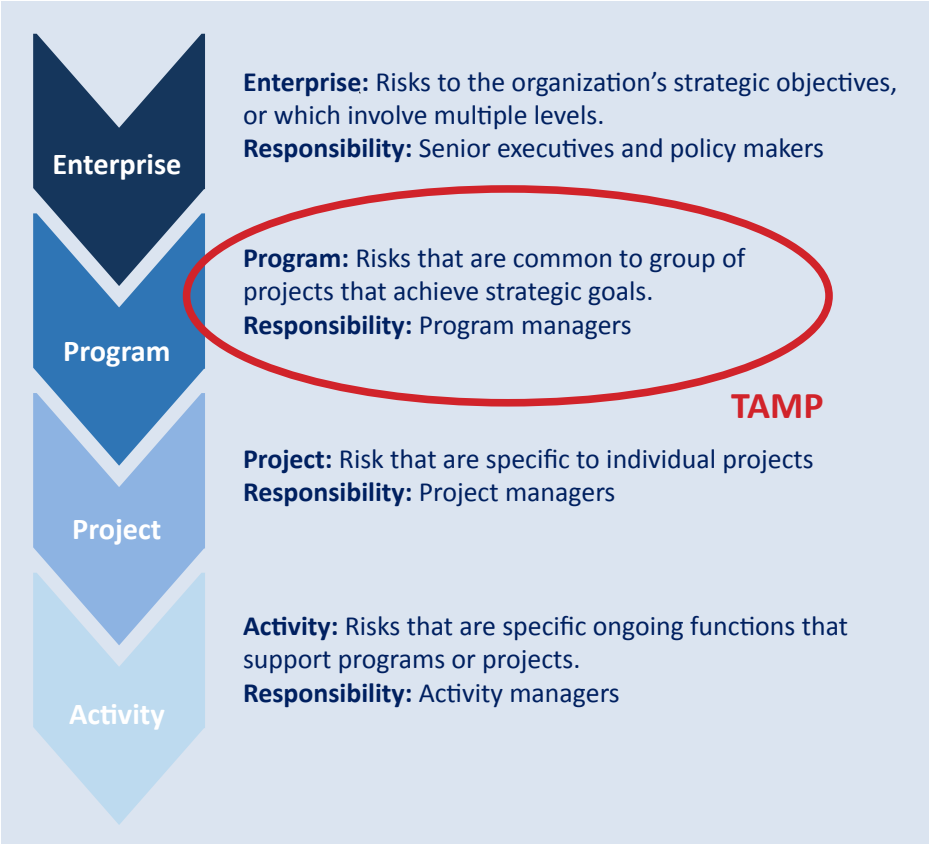


Figure 5-7. Levels of Risk Management.



5.9 Risk Register

The purpose of the risk registers is to provide SCDOT with a list of priority risks identified, stated clearly and assessed as to their importance to meeting agency objectives. The risk register leads directly to managing the severity and impacts of the risk, such as risk mitigation/treatment. In the register below, we have identified the top three priority risks, risk consequences, risk severity score, policy control measures, risk management plan action items, and risk owners for each asset. The risk severity is color coded to correspond to the risk matrix (Figure 5-4). The bridge and pavement risk registers were reviewed and updated in 2022 with a smaller internal group. See the following pages for the top three risks for the Bridge Program (Table 5-2) and top three risks for the Pavement Program (Table 5-3). The complete Risk Register can be viewed in Appendix E. The Risk Registers for Bridge and Pavement were updated internally in Summer/Fall of 2022 by an internal working group with members from Maintenance and Planning.

Note: The final adjusted risk severity score was derived through an iterative scoring process, which began with the assignment of an initial risk score (Column 3). The assessed score was based on the likelihood and severity of the risk to the agency as illustrated in Figure 5-4. Policy control measures, which include existing agency policies and practices, as well as proposed risk management action plan items (Columns 4 and 5, below) were applied to the risk. Following the application of the mitigation measures, the risk was then rescored. The results from this exercise are displayed in the final adjusted risk score (Column 6, below).

Table 5-2 Bridge Risk Registry

Bridge Risk Registry						
Type of Risk or Opportunity	**Risk Consequences/Impacts**	**Original Risk Severity Score**	**Policy Control Measures (Primary (P) and Secondary (S))**	**Possible Risk Management Action Plan Items**	**Final Adjusted Risk Severity Score**	**Risk Owner**
Additional bridges are added to the load-restricted or "poor" rating lists	Delays in program; Increase in cost.	**Extreme** **25.0**		Explore increase in rehab options; Robust Preservation Program.	**High** **20.0**	Maintenance
Costs inflate substantially on a program level	Delays in project delivery due to scope expansion and requests for additional funds; Unmet agency goals and customer expectations.	**Extreme** **25.0**	(P) Agency Policies, Procedures, Design Criteria; (P) Develop contingencies for the successful delivery of projects considering many different scenarios of cost inflation; (S) Partner with contractors, manufacturers, and industry to develop long-term material needs and supply plan for Bridge program.	Allowance for increased risk of low-volume bridge design manual; Growing District in-house Bridge capabilities; Explore increase in rehab options.	**Medium-High** **17.5**	Planning Finance Maintenance Preconstruction
Ability to deliver projects impacted by lack of qualified internal workforce	Can delay project and program delivery times; Can lead to unmet system performance.	**High** **20**	(P) HR Retention; Outsourcing Labor	Research on Technology and Efficiency Assessments to reduce staff workload; Utilitize Consultant services More Flexible HR Programs.	**Medium-Low** **6.0**	HR

Table 5-3 Pavement Risk Registry

Pavement Risk Registry						
Type of Risk or Opportunity	**Risk Consequences/Impacts**	**Original Risk Severity Score**	**Policy Control Measures (Primary (P) and Secondary (S))**	**Possible Risk Management Action Plan Items**	**Final Adjusted Risk Severity Score**	**Risk Owner**
Loss or lack of Institutional Knowledge	Loss of productivity, quality of work, delays, increase in cost.	**High** **20.0**	Recruitment and Retention Plans; Workshops and Trainings for Internal Staff and Contractors; Outsourcing.	Target Operating Model (TOM) put in place	**Medium** **16.0**	HR
Project costs inflate substantially	Delays in project delivery due to scope expansion and requests for additional funds; Unmet agency goals and customer expectations.	**High** **18.0**	(P) Develop contingencies for the successful delivery of projects considering many different scenarios of cost inflation.	Optimize the blend of investment; Corridor Management; Increasing daytime work; Strategic grouping in value for packaging of projects	**Medium** **13.5**	Planning Finance Preconstruction / Alternative Delivery
Inaccurate condition prediction models	Will impact the pavement program financial plan and target setting process.	**Medium** **12.0**	(P) Regularly Update Cost in Models; Deterioration Curves Development; (S) Develop Pavement Management Data Quality Management Plan.	Add age of concrete; Follow Engineering Directive Add a structural evaluation; Ongoing research project to update deterioration curves; Add a construction history (going forward)	**Medium-Low** **6.0**	Road Data Services

5.10 Risk Monitoring

The SCDOT recognizes that the risk management process is a cyclic process that requires continuous monitoring and evaluation, serving as a feedback loop, to achieve risk based agency goals (Figure 5.3). An effective implementation of a risk based decision-making practice must include evaluation and monitoring of the priority risks by the risk owners on a periodic basis.

Risk owners or their designees assigned with the responsibility of tracking and evaluating the status of their assigned risks periodically determine what additional mitigation measures/treatments may be required to reduce the overall risk severity. Risk owners report findings back to the STAMP Risk Management Steering Committee and the risks are reevaluated and rescored on an annual basis. The annual review of the Risk Management Plan corresponds with the review schedule of the SCDOT Strategic Plan.

5.11 Summary of Part 667 Evaluations

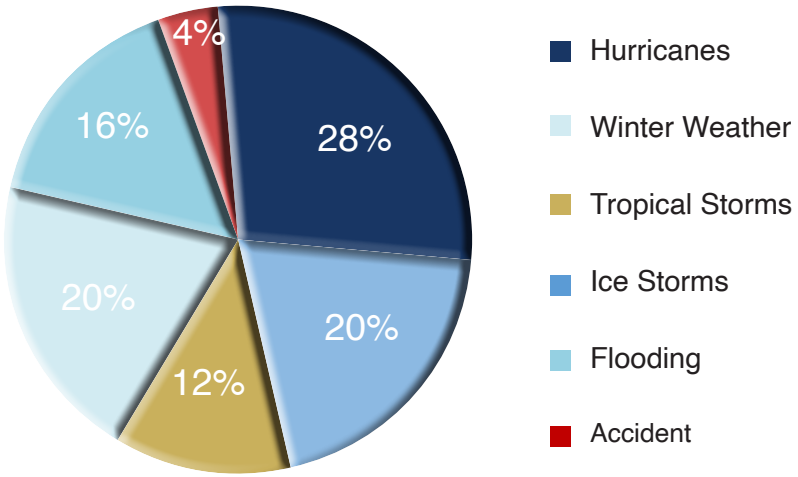
As part of its risk management process, in accordance with 23 CFR 667, SCDOT evaluated its pavement and bridge assets on the NHS to determine if repair and reconstruction activities occurred at least twice due to the effects of events that resulted in an emergency or disaster declaration by the Governor of South Carolina or President of the United States.

Between 1998 and 2021, there were 23 emergency weather related events resulting in either a gubernatorial or presidential declaration for the State of South Carolina. SCDOT began maintaining detailed records on whether a specific asset was affected by these emergency events resulting in a declaration beginning in 2005. Prior to then, the records only show that various repairs were needed on roadways in a particular area without defining the specific asset. Based on an extensive analysis conducted by the SCDOT it was determined that no discernable damage had occurred to facilities more than once during the review period.

Table 5-2 Declared Weather Events (1998-2021)

Year	Event Name	Declaration Type
8/25/98	Hurricane Bonnie	Presidential
9/14/99	Hurricane Floyd	Presidential
1/22/00	Winter Storms	Presidential
2/2/02	Ice Storm	Governor
10/25/02	Tornado/Floods	Governor
12/4/02	Ice Storm	Presidential
1/23/03	Winter Weather	Governor
1/26/04	Ice Storm	Presidential
8/14/04	Hurricane Charley	Presidential
8/28/04	Tropical Storm Gaston	Presidential
9/6/04	Tropical Storm Frances	Presidential
8/29/05	Hurricane Katrina	Presidential
12/15/05	Ice Storm	Presidential
8/29/06	Tropical Storm Ernesto	Governor
1/10/11	Winter Storm	Governor
1/28/14	Ice Storm	Governor
2/10/14	Winter Storm	Presidential
10/1/15	Major Flood	Presidential
10/4/16	Hurricane Matthew	Presidential
1/6/17	Winter Weather	Governor
9/6/17	Hurricane Irma	Presidential
9/16/18	Hurricane Florence	Presidential
2/6/20	Severe Weather and Flooding	Presidential

Figure 5-8 Historic Emergency Events Categories (1998-2021)



SCDOT staff determined that several NHS road assets required repair and/or replacement first during the historic flood in October 2015; from Hurricane Matthew in October 2016; and from Hurricane Florence in 2018. Based on financial data maintained by the Office of Program Controls, the most expensive repair was approximately $13.2 million on the US 301 bridge over Black River Swamp. Most of the damage encountered during the storm events resulted in less than $1 million. A detailed list of the gubernatorial and presidential declared emergency events; a detailed list of NHS roadways damaged through events declared as an emergency; and a memo summarizing the SCDOT periodic evaluation of facilities repeatedly requiring repair and reconstruction due to emergency events, is provided in Appendix H.

Based on historic funding levels and frequency of events, it has been the agency's practice to tolerate the risk to its NHS assets resulting from emergency events. In situations where an asset is damaged for the second time, a cost benefit analysis will be conducted to determine the return on investment for repairs that will mitigate the risk of recurring damage from future events.

5.12 South Carolina Resilience Initiatives

With the passing and implementation of the IIJA, State DOTs are required to consider resilience and extreme weather in life-cycle planning and risk management analyses. SCDOT has improved discussion of current considerations relating to resilience and extreme weather throughout the Whole Life Management and Risk Management chapters. This section provides an overview of additional resilience related initiatives that are in progress.

- **South Carolina Office of Resilience (SCOR)** – SC Code of Laws 48-62-30 identifies the South Carolina Office of Resilience (SCOR) as the lead agency for preparing a *Strategic Statewide Resilience and Risk Reduction Plan*. SCOR formed an Advisory Committee to guide the development of this plan.
- SCDOT is currently participating on the statewide Resilience Advisory Committee. From SCDOT, the Director of the Office of Engineering Support and the Hydraulic Design Support Engineer participate in the Advisory Committee. Resilience for our transportation system requires focused attention on preparation, planning, recovery, and adaptation to adverse events.
- **Strategic Statewide Resilience and Risk Reduction Plan** – The plan is intended to serve as the framework to guide South Carolina's investment in mitigation projects and the adoption of programs and policies to protect people and property from damage and destruction associated with extreme weather events. The plan will serve as the framework to guide state investment in mitigation projects and the adoption of programs and policies to protect the people and property of South Carolina from the damage and destruction of extreme weather events. The initial draft plan was intended for completion in Summer of 2022. However, a revised date is being determined due to the magnitude and complexity and the level of stakeholder engagement necessary to create a practical and strategic plan.
- **Sea Level Rise and Criticality** – The SCDOT Hydraulic Design Support Office is working on the selection of a Sea Level Rise (SLR) scenario in coordination with the aforementioned *Strategic Statewide Resilience and Risk Reduction Plan*. This will be accomplished in partnership with other state agencies to ensure a consistent statewide approach to SLR. The approach will include analysis of data from the representative South Carolina tidal gages with long term data and the development of tools that combine surge, SLR, and tides probabilistically. The concept of criticality will be used to determine the water surface elevations to be used for infrastructure design. Criticality is a measure of importance of the structure, which takes into consideration the following factors: existing and projected traffic volumes, route impact on local residents and businesses, availability and length of detours, evacuation / emergency response routes, and the duration / difficulty / cost of the infrastructure damage repair or replacement.

CHAPTER 6 FINANCIAL PLAN

Financial Plan

The financial plan chapter outlines SCDOT's financial planning efforts in funding its pavement and bridge assets, safety, capacity, MPO/COG, TSMO, and specialty programs, including documenting current and future financial capacity. SCDOT's financial goal is to provide its customers a safe and quality transportation system while maintaining financial and asset sustainability.

6.1 Development of Financial Plan

SCDOT develops its asset management financial plan for a ten-year period by state fiscal year. Staff from Finance and Administration and Program Controls provide financial data inputs over this period, which consider known and reasonably available revenue and project costs based on the agency's investment strategies. The current structure of SCDOT's 10-Year budget and investment strategies is to allocate funding by investment area, such as safety and Interstate System Upgrade, and pavement and bridge subsystems.

Annual funding allocations for each pavement system are designed to achieve specific targets outlined in the agency 10-Year Plan as determined by the pavement condition/ funding model. Funding for preservation is currently set at ten percent, with the remaining funding allocated for rehabilitation, and reconstruction work types based on the percentage of assets eligible for that type of work determined by asset condition. Pavement programs are managed on a network basis. The interstate pavement program is prioritized on a statewide basis. For the other pavement networks, funding is allocated on a county-by-county basis, determined by the counties' share of the statewide pavement assets eligible for preservation, rehabilitation, or reconstruction from the agency's annual budget. Bridge funding is allocated annually based on the agency's financial projections to meet its strategic bridge program goals. All projects for the various program categories are prioritized using objective and quantifiable criteria and presented to the SCDOT Commission for approval. More information about the processes is included in Appendices B, C, and D, and a breakdown of funding allocation by pavement subsystem and work type is included in Chapter 7.

6.2 Funding Sources

SCDOT receives funding from both the State and federal government in financing eligible transportation programs. Each fund category has restrictions, and the governing authority of the agency over these funds varies accordingly. Certain funding the agency receives is on a recurring basis, such as revenue from state and federal gas taxes. Other funding the agency receives is through one-time appropriations enacted in law by the State or federal government. The following are the main funding sources that support the management of the South Carolina highway system:

- **State Highway Fund (SHF):** the SHF is supported largely by state motor fuel taxes, also known as the highway user fee or gas tax, which in the recent past has generated approximately $500 million annually from a combination of gasoline and diesel fuel sales. The gas tax remains the most common source of revenue for the SHF, historically accounting for approximately one third of the SHF revenue. The SHF is also supported by revenue from the Department of Motor Vehicles through provisions in Act 275 of 2016, which amount to approximately $86 million annually.

- **Infrastructure Maintenance Trust Fund (IMTF):** Act 40 of 2017 requires SCDOT to establish the IMTF. The IMTF must be used exclusively for the repairs, maintenance, and improvements to the existing transportation system. The new fund consists of the incremental increase in the gas and diesel tax of $0.02 per year through FY 2023, when it reaches $0.12, fees from vehicle purchases, and certain fees collected by the Department of Motor Vehicles.

- **Non-Federal Aid Highway Fund (NFAHF):** the NFAHF is used strictly for maintenance and preservation purposes on roadways that do not qualify for federal funds. The NFAHF is primarily financed by revenue from the Department of Motor Vehicles, an electric power tax, and gas taxes. In FY 2021, the NFAHF provided approximately $54.8 million for maintenance and preservation of non-federal aid roads.

- **Federal-Aid Highway Program (FHP):** the FHP funds programs that support federal aid eligible transportation goals, which includes specific highways and activities allowed by federal legislation. Not all state-owned highways are eligible to benefit from federal funds and in South Carolina, about half of the highways maintained by SCDOT are eligible. Federal funds require a match, which is typically 10 or 20 percent. Federal funds are provided on a reimbursement basis. As the SCDOT must spend state dollars first, then it is reimbursed, minus the match. SCDOT projects to receive $ 1.016 billion from the Federal- Aid Highway Program for use to program on its assets in 2021 an expected 34.6% increase from FY 2020.

- **General Fund:** in addition to the above funds, SCDOT also periodically receives on-time appropriations as stipulated by the South Carolina Legislature for specific projects or activities. The legislature has approved $120 million per year for a 5-year period to provide a match to fully capture the IIJA funds available to South Carolina.

- **Emergency Management Grant:** Additional one-time grants include federal emergency grants for recovery programs during natural disasters. These funds require a state match; however, the percentage of match can be reduced.

In addition to the above funding sources, SCDOT oversees and often administers the “C-Fund,” which historically has primarily been funded by a portion of the state gas tax and is distributed by formula to South Carolina’s 46 counties. By law, per Act 40 of 2017, counties must now spend at least one-third of their C-Fund allocations on the state highway system for construction, improvements, and maintenance; however, in practice, the counties collectively spend roughly half of their C-Fund allocations on the state highway system. For FY 2022-23, the C-Fund is forecasted to receive approximately $380 million in total. This amount stems from the normal apportionment (approximately $110 million), donor bonus (approximately $20 million), and a $250 million non-recurring earmark.

6.3 Current Funding Levels

During the 2018 Legislative Session Act 40, (the "Roads Bill) was adopted which has provided the Department with the first sustainable and significant increase in revenue in 30 years. The motor fuel has increased by 2-cents per year which began in 2018, and continues to increase by 2-cents per year for the next 6 years for a total of 12-cents by July 2022. In addition to motor fuel user fees, Act 40 increased a variety of motor vehicle fees, the maximum sales and use tax and created an infrastructure maintenance fee. At full implementation, the 2018 Roads Bill will add an estimated additional $600 million annually. With the Legislature's foresight the Roads Bill has diversified the revenue stream for the Department (See Figure 6-1) and allowed the agency to remain strong during and through the pandemic, and not be over reliant on federal funds. In 2021, SCDOT programmed approximately $2.5 billion for its assets, of which 66% came from the Infrastructure Maintenance Fund and the Federal-Aid Highway Program. Table 6-2 outlines the funding sources and associated amounts SCDOT programmed for its assets for the 10-Year Plan.

The current revenue projections include approximately a 34.6% increase in federal funding for surface transportation over the next five years from the passing of the Infrastructure Investment and Jobs Act (IIJA).

On the following page in Figure 6-3 (Current as of March 1, 2022), the chart illustrates funding for the construction program has increased since the passage of the Roads Bill with more work under contract and work completed. This has translated to more work on the street with a near tripling of work over the last five years. For a full description of 10-Year projected revenues for the asset management program, see Table 6-1.

Figure 6-4 shows clarity of the Infrastructure Maintenance Trust fund and other SCDOT funds and distinguishes program expenditures by category of external payments and SCDOT allocated resources (DOT Labor, equipment and lab fees).

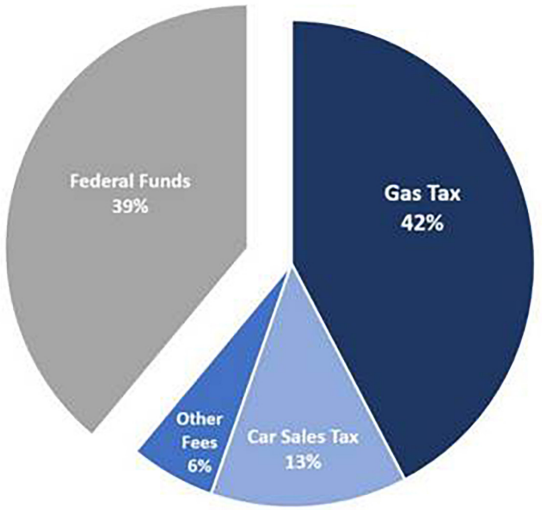


Figure 6-1. Diversified Revenue Stream

The Legislature's foresight enabled:

- ✓ **The road and bridge program to remain strong during and through the pandemic.**
- ✓ **Ample planning to allow SC to be extremely well-positioned to be able to deploy additional projects.**

Figure 6-3. Historical Trend of Construction Program

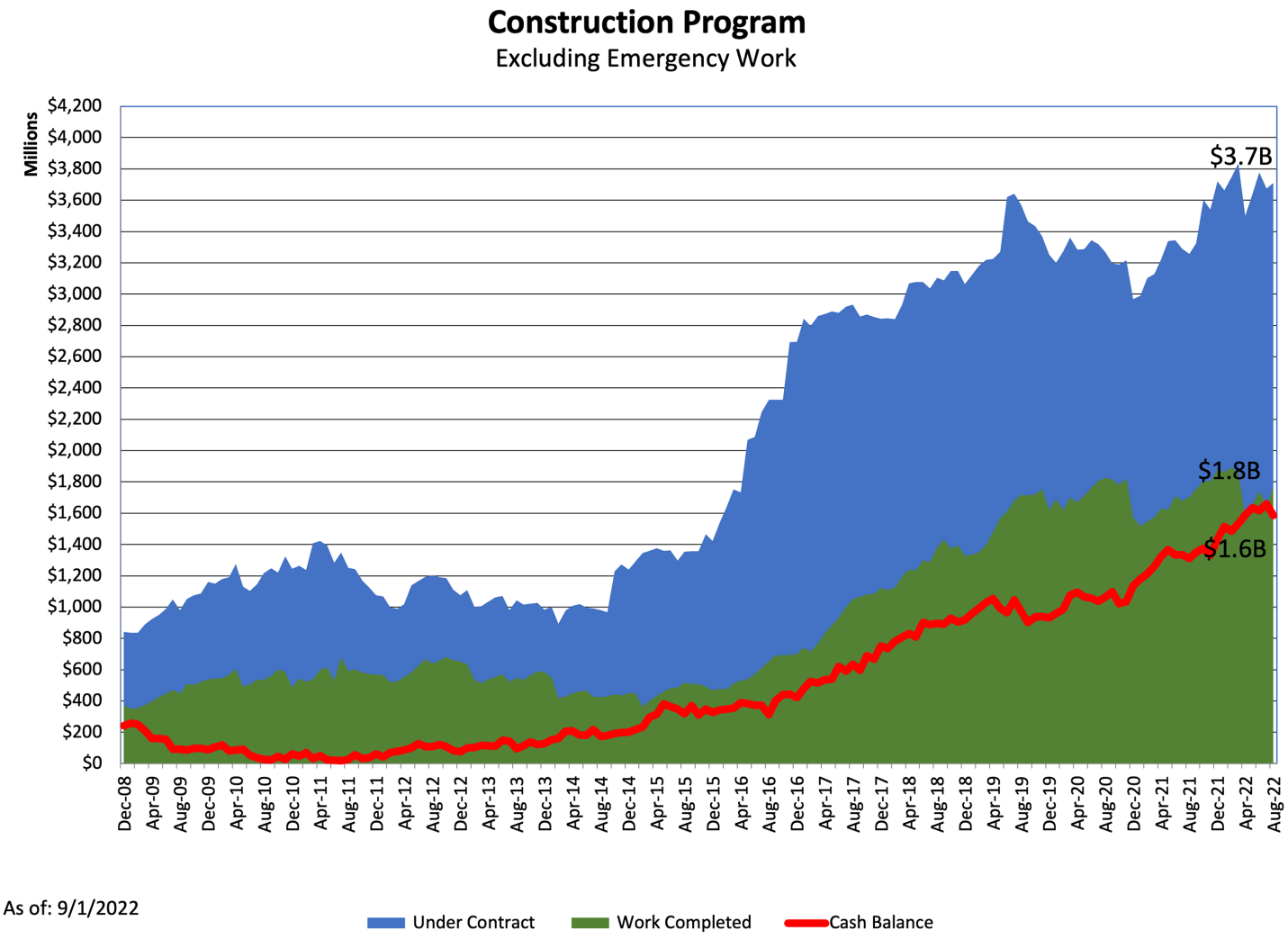
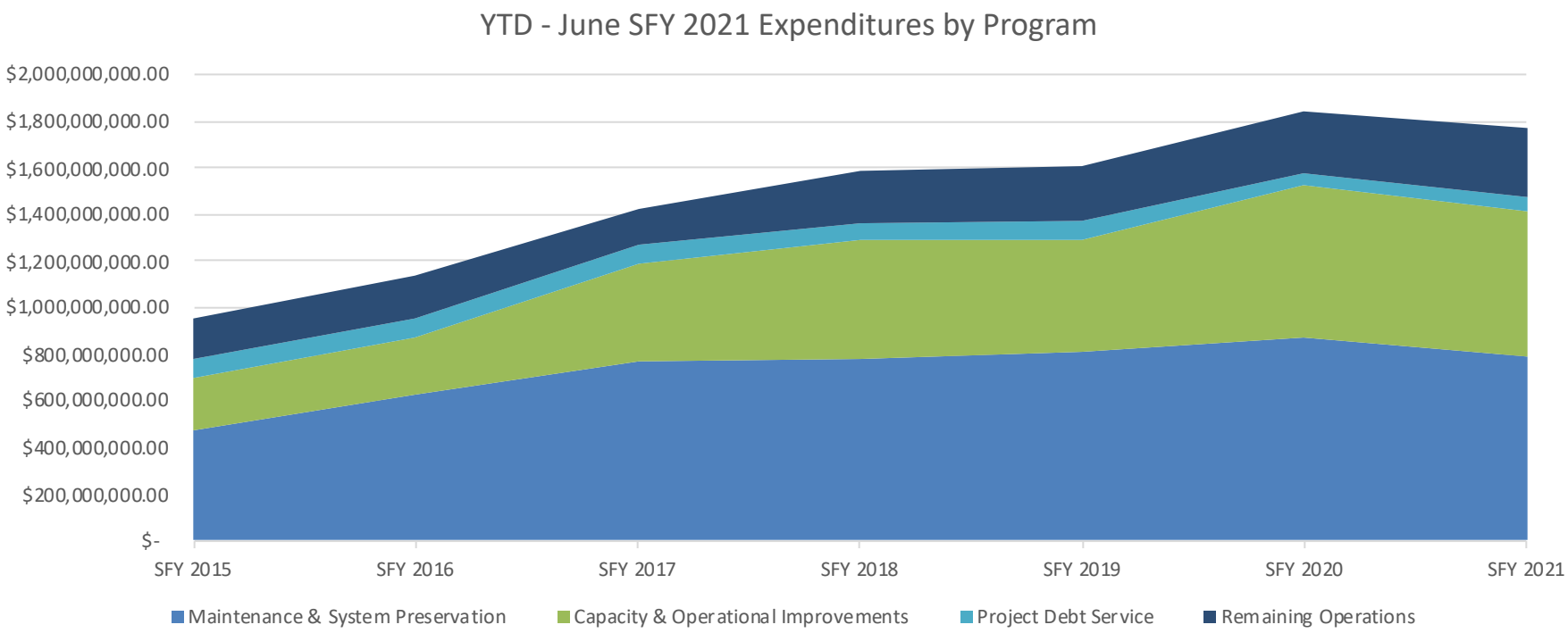


Figure 6-4. SCDOT Total Maintenance & System Preservation Expenditures



6.3.1 Preventative Maintenance Tax Credit

Act 40 of 2017 includes a preventative maintenance tax credit for South Carolina residents that automatically sunsets after calendar year 2023 unless the Legislature extends it in law. SCDOT projects the value of the credit to be approximately $114 million per year. If the credit were to sunset, the SCDOT Commission, based on SCDOT staff recommendation, has directed that the additional revenue be invested on the interstate system. These investment strategies align with SCDOT's Strategic Plan and the agency intends to use asset management and whole life management principles to select projects if the additional reoccurring funding were to become available.

6.4 Investment in Highway Infrastructure

Highway maintenance in South Carolina is under the Division of Maintenance, which has the responsibility of developing and implementing maintenance policies for roads and bridges under the jurisdiction of SCDOT. The office ensures the State's bridges and pavements are functionally capable to handle traffic and maintains and improves the quality of bridges and pavements by doing preventative, routine, and reactive maintenance, such as patching potholes, cleaning catch basins, regrading shoulders, and performing vegetation management.

In addition to routine highway maintenance, SCDOT invests in the performance of its transportation system through treatment programs, such as preservation, rehabilitation, or reconstruction of pavements and bridges, and by adding capacity to its interstate system. Other investments in pavement and bridge assets include investments related to safety, funding distributed to MPOs and COGs, Transportation System Management Operations (TSMO), and a variety of Specialty Programs. Figure 6-5 and Table 6-1, represents SCDOT's 10-Year Plan program for the fiscal year 2022 through 2032.

Figure 6-5. Historical Trend of Construction Program

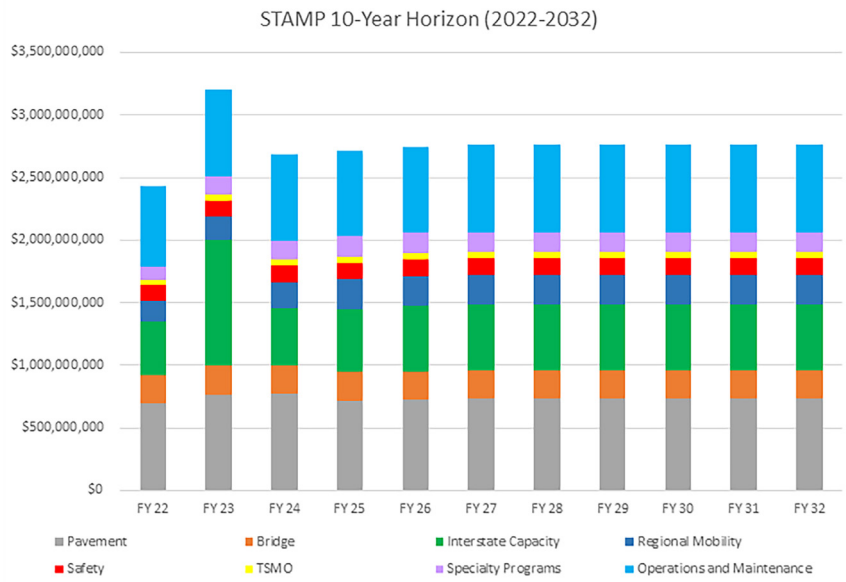
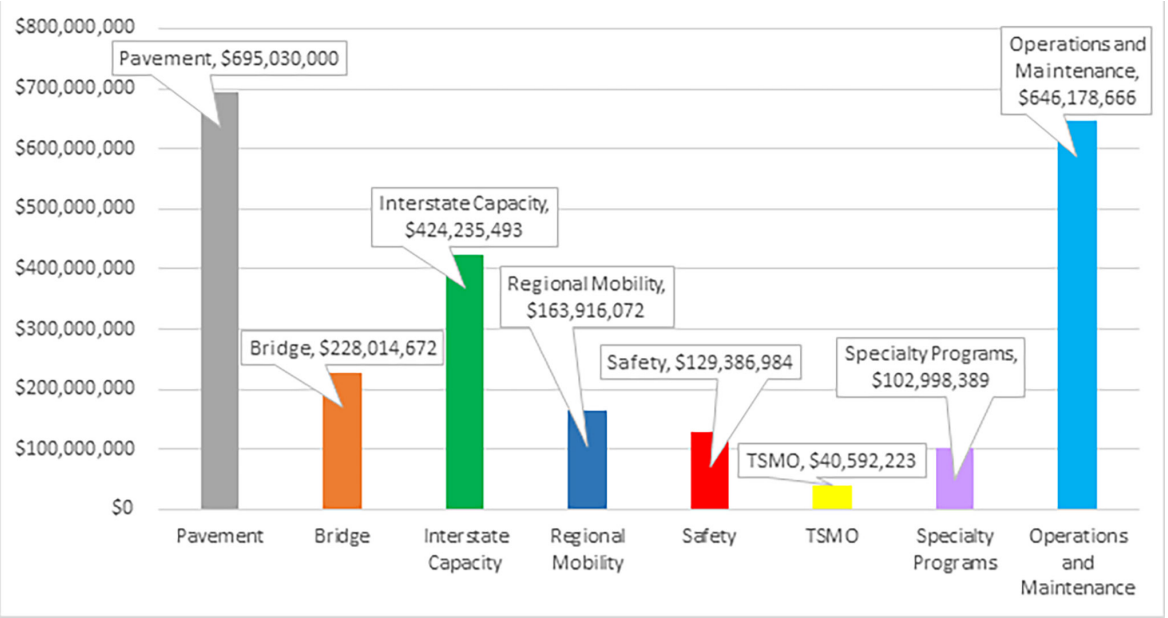


Table 6-1. Historical Trend of Construction Program

Program Category	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32
Pavement	$695,030,000	$768,969,001	$774,620,582	$719,000,000	$726,000,000	$734,000,000	$734,000,000	$734,000,000	$734,000,000	$734,000,000	$734,000,000
Bridge	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672	$228,014,672
Interstate Capacity	$424,235,493	$1,001,190,210	$450,525,950	$501,096,034	$519,327,810	$522,183,031	$522,183,031	$522,183,031	$522,183,031	$522,183,031	$522,183,031
Regional Mobility	$163,916,072	$188,000,000	$213,000,000	$238,000,000	$238,000,000	$238,000,000	$238,000,000	$238,000,000	$238,000,000	$238,000,000	$238,000,000
Safety	$129,386,984	$131,525,198	$133,152,105	$134,811,550	$136,504,183	$136,504,183	$136,504,183	$136,504,183	$136,504,183	$136,504,183	$136,504,183
TSMO	$40,592,223	$46,392,126	$47,299,519	$48,225,059	$49,169,111	$49,169,111	$49,169,111	$49,169,111	$49,169,111	$49,169,111	$49,169,111
Specialty Programs	$102,998,389	$145,480,342	$149,224,933	$158,612,091	$159,472,138	$153,793,794	$153,793,794	$153,793,794	$153,793,794	$153,793,794	$153,793,794
Operations and Maintenance	$646,178,666	$688,518,996	$689,605,841	$684,085,801	$690,509,159	$696,996,750	$696,996,750	$696,996,750	$696,996,750	$696,996,750	$696,996,750

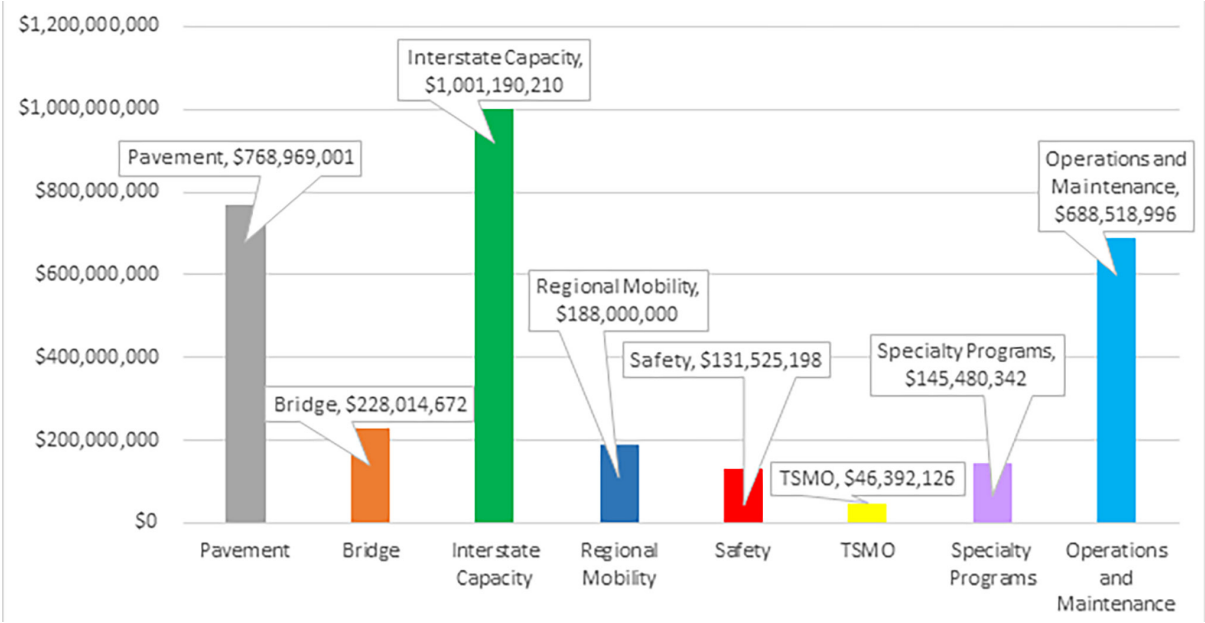
Figure 6-6. FY 2022 Asset Management



FY 2022 Pavement Program Budget (in Millions)	
Interstates	$203
Non-Interstate NHS	$90
Non-NHS Primary	$180
Federal Aid Secondaries	$140
Non-Federal Aid Secondaries	$82

FY 2022 Bridge Program Budget (in Millions)	
Interstate/NHS	$58
Federal Aid Non-NHS	$30
Non-Federal Aid (Off-System)	$27
Bridge Reactionary Maintenance	$19
Bridge Repair	$45
Bridge Maintenance	$23
Bridge Inspection	$25

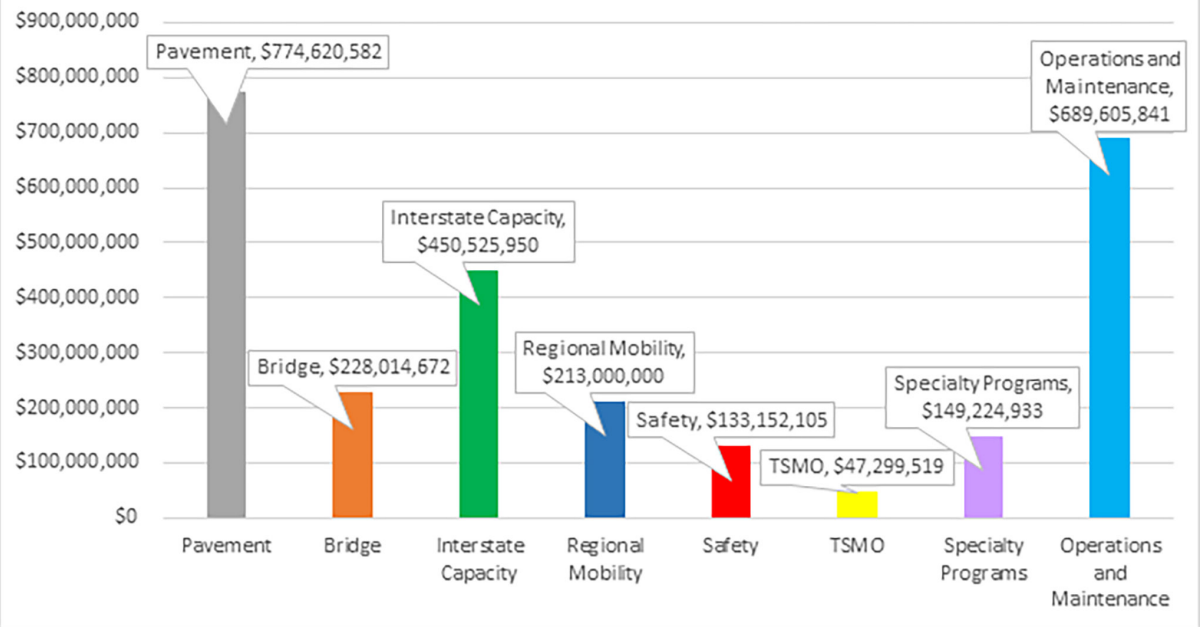
Figure 6-7. FY 2023 Asset Management



FY 2023 Pavement Program Budget (in Millions)	
Interstates	$208
Non-Interstate NHS	$98
Non-NHS Primary	$240
Federal Aid Secondaries	$140
Non-Federal Aid Secondaries	$82

FY 2023 Bridge Program Budget (in Millions)	
Interstate/NHS	$58
Federal Aid Non-NHS	$30
Non-Federal Aid (Off-System)	$27
Bridge Reactionary Maintenance	$19
Bridge Repair	$45
Bridge Maintenance	$23
Bridge Inspection	$25

Figure 6-8. FY 2024 Asset Management



FY 2024 Pavement Program Budget (in Millions)	
Interstates	$212
Non-Interstate NHS	$100
Non-NHS Primary	$240
Federal Aid Secondaries	$140
Non-Federal Aid Secondaries	$82

FY 2024 Bridge Program Budget (in Millions)	
Interstate/NHS	$58
Federal Aid Non-NHS	$30
Non-Federal Aid (Off-System)	$27
Bridge Reactionary Maintenance	$19
Bridge Repair	$45
Bridge Maintenance	$23
Bridge Inspection	$25

6.5 Future Funding Levels

This section presents the program level revenue projections for SCDOT's transportation assets. The projections are based on historical revenue trends for both state and federal appropriations, inflation numbers, and forecast revenue from Act 40 in May 2017.

With the passage of Act 40 of 2017, revenue from the gas tax is expected to increase over the 10-Year period by approximately 75%, as the gas tax will increase in 2-cent annual increments from $0.1675 to $0.2875 by July 1, 2022.

Along with increasing the fees collected for vehicle purchases from a ceiling of $300 to $500 and price changes to registration fees, the Act has diversified and increased annual revenues for SCDOT's assets by approximately $600 million once fully phased in beginning in FY 2023 compared to the FY 2017 funding level. Table 6-2 represents the Department's asset management revenue forecast for FY 2022 to FY 2032 and also includes the additional IIJA Federal Funding. SCDOT projects $21.5 billion over the 10-Year period will be available to program for its transportation assets.

Table 6-2. Forecasted Asset Management Program Funding Level Sources FY 2022-2032 (In Millions)

Revenue Source	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	10-Year Average
Federal Aid Program	$1,018.81	$996.79	$1,014.59	$1,032.75	$1,051.34	$10.53.13	$10.53.13	$10.53.13	$10.53.13	$10.53.13	$**10.53.13**	**$1,022.86**
State Highway Fund	$651.89	$1,278.57	$782.83	$787.42	$792.09	$796.77	$796.77	$796.77	$796.77	$796.77	**$796.77**	**$824.86**
Infrastructure Maintenance Fund	$674.71	$701.33	$753.30	$760.26	$767.30	$774.43	$774.43	$774.43	$774.43	$774.43	**$774.43**	**$754.86**
Non-Federal Aid Fund	$53.79	$54.00	$54.00	$54.00	$54.00	$54.00	$54.00	$54.00	$54.00	$54.00	**$54.00**	**$53.98**
General Fund	$51.13	$43.18	$34.20	$25.21	$16.23	$7.24	$7.24	$7.24	$7.24	$7.24	**$7.24**	**$19.40**
Total	**$2,467.49**	**$2,557.03**	**$2,558.90**	**$2,582.11**	**$2,605.85**	**$2,473.01**	**$2,473.01**	**$2,473.01**	**$2,473.01**	**$2,473.01**	**$2,473.01**	$2,509.95
2023 includes one time $453.50 million in ARPA and $136.77 million in Rural Interstate Funds in the State Highway Fund. 2023 forward includes recurring $120 million IIJA match funds												

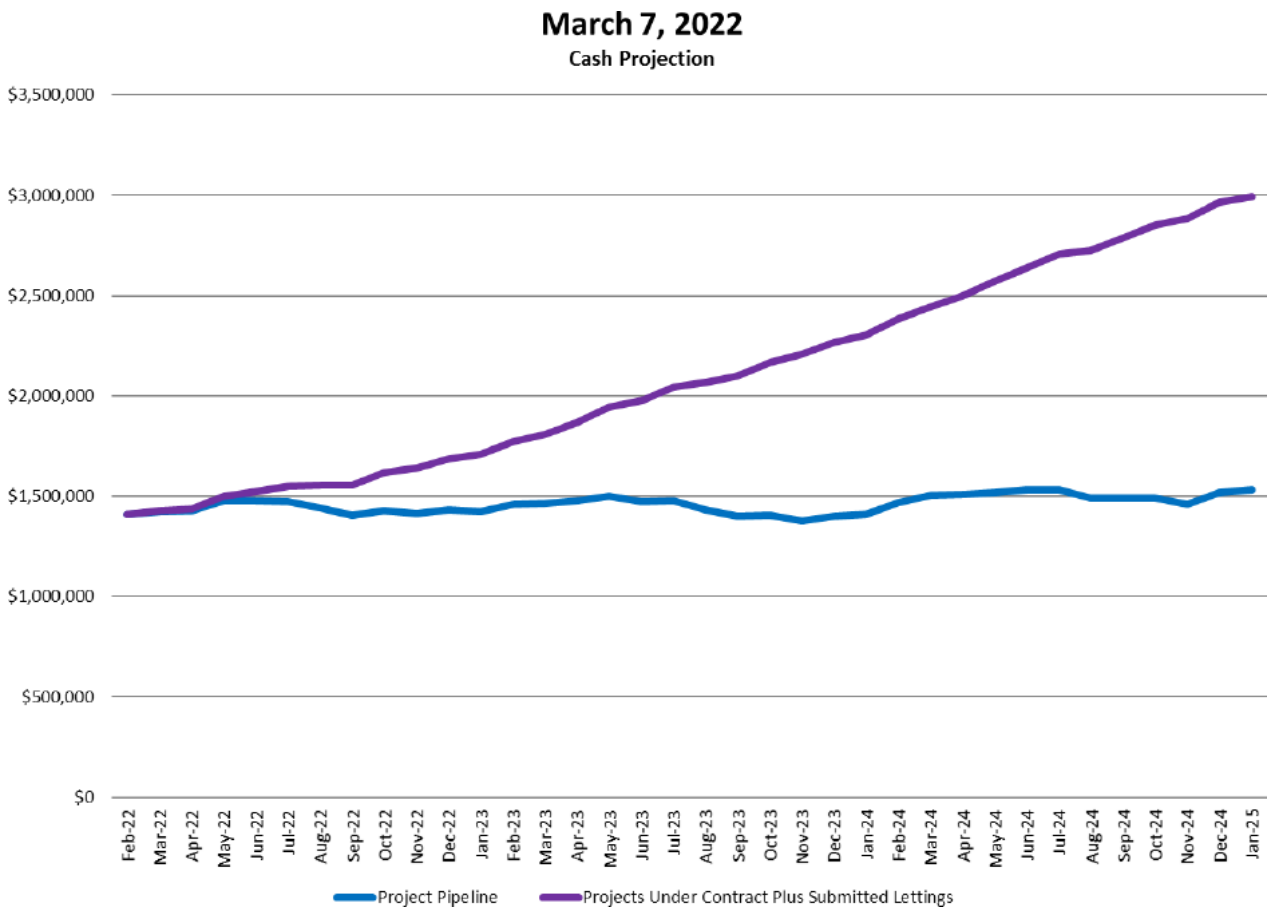
[1] Excludes $57 million in FY 2023 and $114 million annually thereafter based on the potential sunset of a vehicle preventative maintenance tax credit.

6.6 Cash Flow Monitoring

SCDOT leadership holds regular Program and Resource Analysis Meetings (PRAM) to review cash flow projections, monitor the delivery of special projects, and the Department's ability to meet its future financial obligations. Figure 6-9 shows the cash flow projection for projects under contract and in the development phase.

Projects are trending normally based on historical data. These meetings provide timely and relevant information to the Secretary and senior leadership that facilitates communication regarding resource utilization and to ensure that the agency is on track to meet asset condition targets. These meetings also provide SCDOT the opportunity to enact changes to resource allocation in a timely manner in order to meet program goals. Additionally, the Agency created a Chief of Financial Planning (CFP) positon with the sole responsibility of ensuring the effective management of the transportation programs through responsible short and long-term planning of all financial resources including cash; federal, state, and local revenues; and bond proceeds, in order to ensure all activities remain in budget.

Figure 6-9. Cash Flow Projection Curves



Projects Under Contract Plus Submitted Lettings include the February, March & April 2022, Lettings that either bids have been received, contracts have been advertised, or PS&E packages are being prepared

Project Pipeline includes Lettings beyond April 2022, and STIP Placeholder estimates for planned programs where individual projects do not yet exist such as Resurfacing.

CHAPTER 7 INVESTMENT STRATEGIES

7. Investment Strategies

7.1 Overview

This chapter outlines SCDOT's investment approach to allocating resources to its assets. The investment strategies focus on areas important for SCDOT and align with the agency's strategic goals. The strategies result in statewide ten-year targets for SCDOT's safety, pavement, bridge, and interstate mobility programs (See Appendix I). This chapter incorporates federally-required measures and targets where appropriate, but primarily focuses on state- specific transportation asset management targets.

7.2 Guiding Principles of SCDOT Investment Strategies

SCDOT's investment strategies are shaped by the earlier chapters of the STAMP to develop a set of strategies that result from evaluating various level of funding to achieve targets for asset condition and system performance effectiveness at a minimum practicable cost while managing risks. The investment strategies incorporate the guiding principles of the Strategic Plan and make progress towards national goals.

SCDOT's Strategic Plan has five stated goals SCDOT Strategic Plan Overview :

- Improving safety programs and outcomes in high-risk areas.
- Maintaining and preserving existing transportation infrastructure.
- Improving program delivery to increase the efficiency and reliability of the road and bridge network.
- Providing a safe and productive work environment for SCDOT employees.
- Earning public trust through transparency, improved communications, and audit compliance.

The seven National Goals, which are in harmony with SCDOT's goals, are:

- Safety – To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- Infrastructure Condition – To maintain the highway infrastructure asset system in a state of good repair.
- Congestion Reduction – To achieve a significant reduction in congestion on the National Highway System.
- System Reliability – To improve the efficiency of the surface transportation system.
- Freight Movement and Economic Vitality – To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets and support regional economic development.
- Environmental Sustainability – To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- Reduced Project Delivery Delays – To reduce project costs, promote jobs and the economy and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

The goals of the Department's Strategic Plan form the basis of the guiding principles of SCDOT's Investment Strategies, which focus on the maintenance, preservation, and safety of the existing transportation system. Directing investments based on a hierarchy of highway systems and priority networks, integrating risk-based prioritization, improving safety of the roadways, advancing lifecycle cost in investment programming, and enhancing mobility. The application of these principles is supplemented by accurate and quality data, inputs from experts, and collaboration among local government representatives. In developing its Investment Strategies, SCDOT considers the results of its life cycle planning efforts and internal risk assessment with the objective of closing its performance gap and moving toward a state of good repair for its assets. Through these processes, SCDOT programs suitable investment strategies that drive progress towards performance targets.

7.3 Selection of Investment Strategies

A key step in a risk-based asset management business approach is selecting investment strategies that link agency goals and system performance targets with SCDOT's risk assessment. SCDOT's objective in undertaking transportation asset management is to provide a properly maintained and safe transportation network at a minimum practicable cost over the life of its assets. As such, SCDOT has identified uncertainties that threaten the achievement of its objectives and mitigates those associated risks while taking advantage of arising opportunities. The agency's risk assessment outlines the threats to which SCDOT is exposed, as well as the number of risks, types of risk, and potential impacts of the risk events.

SCDOT considers tradeoff analysis as an important component in selecting investment strategies. The tradeoff analysis component enables SCDOT to evaluate the effectiveness of each strategy on the performance of the system and the cost involved in foregoing other investment strategies. This is done by presenting various alternative funding scenarios for consideration and the corresponding projected system condition. These strategies are further shaped by performance targets, which consider agency and national goals, funding constraints, and the agency's risk profile.

Chapter 8 of the STAMP includes further discussion on the agency's action plan.

7.3.1 Safety Investment Strategies

While the majority of SCDOT's STAMP addresses its pavement and bridge assets, it is also important to note other priorities of the agency. Historically, South Carolina has had one of the highest traffic fatality rates in the nation. Most recently, in 2019 and 2020, South Carolina was worst in the nation for the number of deaths per 100 million vehicle miles traveled, with 1.74 and 1.97 deaths respectively. The rate in 2020 is 57 percent higher than the national rate and 38 percent higher than our neighboring state of Georgia. In total, approximately 1,100 people die on South Carolina public roads annually. Many of these fatalities occur on the State's rural road system, which encompasses many of the state-maintained roads located within rural areas that link communities. According to the most recent data as of publishing, 30 percent of the rural traffic-related fatalities and serious injuries occur on just five percent of SCDOT's system.

With the additional funding available from Act 40 of 2017, SCDOT is directing $50 million annually through FY 2032 into its Rural Road Safety Program, a plan that was first presented to the Transportation Commission in June of 2017. With the funding influx, SCDOT initially will be targeting nearly 1,000 miles of non-interstate rural roads with safety solutions particularly tailored for those corridors based on crash data compiled by the Department's Traffic Engineering Office. More recently, SCDOT increased that target to 1,250 miles annually. Those safety solutions include rumble strips, raised pavement markings, highly reflective signs, wider pavement markings, guardrail, specialized pavement treatments, wider shoulders, paved shoulders, wider clear zones adjacent to roadways, and relocating drainage ditches further away from the roadways.

Other safety emphasis areas for the agency include limiting roadway departures, improving intersections and other high-risk locations, and protecting non-motorized roadway users. SCDOT's 10-Year Safety Targets are in Chapter 3.4.

7.3.2 Pavement Investment Strategies

Investment in pavement assets reflects a whole life management approach and emphasizes the strategies listed below. The strategies listed here are not in an order of implementation priorities. Rather, SCDOT selects and implements a combination of strategies based on system conditions, funding, and risk. The current policy of SCDOT is to allocate dedicated levels of funding to the different pavement strategies.

- Pavement preservation: SCDOT is committed to preserving and extending the service life of the existing transportation network. Under the pavement preservation investment strategy, emphasis is placed on performing preventive maintenance activities that keep "good" roads "good" for an extended period of time. These activities involve the timely application of lower-cost surface maintenance treatments that delay pavement assets declining from a state of good repair into a state that will require rehabilitation or reconstruction. Preservation of the existing system and keeping a majority of the NHS in a good condition is a priority of SCDOT. Pavements in good condition require relatively low maintenance costs; consequently, requiring minimum resources to maintain the pavements over their remaining service life while the pavements remain in good condition. Based on research, for every dollar spent on preservation, SCDOT saves six to ten dollars that would have been spent on rehabilitation or reconstruction in the future. Table 7-1 lists the average pavement treatment costs per lane mile for the most common preservation, rehabilitation, and reconstruction treatments used by SCDOT.
- Pavement rehabilitation: SCDOT is committed to utilizing strategies that enhance pavements that have structural or functional deficiencies. The rehabilitation strategy is implemented to enhance pavement structure and restore heavily deteriorated pavements. SCDOT adopts the rehabilitation strategy to extend the service life of pavements that have moved beyond the minimum threshold for preservation. Restoration, resurfacing, and recycling rehabilitation strategies are implemented to modernize and extend the pavements' service life and return the pavements to a state of good repair.
- Pavement reconstruction/replacement: SCDOT will utilize the reconstruction strategy for roads with heavily deteriorated pavement structures. Reconstruction involves the replacement of the entire existing pavement structure with an equivalent or increased pavement structure. Pavement reconstruction is the most expensive of the pavement investment strategies. For the purpose of effective utilization of resources, some roads may be strategically allowed to deteriorate to this level for reconstruction at a later date, especially if there are other planned construction activities for the roads, such as widening projects or safety improvements, which reduce overall cost by eliminating duplication of certain construction activities.
- Routine Maintenance: Routine maintenance as defined by the AASHTO Subcommittee on Maintenance is work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service. This includes pavement work such as patching potholes and broken pavement edges to minor leveling and strengthening of localized areas.

Table 7-1. Average pavement treatment costs per lane mile for the various preservation treatments used by SCDOT and for rehabilitation and reconstruction, summarized by federal work type.

2022 Pavement Improvement Program (Award Amounts)		
Treatment	**LM Average**	**SY Average Cost**
Chip Seal (Preservation)	$24,976.67	$3.55
Crack Seal (Preservation)	$2,644.21	$0.38
Thin Lift (Preservation)	$69,951.48	$9.94
Micro Surface (Preservation)	N/A	N/A
Full-Depth Patch (Preservation)	$12,402.94	$1.76
All Preservation	**$23,216.72**	**$3.30**
Heavy Rehabilitation	$189,605.24	$26.93
Rehabilitation	$125,670.43	$17.85
All Rehabilitation	**$135,401.15**	**$19.23**
Cement Modified Recycled Base (CMRB) Reconstruction	$177,845.30	$25.26
Full Depth Asphalt (FDA) Reconstruction	$614,341.49	$87.26
Roller Compacted Concrete Reconstruction	$661,733.40	$94.00
Reconstruction	**$189,227.65**	**$26.88**
***** These are average contract cost based on all of the included pay items for each specific treatment. LM amounts based on 12' lane		
Values are a weighted average of 2022 Pavement Improvement and Preservation Programs		

7.3.3 Bridge Investment Strategies

The Bridge Program at SCDOT has been revised after results of the Load Rating Effort was completed in 2021, and an additional $69 million in annual funding through the passage of the IIJA. The results validated the inspection program, reprioritized bridge projects and highlighted additional bridge replacement and rehabilitation needs. Expanded information about the Bridge Management Program and results of the Load Rating Effort is found in Chapter 4.5.

With the agency's needs-based approach, bridge investment strategies include a combination of routine maintenance, preservation, rehabilitation, and replacement activities. The most common routine maintenance activities include concrete spall repairs, repairs to bridge rail, cleaning of bearing assemblies, pile repairs, debris removal, and cleaning drainage weep holes. Preservation strategies include painting, deck patching, and sealing expansion joints. Rehabilitation activities include deck replacements, bearing replacements, and other major repairs. This approach enables SCDOT to address structurally deficient bridges while ensuring that bridges in good condition are effectively preserved to delay the higher cost of rehabilitation or replacement. SCDOT has revised the Bridge Program since the 2018 STAMP was published, the new program implements investment strategies with the objective of achieving a more balanced approach to extend the life of the State's bridge system:

- **Bridge (Rehabilitation) Reactionary Maintenance:** SCDOT staff has dedicated $19.3 million towards the reactionary maintenance fund, which will addresses problems as they arise in real time. Typically these are systems that have progressively deteriorated over time and an event creates a problem that needs to be addressed quickly. These events are not typically emergency events such as federal or state level declaration emergency
- Bridge Preservation: $23.5 million will be set aside annually for preservation activities. The life of a bridge can be extended significantly and kept off the replacement list by maintaining the decks, superstructure, joints and other systems in good working order.
- Inspection and Compliance Programs: The third "non-replacement" program is the inspection and compliance program which will receive $25 million annually. Bridge inspections are performed at least every two years in accordance with NBIS requirements and those inspection results are a significant component in creating an accurate load rating. Recent inspections could cause a bridge to be reprioritized and addressed through repairs or replacement.
- Bridge Repair and Preventive Maintenance: With the completion of the Load Rating Effort a reprioritized bridge list was completed blending the original 465 bridges with the new priorities, details of how that list was prioritized can be found in Chapter 4.5. The agency evaluated each bridge for repair/rehab versus replacement, determined the delivery method, bundling opportunities and project priorities. For a bridge to be selected for repair/rehab over a replacement it must satisfy several criteria. First the repairs must be such that the load restriction is removed and the bridge has a minimum remaining lifespan of 25 years. Second, the bridge after repairs can no longer be rated as "poor" after inspection. The repair/ rehab must slow the deterioration. Strategies such as pile wraps, crutch bents, beam repairs, deck rehabs will be used to strengthen bridges while also incorporating bridge preservation activities such as paint and joint work into the scope.
- Individual Project Specific STIP Replacements: The final program for bridge investment is full replacement. The Preconstruction group in the agency is charged with delivering the bridge replacements using in-house staff as well as consultants from the prioritized bridge list.

Bridge Program (Award Amounts)	
Treatment	Average Cost
Concrete Overlay (Latex) (Preservation)	$2903/CY
Concrete Overlay (Epoxy) (Preservation)	$53/SY
Concrete Class 4000 for Full Depth Deck Patching (Preservation)	$6597/CY
Partial Depth Patching of Existing Deck (Preservation)	$654/SY
Cleaning and Painting Existing Structural Steel (Preservation)	Lump Sum Bids ($35k to $2.263 Million) $882,231 Average Lump Sum

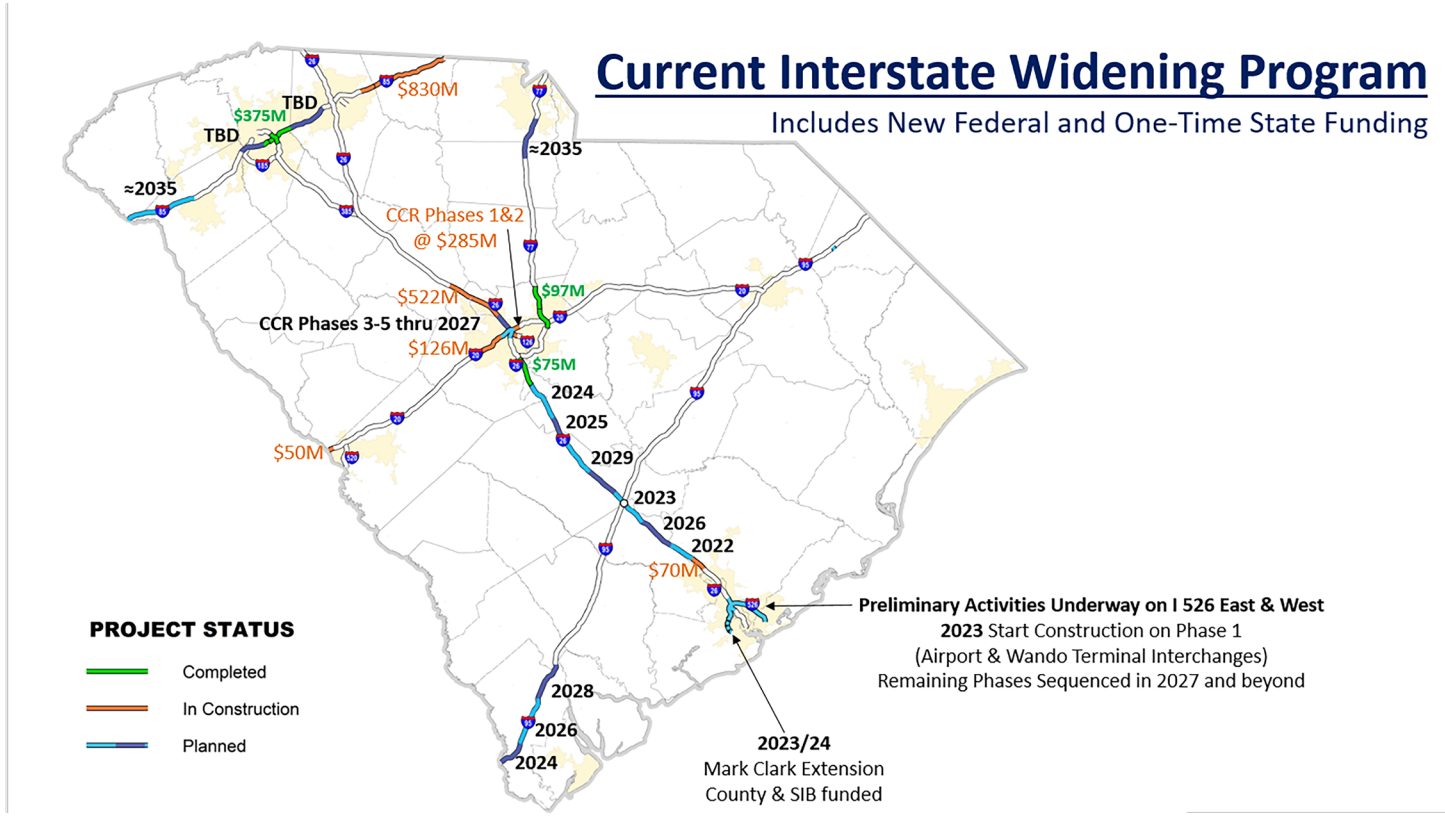
*These are average contract cost based on 3 year statewide weighted average prices

* The Bridge Program has been restructured and additional data will be available for other work types in future revisions of the STAMP

7.3.4 Interstate Capacity Investment Strategies

The interstate system within South Carolina carries 29% of the annual traffic in the State, but consists of just 4% of the state-maintained system by mileage. To help relieve congestion, reduce delay, and prevent freight bottlenecks, SCDOT is targeting certain interstate corridors for widening over the next 10 years. This includes the Rural Interstate Freight Corridor Mobility Improvement Program that was approved by the SCDOT Commission in October 2018. In addition to solving the above issues, this strategy will improve pavement conditions on the interstate as existing pavements will be resurfaced when lanes are added. SCDOT has targeted 100 + centerline miles of interstate to be widened through 2029. Figure 7-1. shows the current interstate widening program with estimated cost and schedule and includes the new federal funding. Beyond 2029 The Offoce of Planning considers future interstate widening projects and urban interchanges that need to be addressed as funding becomes available.

Figure 7-1. Current Interstate Widening Program



7.4 The Role of Performance Targets In Investment Decision Making

Performance-based investment decision-making is a strategic approach SCDOT uses to link department goals, objectives, and risks in allocating resources effectively. Performance-based resource allocation is effective with the use of well-defined performance measures and the establishment of practical and achievable performance targets. Performance targets are vital elements in the SCDOT's performance and risk-based asset management program. SCDOT uses 10-Year projected performance conditions as benchmarks in evaluating progress made from baseline performance after the implementation of an investment strategy. These state targets are used to assess the effectiveness of selected investment strategies. The use of targets in performance management allows for accountability to decision makers and the public by communicating the effectiveness of investment actions.

SCDOT's asset performance targets are aligned with performance measures to ensure that resources are utilized efficiently and investments are prioritized effectively, such as percent of pavement miles or bridge structures in "Good" or "Poor" condition. In effect, performance targets enable SCDOT to make investment recommendations based on objective, data-driven results by tracking asset condition performance measures.

SCDOT's performance measures for pavements were established prior to FHWA's final rulemaking in May 2017, and are based on agency- specific performance measures, which do not align with the promulgated national measures. SCDOT uses the pavement quality index (PQI) to determine whether a pavement is in good, fair, or poor condition. The national measures are based on rideability, rutting, cracking percentage, and faulting, all of which are components of PQI. However, using the federal metrics does not produce the same results of good, fair, and poor. Expanded view on PQI and Federal metrics for pavement are found in Chapter 2.3.3. For bridge assets, SCDOT tracks conditions using the FHWA NBI rating criteria, see Chapter 2.4.2.

MAP-21 has given State DOTs the flexibility to establish their own targets. Based on this flexibility, SCDOT has established fiscally constrained targets, also referred to as the 10-Year performance estimates, which are based on projected state and federal funding for the next 10 years. The establishment of these targets is driven by unique factors used to assess system performance over a selected timeframe defined by the STAMP. As a result, the targets are dynamic and may evolve over the next ten years.

7.5 System 10-Year Projected Performance Outcome

SCDOT's approach to managing its system involves the development of investment strategies that optimize system performance with the existing and future budget allocations. SCDOT investigates different investment scenarios and recommends target-achieving strategies or options that minimize the agency's risks at the lowest practical cost. The results of this scenario analysis enables SCDOT to better estimate system financial needs and manage resources effectively.

As noted, SCDOT uses a pavement management system to forecast system conditions and make investment and policy decisions to achieve pavement performance goals. Using an investment strategy that allocates funding within each system proportionate to the percentage of those system pavements in good, fair, or poor condition, Figure 7-2 shows the annual funding level required to achieve a desired percentage of good pavements for each system over the next ten years. The model assumes that if any system were to receive zero funding over the next ten years, all or almost all of the pavement segments classified as being in good condition in 2016 within that system, will deteriorate to either fair or poor condition. It should also be noted that the model does not account for any programmed projects on the state system financed by local option sales taxes due to inherent variability in project timelines and local project selection processes.

Using this model, the funding needed to maintain the system at its 2016 percent good condition levels through 2027, would be approximately:

- $105 million for interstate (65.0% good);
- $38 million for non-interstate NHS (28.0% good);
- $85 million for non-NHS primary (20.0% good);
- $60 million for federal-aid secondary (19.0% good); and
- $85 million for non-federal aid secondary (15.0% good).

Figure 7-2. Ten-Year Projected Performance and Funding Levels for Pavement Systems

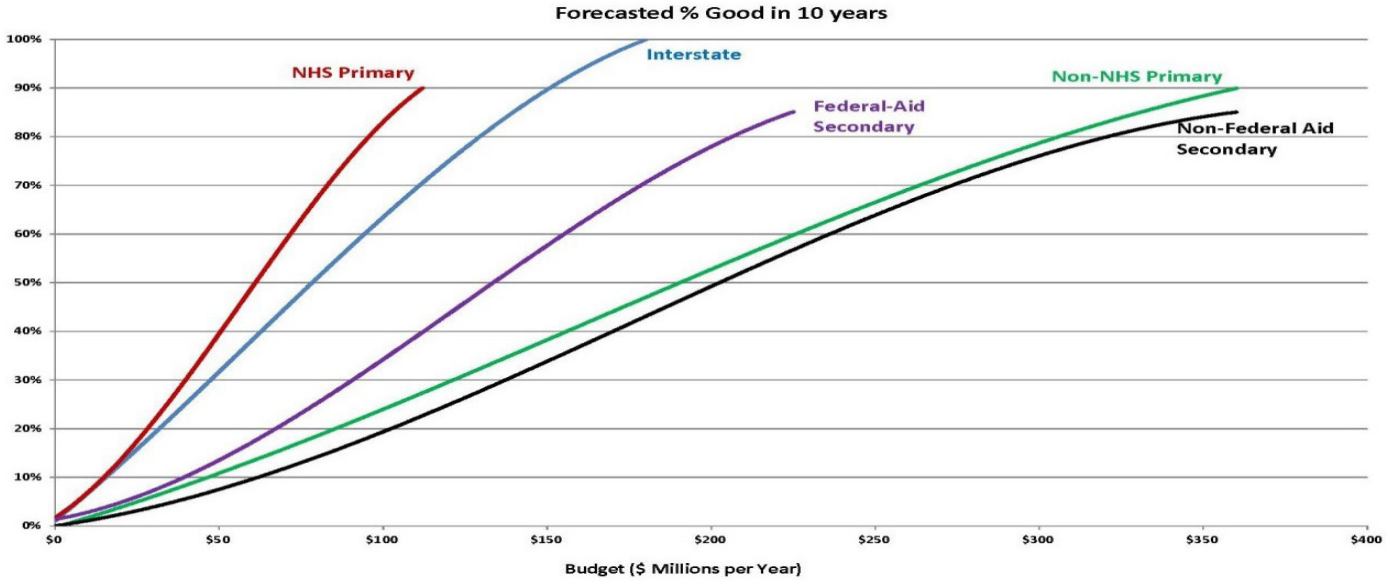
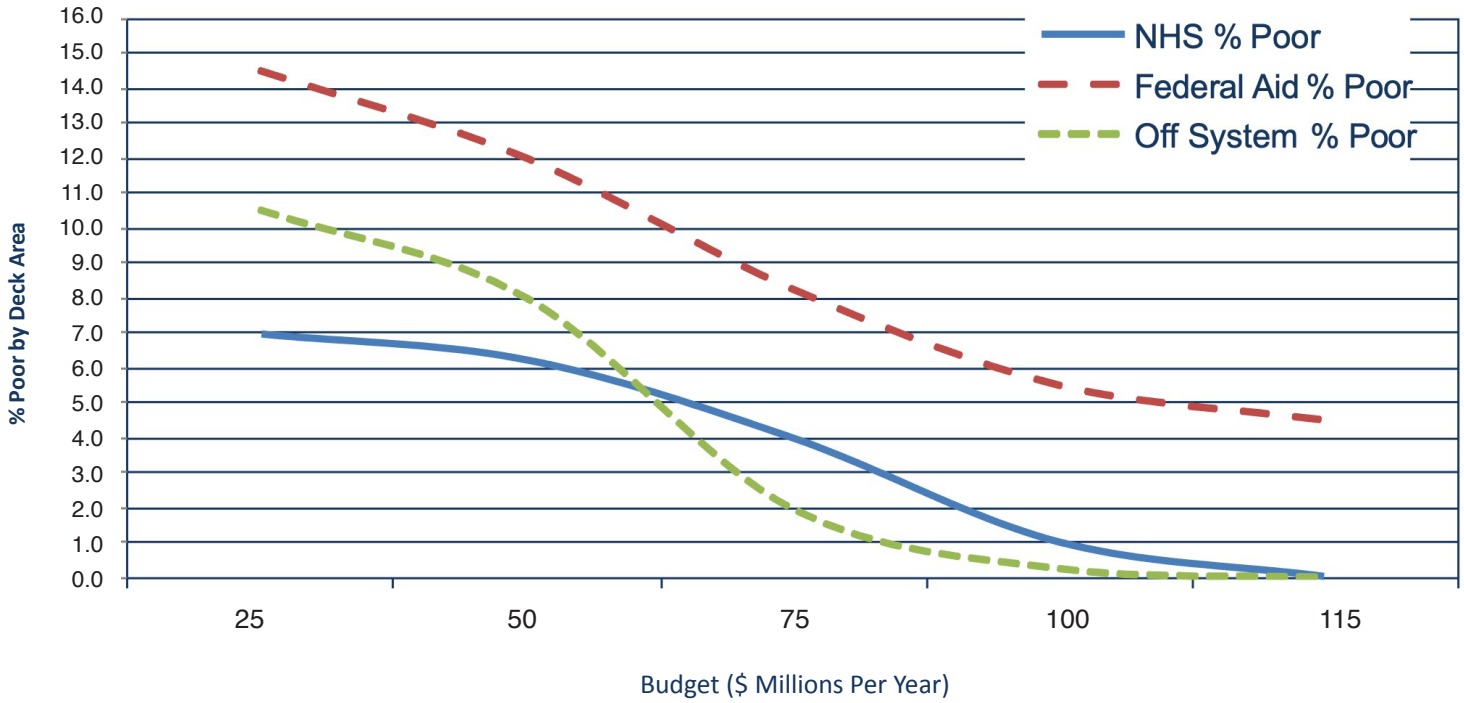


Figure 7-3 likewise shows the average annual funding level required to maintain the three SCDOT-maintained bridge systems at a desired percentage of poor bridges for each system over the next ten years. This model shows the funding necessary to maintain the system at its 2016 percent poor levels through 2027, would be approximately:

- $75 million for NHS bridges (4.0% poor);
- $70 million for federal aid bridges (9.5% poor); and
- $55 million for off-system bridges (7.4% poor).

Figure 7-3. Ten-Year (2018-2027) Projected Performance and Funding Levels for Bridge Systems



As noted in the Financial Chapter, SCDOT will have available for its assets approximately $2.7 billion on average annually through FY 2032. Deducting approximately $772 million per year for its interstate capacity, MPO and COG, freight, and safety programs leaves approximately $963 million on average per year over the ten-year period for pavement and bridge preservation, rehabilitation, and reconstruction. Table 7-2 outlines SCDOT's projected Investment Strategies for the next ten-years. Due to the inherent variability in construction prices, the allocations among asset classes may change based on what the Transportation Commission approves in future years. This table is based on the funding provided within the ten-year consolidated funding plan.

Table 7-2 Projected Program Category Allocations to Assets

Program Budget Allocations (in Millions) FY 2022-2032												
Asset Budget Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	10-Year avg.
Pavements	$695	$768	$774	$719	$726	$734	$734	$734	$734	$734	$734	$735
Interstate	$203	$208	$212	$150	$150	$150	$150	$150	$150	$150	$150	$166
NHS	$90	$98	$100	$107	$114	$122	$122	$122	$122	$122	$122	$113
Non-NHS Primary	$180	$240	$240	$240	$240	$240	$240	$240	$240	$240	$240	$235
Federal Aid Secondary	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140
Non-Federal Aid Secondary	$82	$82	$82	$82	$82	$82	$82	$82	$82	$82	$82	$82
Bridges	$228	$228	$228	$228	$228	$228	$228	$228	$228	$228	$228	$228
NHS	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58
Federal Aid	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30
Off System	$27	$27	$27	$27	$27	$27	$27	$27	$27	$27	$27	$27
Bridge Reactionary Maintenance	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19
Bridge Repair	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45	$45
Bridge Maintenance	$23	$23	$23	$23	$23	$23	$23	$23	$23	$23	$23	$23
Bridge Inspection	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Assets Subtotal	$923	$996	$1,002	$947	$954	$962	$962	$962	$962	$962	$962	$963
Interstate System Upgrade	$424	$1,001	$451	$501	$519	$522	$522	$522	$522	$522	$522	$548
MPO/COG Programs	$164	$188	$212	$238	$238	$238	$238	$238	$238	$238	$238	$224
System Upgrade Subtotal	$588	$1,189	$663	$739	$757	$760	$760	$760	$760	$760	$760	$772
Safety	$129	$131	$133	$134	$136	$136	$136	$136	$136	$136	$136	$134
TSMO	$40	$46	$47	$48	$49	$49	$49	$49	$49	$49	$49	$48
Rest Area Funding	$0	$23	$23	$23	$23	$22	$22	$22	$22	$22	$22	$20
Capital Drainage	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Specialty Programs	$85	$106	$110	$119	$120	$116	$116	$116	$116	$116	$116	$112
Operations & Maintenance	$646	$688	$689	$684	$690	$696	$696	$696	$696	$696	$696	$688
Total	$2,430	$3,198	$2,685	$2,711	$2,746	$2,758	$2,758	$2,758	$2,758	$2,758	$2,758	$2,756
Note: Specialty Programs include, TAP, Planning, EV, SIB												

7.5.1 Initial TAMP Implementation

The Initial SCDOT TAMP was approved in April 2018. Since Its adoption, the SCDOT has implemented STAMP investment strategies consistent with 23 CFR 515.13(b)(2)). This is demonstrated through Table 7-3 thru Table 7-8. These tables provide a current detail of planned and actual expenditures for FY 2018 through FY 2022. Also included are longer-range planned projections for FY 2022 to FY 2032 showing funding allocations for preservation, rehabilitation, and reconstruction; and planned and routine maintenance work types for FY 2022 to FY 2032. The following provides a more detailed explanation of how planned and actual funding levels were determined and why they may not always align.

- The total planned program budget amounts for each system were used for the 10-Year Plan Program budget amounts.
- The planned budget amounts for 2022-2032 were determined using 10% of the allotment for preservation, and the average percentages of the 2018, 2019, 2020 and 2021 actual award amounts for rehabilitation and reconstruction.
- Interstate System - The 2018-2021 Interstate actual amounts were determined by subtracting the amount of funding awarded to contract for preservation from the total funding authorized to arrive at the amount for rehabilitation. No preservation funding was allocated in 2019 due to cost overruns in 2018.
- Non-Interstate NHS and Non-NHS Primary Systems - Planned amounts are based on the percentage of good, fair and poor corresponding to preservation, rehabilitation, and reconstruction. In 2018-2021, the NHS Program was a statewide program that has since reverted back to a county distribution program for year 2022 and beyond, with each county receiving an NHS award allotment. Therefore, the actual award amounts are lower than planned (Non-NHS Primary) due to funding from the Non-NHS Primary program being redirected towards the highest priority routes on the Non-Interstate NHS.
- FA Secondary and Non-FA-Secondary Systems – Planned expenditures were consistent with the amounts provided within Table 7-2. Actual expenditures were generally consistent with planned amounts.
- In Tables 7-4 and 7-6, the total planned program budget amounts for each system were taken from the Consolidated Funding Spreadsheet (September 2022), Table 7-2.
- The amounts reflected in the tables are actual award amounts. The planned values include an addition 11% contingency and engineering and inspection (CE&I)

In Tables 7-3 and 7-5, planned amounts for preservation, rehabilitation, and reconstruction/replacement in years 2018-2022 are averages taken from actual award amounts, and from the construction-letting database.

The Agency is using the investment strategies in its plan to make progress toward achievement of its pavement and bridge performance targets for asset condition and performance of the NHS and to support progress toward the national goals identified in 23 U.S.C. 150(b). As noted in Table 7-2, SCDOT programs and develops its 10-Year investment strategies at the network level.

Table 7-3. Pavement Budget Allocations by Work Type (in Millions) Planned vs. Actual Historical (2018-2022)

Planned Pavement Budget Allocations by Work Type (In Millions) Planned vs. Actual Historical (2018-2022)										
Pavement Asset Budget	2018		2019		2020		2021		2022	
Category	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Interstate	$100.00	$167.56	$100.00	$77.76	$100.00	$71.83	$150.00	$141.62	$203.03	$69.69
Preservation	$10.00	$43.97	$10.00	$	$10.00	$68.31	$20.00	$33.24	$20.30	$31.50
Rehabilitation	$90.00	$123.59	$90.00	$77.76	$90.00	$3.52	$130.00	$44.83	$182.73	$38.19
Reconstruction	$	$	$	$	$	$	$	$63.55	$	$
Non-Interstate NHS	$65.00	$128.07	$80.00	$105.03	$90.00	$60.70	$90.00	$42.67	$90.00	$82.67
Preservation	$14.99	$26.24	$25.46	$21.78	$9.00	$6.73	$9.00	$5.51	$9.00	$3.64
Rehabilitation	$14.16	$97.99	$19.92	$76.69	$75.81	$49.93	$75.81	$35.17	$76.50	$52.36
Reconstruction	$35.85	$3.84	$34.62	$6.56	$5.19	$4.04	$5.19	$1.99	$4.50	$26.65
Non-NHS Primary	$100.00	$71.54	$100.00	$67.94	$140.00	$115.99	$140.00	$106.56	$180.00	$157.90
Preservation	$23.06	$18.65	$31.67	$16.71	$14.00	$10.53	$14.00	$8.59	$18.00	$4.61
Rehabilitation	$21.78	$41.58	$25.11	$37.03	$92.76	$69.95	$99.67	$45.57	$128.14	$56.89
Reconstruction	$55.16	$11.31	$43.22	$14.20	$33.24	$35.51	$26.33	$52.39	$33.86	$96.39
FA Secondary	$55.00	$65.68	$55.00	$53.14	$75.00	$69.96	$100.00	$74.00	$140.00	$124.99
Preservation	$10.60	$13.12	$11.14	$10.08	$7.50	$7.35	$10.00	$6.28	$14.00	$2.42
Rehabilitation	$15.65	$34.12	$14.92	$22.78	$39.76	$26.84	$53.01	$23.84	$74.21	$63.94
Reconstruction	$28.75	$18.44	$28.94	$20.28	$27.74	$35.77	$36.99	$43.89	$51.79	$58.63
NFA Secondary**	$81.80	$101.06	$68.00	$63.71	$68.00	$62.73	$82.00	$63.59	$82.00	$78.28
Preservation	$12.37	$14.55	$11.00	$9.86	$6.80	$5.75	$8.20	$6.24	$8.20	$1.79
Rehabilitation	$24.63	$52.23	$18.37	$24.65	$34.78	$35.90	$41.94	$29.52	$41.94	$39.45
Reconstruction	$44.80	$34.28	$38.63	$29.20	$26.42	$21.08	$31.86	$27.83	$31.86	$37.03
Totals Actual	$401.80	$533.91	$403.00	$367.58	$473.00	$381.21	$562.00	$428.44	$695.03	$513.52

** Zero dollars spent for interstate preservation in 2019 due to over programming in 2018*

*** NFA Secondary Budget reduced by $14M in 2019 & 2020 due to program overruns in 2018 Note: 2018 & 2018-2021 represent actual contract award amounts*

***2022 actuals include 8% contingency to award amounts*

***2022 Budget increased with passage of Infrastructure Investment and Jobs Act (IIJA)*

Table 7-4. Planned Pavement Budget Allocations by Work Type (in Millions) FY 2022-FY2032

Planned Pavement Budget Allocations by Work Type (In Millions) FY 2022-2032											
Pavement Asset Budget	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Category	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned
Interstate	$203.03	$208.96	$212.62	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00	$150.00
Preservation	$20.30	$20.90	$21.26	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
Rehabilitation	$182.73	$188.06	$191.36	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00	$130.00
Reconstruction	$	$	$	$	$	$	$	$	$	$	$
Non-Interstate NHS	$90.00	$98.00	$100.00	$107.00	$114.00	$122.00	$122.00	$122.00	$122.00	$122.00	$122.00
Preservation	$9.00	$9.80	$10.00	$10.70	$11.40	$12.20	$12.20	$12.20	$12.20	$12.20	$12.20
Rehabilitation	$76.50	$83.30	$85.00	$90.95	$96.90	$103.70	$103.70	$103.70	$103.70	$103.70	$103.70
Reconstruction	$4.50	$4.90	$5.00	$5.35	$5.70	$6.10	$6.10	$6.10	$6.10	$6.10	$6.10
Non-NHS Primary	$180.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00	$240.00
Preservation	$18.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
Rehabilitation	$128.14	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86	$170.86
Reconstruction	$33.86	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14	$45.14
FA Secondary	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00	$140.00
Preservation	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00	$14.00
Rehabilitation	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21	$74.21
Reconstruction	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79	$51.79
NFA Secondary**	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00	$82.00
Preservation	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20	$8.20
Rehabilitation	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94	$41.94
Reconstruction	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86	$31.86
Total	$695.03	$768.96	$774.62	$719.00	$726.00	$734.00	$734.00	$734.00	$734.00	$734.00	$734.00

Table 7-5. Bridge Budget Allocations by Work Type (in Millions) Planned vs. Actual (2018-2022)

Planned Bridge Budget Allocations by Work Type (In Millions), Planned vs. Actual (2018-2022)										
Bridge Asset Budget Category	2018		2019		2020		2021		2022	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
NHS	**$110.00**	**$25.56**	**$115.00**	**$43.99**	**$115.00**	**$39.83**	**$115.00**	**$132.06**	**$115.00**	**$115.36**
Preservation	$10.75	$0.91	$11.25	$4.28	$11.24	$3.05	$11.24	$9.74	$11.24	$0.50
Rehabilitation	$20.75	$6.60	$21.69	$8.27	$21.69	-	$21.69	$20.72	$21.69	$0.00
Replacement	$78.50	$18.05	$82.06	$31.44	$82.07	$36.78	$82.07	$101.61	$82.07	$114.86
FA Non-NHS	$50.50	$115.63	$25.50	$111.20	$13.00	$28.04	$13.00	$75.48	$42.27	$52.93
Preservation	$1.68	$0.39	$0.85	$3.70	$0.43	$0.27	$0.44	$2.43	$1.39	$0.26
Rehabilitation	$4.50	$8.20	$2.27	$9.90	$1.16	$0.90	$1.19	$	$3.89	$
Replacement	$44.32	$94.19	$22.38	$97.60	$11.41	$26.87	$11.36	$73.05	$36.94	$52.67
New Location	$	$12.85	$	$	$	$	$	$	$	$
Off System	**$19.50**	**$9.63**	**$29.50**	**$9.53**	**$17.00**	**$41.41**	**$17.00**	**$7.50**	**$46.28**	**$30.17**
Preservation	$0.28	$0.77	$0.42	$0.14	$0.24	$0.50	$0.26	$0.01	$0.26	$0.01
Rehabilitation	$	$	$	$	$	$	$	$	$	$
Replacement	$19.22	$8.86	$29.08	$9.39	$16.76	$40.91	$16.74	$7.49	$46.02	$30.16
Bridge Reactionary Maintenance	$	$	$	$	$	$	$	$	$19.25	$19.25
Totals	**$180.00**	**$150.82**	**$170.00**	**$164.72**	**$145.00**	**$109.28**	**$145.00**	**$215.04**	**$222.80**	**$217.71**

Note: 2018 -2021 represent actual contract amounts, 2022 represents actual program budget amounts

Bridge Reactionary Maintenance / Rehabilitation is a new program category in response to inspection findings, can apply to any bridge asset category

Table 7-6. Planned Bridge Budget Allocations by Work Type (In Millions) FY 2023-2032

Planned Bridge Budget Allocations by Work Type (In Millions) FY 2023-2032										
Bridge Asset Budget Category	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned
NHS	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**	**$58.65**
Preservation	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87	$5.87
Rehabilitation	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73	$11.73
Replacement	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06	$41.06
FA Non-NHS	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Preservation	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99	$0.99
Rehabilitation	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76
Replacement	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22	$26.22
New Location	$	$	$	$	$	$	$	$	$	$
Off System	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**	**$27.11**
Preservation	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41	$0.41
Rehabilitation	$	$	$	$	$	$	$	$	$	$
Replacement	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70	$26.70
Bridge Reactionary Maintenance	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**	**$19.25**
Bridge Repair	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**	**$45.00**
Bridge Maintenance	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**	**$23.00**
Bridge Inspection	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**	**$25.00**
Totals	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**	**$228.01**
Bridge Reactionary Maintenance, Bridge Repair, Bridge Maintenance, and Bridge Inspection are new program categories in response to inspection findings, can apply to any bridge asset category										

Table 7-7. Planned Routine Maintenance for Pavements and Bridges (In Millions), Planned vs. Actual (2018-2022)

Planned Routine Maintenance for Pavements and Bridges (In Millions), Planned vs. Actual (2018-2022)										
	2018		2019		2020		2021		2022	
Routine Maintenance	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Pavements	**$7.63**	**$9.57**	**$11.89**	**$11.75**	**$12.43**	**$12.26**	**$12.15**	**$12.10**	**$12.15**	**$8.40**
Interstate	$0.04	$0.05	$0.09	$0.09	$0.09	$0.06	$0.08	$0.09	$0.08	$0.05
Non-Interstate NHS	$0.14	$0.18	$0.30	$0.29	$0.31	$0.34	$0.27	$0.33	$0.27	$0.12
Non-NHS Primary	$0.23	$0.29	$0.48	$0.47	$0.50	$0.53	$0.43	$0.51	$0.43	$0.18
FA Secondary	$1.53	$1.92	$2.33	$2.31	$2.44	$2.84	$2.41	$2.50	$2.41	$1.71
NFA Secondary	$5.69	$7.13	$8.69	$8.59	$9.09	$8.49	$8.97	$8.67	$8.97	$6.34
Bridges	**$0.53**	**$0.75**	**$0.56**	**$0.33**	**$0.56**	**$0.53**	**$0.55**	**$0.21**	**$0.55**	**$0.31**
NHS	$0.05	$0.07	$0.06	$0.03	$0.06	$0.04	$0.06	$0.05	$0.06	$0.05
Non-NHS Primary	$0.07	$0.10	$0.22	$0.13	$0.22	$0.14	$0.22	$0.15	$0.22	$0.13
Off System	$0.40	$0.57	$0.28	$0.17	$0.28	$0.35	$0.27	$0.01	$0.27	$0.13
Totals	**$8.16**	**$10.32**	**$12.45**	**$12.08**	**$12.99**	**$12.79**	**$12.70**	**$12.31**	**$12.70**	**$8.71**
Note: Maintenance Costs are for Materials only and do not include labor and equipment, since this is how these activities are budgeted.										

Table 7-8. Planned Routine Maintenance for Pavements and Bridges (In Millions) FY 2022-FY 2032

Planned Routine Maintenance for Pavements and Bridges (In Millions) FY 2022-FY 2032											
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Routine Maintenance	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned	Planned
Pavements	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15	$12.15
Interstate	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
Non-Interstate NHS	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27
Non-NHS Primary	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43
FA Secondary	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41	$2.41
NFA Secondary	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97	$8.97
Bridges	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55	$0.55
NHS	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Non-NHS Primary	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22
Off System	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27	$0.27
Totals	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70	$12.70
Note: Maintenance Costs are for Materials only and do not include labor and equipment, since this is how these activities are budgeted.											

7.5.2 Fiscally-Constrained Targets

Targets are established by SCDOT based on observed financial and historic system performance trends, projected revenue, and industry capacity to deliver. Fiscally-constrained targets are assumed to be realistic in nature and emulate the existing and projected fiscal environment of the agency. Accordingly, key aims for establishing fiscally constrained targets are to:

- Communicate what is achievable with forecasted revenue streams to decision makers and system users;
- Pursue realistic investment strategies that can be financially supported by SCDOT and realistically delivered by the transportation industry in South Carolina; and
- Establish consistent and rational resource allocation policies that facilitate progress towards achieving performance targets and agency goals.

Due to limitations in its current pavement management software, SCDOT can only project the future percentage of good pavements on its system using the software. SCDOT is currently working on adding the capability for the projection of the percent of poor pavements over a ten-year or longer horizon. In lieu of using the pavement management software, SCDOT pavement management engineers analyzed the 5-year historical relationship between the amount of fair and poor pavements and projected the percentage of poor pavements in ten years using that constant relationship.

As noted, pavement targets are represented using PQI in Table 7-6. Based on a 0 to 5 scale, Good is greater than or equal to 3.4 and Poor is less than or equal to 2.6. Bridge targets are based on the 0-9 federal NBI measurement. Good bridges must have values of 7 or higher for the deck, substructure, and superstructure components and Poor bridges have values of 4 or less in one or more of the deck, substructure, or superstructure components. Culverts considered bridges follow the same rating values. See Table 7-6 for current conditions and ten-year fiscally-constrained targets by pavement system and bridge system. These targets were developed using models built into SCDOT's pavement management system and historical bridge condition data trends.

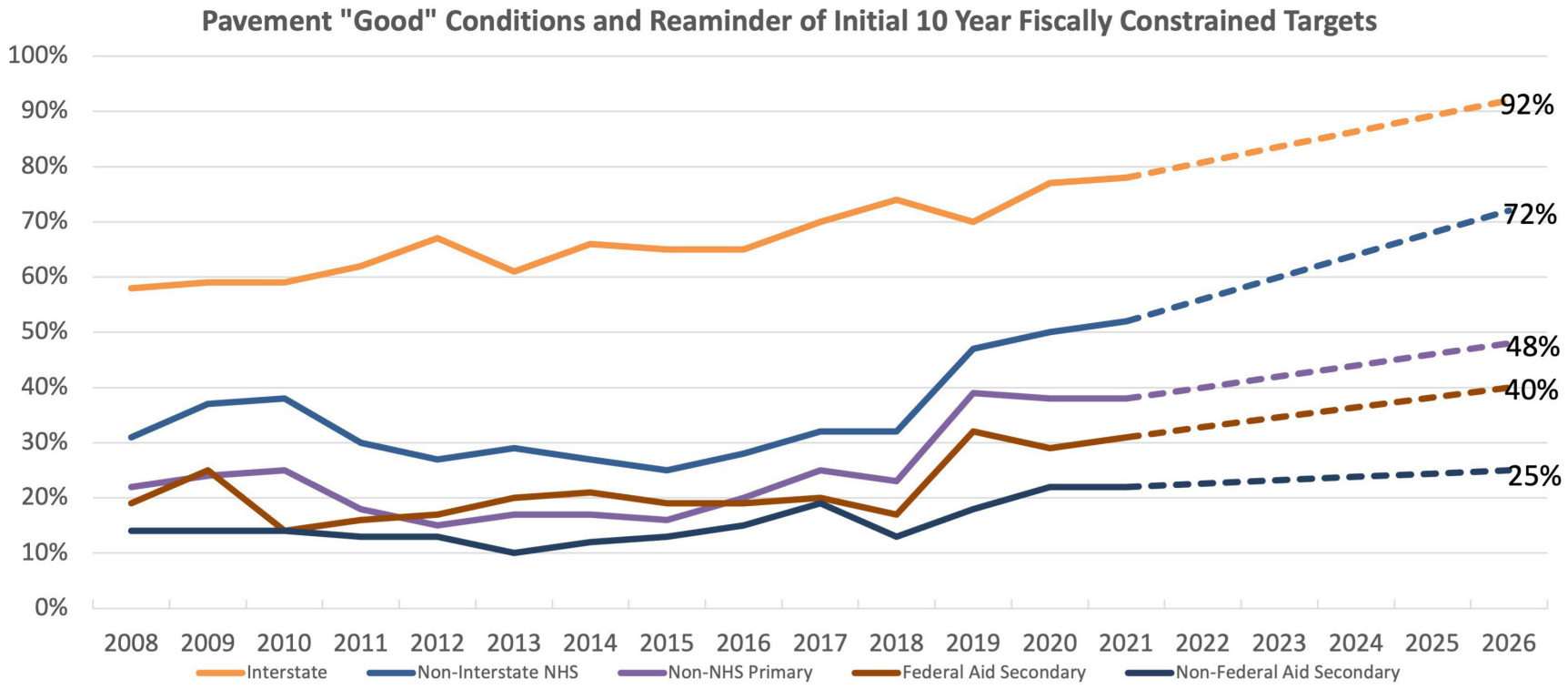
Table 7-9. SCDOT Pavement and Bridge System Fiscally-Constrained Targets*

Program Category	2016 (Actual) % Good	2016 (Actual) % Poor	2027 Target % Good	2027 Target % Poor	Average 10-Year Allocation (in millions)
Pavements					
Interstate[1]	65%	11%	92%	3%	$166.00
Non-Interstate NHS	28%	45%	72%	16%	$113.00
Non-NHS Primaries	20%	61%	48%	37%	$235.00
Federal Aid Secondary	19%	52%	40%	35%	$140.00
Non-Federal Aid Secondary[2]	15%	55%	25%	45%	$82.00
Bridges (by count)					
NHS	48%	6%	66%	0%	$58.00
FA	46%	11%	41%	11%	$30.00
Off System	40%	9%	36%	10%	$27.00
Bridges (by deck area)					
NHS	42%	4%	60%	0%	$58.00
FA	50%	10%	41%	15%	$30.00
Off System	51%	7%	44%	10%	$27.00

Note: Pavement condition based on Pavement Quality Index (PQI) scale. Bridge condition is based on the federal National Bridge Inventory (NBI) scale.

The 2027 fiscally constrained targets shown in Table 7-6 and Figure 7-4 below are based on current available data. SCDOT staff will annually monitor its pavement and bridge asset condition data to track its investment strategies against its 2027 targets. If the data trend results in a significant deviation from the 10-Year asset condition targets, the agency will consider alternative strategies to close the performance gap, or consider amending its 2027 targets if analysis shows the gap cannot be closed.

Figure 7-4. Pavement "Good" Conditions and 10 Year Fiscally Constrained Targets.



The ten-year condition targets outlined in this plan are based on best available current data. Managing the fourth-largest highway system in the United States necessarily involves a careful analysis of competing priorities. For example, SCDOT's Interstate Capacity Program will impact its future pavement program budget by increasing the mileage that needs ongoing preservation. While it is likely that added capacity during this STAMP's ten-year timeframe will not need preservation treatments during that period, the agency is aware that it will need to increase the future amount budgeted to its pavement program budget to properly maintain its interstate system. However, the need for an increased future pavement program budget does not affect the agency's decision as to whether it will pursue added interstate capacity in the present, other factors such as mobility, level of service, and freight needs.

7.5.3 State of Good Repair and Gap Analysis

With the passage of Act 40 in May of 2017, SCDOT projects received an additional $700 million in state revenue when it is fully phased in July 2022, a near doubling of its state resources. In addition to an increase in state revenues, the passage of the IIJA has increased federal funding 34.6% to approximately $1.0 billion. Additional one time funding and other state appropriations are currently in discussion for South Carolina State Legislature approval. This additional revenue will enable SCDOT to greatly improve the condition of its assets by 2032. However, even with this additional funding, due to the size of SCDOT's highway and bridge systems, SCDOT does not project for its system to reach a state of good repair for all categories during the STAMP's ten-year timeframe. It will likely take 20-years to recover the system that has decayed over the past 30-years. For the purposes of the STAMP, SCDOT defines its pavements and bridges to be in a state of good repair as the projected condition that can be achieved in 20-years utilizing the level of funding projected to be available through 2037. Table 7-7 lists the projected percentages of good and poor pavements and bridges using the data and prediction models currently available.

The current condition data for the end of Q4 in 2021 is shown in Table 7-7 with the current gap that exists between the current condition and the desired state of good repair. Progress has been made towards the achievement of the 10-Year targets and desired state of good repair, those in green are currently achieved and need to be maintained, those in yellow is still in progress. SCDOT may update the state of good repair as data and deterioration models are updated, or if additional funding becomes available.

Table 7-7. SCDOT's Desired State of Good Repair

SCDOT Desired State of Good Repair												
Asset	Centerline Miles	% VMT	Current Condition (Q4 2021 Data)		10-Year Target		Current Gap to 10-Year Target		Desired State of Good Repair (DSOGR)		Current Gap to DSOGR	
Pavements			% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor
Interstate	851	30%	78%	8%	92%	3%	14%	-5%	95%	4%	17%	-4%
Non-Interstate NHS	2,752	26%	52%	30%	72%	16%	20%	-14%	90%	10%	38%	-20%
Non-NHS Primaries	6,765	20%	38%	47%	48%	37%	10%	-10%	90%	10%	52%	-37%
FA Eligible Secondary	10,370	17%	31%	43%	40%	35%	9%	-8%	50%	20%	19%	-23%
Non-Federal Aid Eligible Secondary	20,657	7%	22%	45%	25%	45%	3%	0%	40%	25%	18%	-20%
Asset	# of Structures	% VMT	Current Condition (Q4 2021 Data)		10-Year Target		Current Gap		Desired State of Good Repair		Current Gap	
Bridges by Count			% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor
NHS	1,745	56%	44%	3%	66%	0%	22%	-3%	66%	0%	22%	-3%
Non-NHS	3,883	37%	38%	6%	41%	11%	3%	5%	46%	11%	8%	5%
Off-System	2,794	7%	44%	6%	36%	10%	-8%	4%	40%	9%	-5%	3%
Asset	Deck Area (square feet)	% VMT	Current Condition (Q4 2021 Data)		10-Year Target		Current Gap		Desired State of Good Repair		Current Gap	
Bridges by Deck Area			% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor	% Good	% Poor
NHS	39,110,289	56%	39%	4%	60%	0%	22%	-4%	60%	0%	22%	-4%
Non-NHS	24,903,895	37%	48%	6%	41%	15%	-7%	9%	50%	10%	2%	4%
Off-System	7,607,110	7%	47%	5%	44%	10%	-3%	5%	51%	7%	3%	3%

Note: Green shaded boxes are gaps that have been achieved, Yellow shaded boxes are in progress

CHAPTER 8

THE FUTURE OF TAMP AT SCDOT

8. TAM Process Enhancements

8.1 Overview

This chapter documents the strategic areas and initiatives that SCDOT has identified as gaps or opportunities for improvement in applying and strengthening the principles of transportation asset management at SCDOT. Particularly, SCDOT has identified the following areas—grouped under three broad areas: culture, data, and tools—that could be enhanced to improve the efficient use of transportation resources, as well as to improve transparency and accountability. Table 8-1 shows the agency's action plan matrix for improving and strengthening transportation asset management practices at SCDOT. These enhancement opportunities are further expanded in the following paragraphs with accompanying action items to support identified strategies. SCDOT expects these action items to build upon its existing practices to increase the benefits transportation asset management offers.

Table 8-1. Opportunities for Improvements Action Plan Matrix

Strategic Area	Strategic Direction	Timeframe	Owner
Culture	Identify communication strategies to disseminate transportation asset management information to key stakeholders.	Ongoing	Secretary of Transportation and Deputy Secretaries for Intermodal Planning, Engineering, and Finance and Administration
	Increase the use of Whole Life Management principles in the pavement, bridge, and maintenance management processes.	Ongoing	Secretary of Transportation and Deputy Secretaries for Intermodal Planning and Engineering
	Conduct annual risk assessments of key assets.	2-4 years	Secretary of Transportation and Deputy Secretaries for Intermodal Planning, Engineering, and Finance and Administration
Data	Create a comprehensive inventory of transportation infrastructure assets.	5-10 years	Directors of Planning and Asset Management, Maintenance, and Information Technology
	Develop a data governance plan for assets.	5-10 years	Directors of Planning and Asset Management and Information Technology
Tools	Evaluate securing analytical tradeoff decision support tools to support transportation asset management decision making.	5-10 years	Directors of Planning and Asset Management and Maintenance
	Enterprise Asset Management Software (EAMS) Implementation	Ongoing, 5-7 years	Information Technology Department, Agile Assets

8.2 Action Items

The focus of the action items is on iproving the efficiency of transportation asset management and in supporting risk-based resource allocation at SCDOT. The matrix emphasizes the need for cultural change because even with the acquisition of asset data management systems and/ or analytical tools, staff and leadership need to adopt an asset management philosophy. Instituting this philosophical change will facilitate the effective use of existing data and tools while the agency works to improve upon these areas. Areas of strategic interest include:

Identifying communication strategies to disseminate transportation asset management information to key stakeholders:

- Develop a transportation asset management communication plan that targets key transportation asset management stakeholders.
- Improve collaboration with local transportation and transit operators to improve efficiency of the transportation system.

Increasing the use of Whole Life Management principles in the pavement, bridge, and maintenance management processes:

- Continue and expand the use of advanced monitoring techniques to identify potential problems and minimize the need for future costly repair options on bridges.
- Develop a more accurate construction and maintenance history over time, as resources become available to yield long-term benefits for WLM approaches.
- Continue with the assessment of the service life of all pavement treatments and bridge components.

Conducting a risk assessment of key assets:

- Develop a resiliency plan to protect key assets from disasters or emergency events

Creating a comprehensive inventory of transportation infrastructure assets:

- SCDOT leadership team will evaluate and determine what additional assets should be included in the STAMP, such as the agency's drainage structures and signal systems.
- Develop performance measures and performance targets for each prioritized asset group in addition to pavements and bridges.
- Consider a holistic and systematic approach to asset management at the corridor level.

Developing a data governance plan for assets:

- Develop a consistent data management governance structure to guide divisional data gathering, reporting, and analysis.
- Coordinate the agency's data gathering and storage activities involving all divisions to follow a standard plan.
- Develop an implementation plan to integrate and utilize legacy systems to support decision making.

Evaluating securing analytical tradeoff decision-support tools to support transportation asset management decision making:

- Apply tradeoff analysis to support transportation asset management recommendations and decisions.
- Develop policies to guide the allocation of resources within and across different types of investments.
- Investigate alternative methods for cross-asset resource allocation,tradeoff analysis, and optimization to achieve system objectives.
- Consider risk assessment in cross-asset resource allocation, tradeoff analysis, and optimization procedures.

Enterprise Asset Management Software Implementation (EAMS):

- Agile Assets is currently working with SCDOT staff to implement EAMS software across the agency.
- The rollout of the software will take 5-7 years, with Maintenance being the first department to be integrated into the new system.
- The software will streamline and optimize asset management throughout the lifecycle planning process.

APPENDICES

APPENDIX A: ENGINEERING DIRECTIVE 15

South Carolina Department of Transportation

Engineering Directive

Directive Number:	**ED-15**
Effective:	**July 15, 2014**
Subject:	**Pavement Type Selection Process**
References:	**None**
Purpose:	**Establish Procedure for Pavement Selection**
This Directive Applies To:	**Construction**

Requests for pavement design will be initiated by the design manager and sent to the Pavement Design Unit at the Office of Materials and Research. The Pavement Design Unit will use soil information provided by the Geotechnical Materials Unit at the Office of Materials and Research and estimates of future traffic provided by Traffic Engineering to derive the structural requirements for the pavement structure.

Once the pavement parameters are known, the Pavement Design Unit will analyze the project's pavement type requirements according to the process described in Figure 1. For existing pavements, the existing pavement type and its required rehabilitation will generally dictate the pavement type for widening or other improvements. In these cases, the State Pavement Design Engineer will select the pavement type without further approval, subject to the normal review process for all pavement design recommendations.

For pavements being constructed on new location or reconstructed, the pavement with the lowest initial cost will generally be the default selection without further approval when the required structural number is below 4.0. However, the State Pavement Design Engineer may choose to consider alternative pavement structures for any project if economic circumstances cause significant changes in the price of either pavement type or if consideration of alternative pavement structures is considered to potentially be in the best interest of the Department, even if the required structural number is below 4.0. If the State Pavement Design Engineer determines that an alternative pavement structure is desirable, review by the Pavement Advisory Committee and approval by the Directors of Preconstruction and Construction is required.

For ramps, parking areas, minor paving projects of less than 20,000 square yards, and projects officially designated "demonstration projects" by the Deputy Secretary for Engineering for the purposes of pavement research, the State Pavement Design Engineer may select any pavement type after consultation with the design manager and the Director of Construction and without regard to the required structural number. The State Pavement Design Engineer may also make pavement type recommendations directly to the Directors of Construction and Preconstruction for their review or choose to consult the Pavement Advisory Committee. For other new location or reconstructed pavement projects not meeting the requirements given above and with a required structural number above 5.0 and for rehabilitation projects where the State Pavement Design Engineer has indicated that alternative pavement types may be advantageous, the Pavement Advisory Committee will be convened to make type selection recommendations.

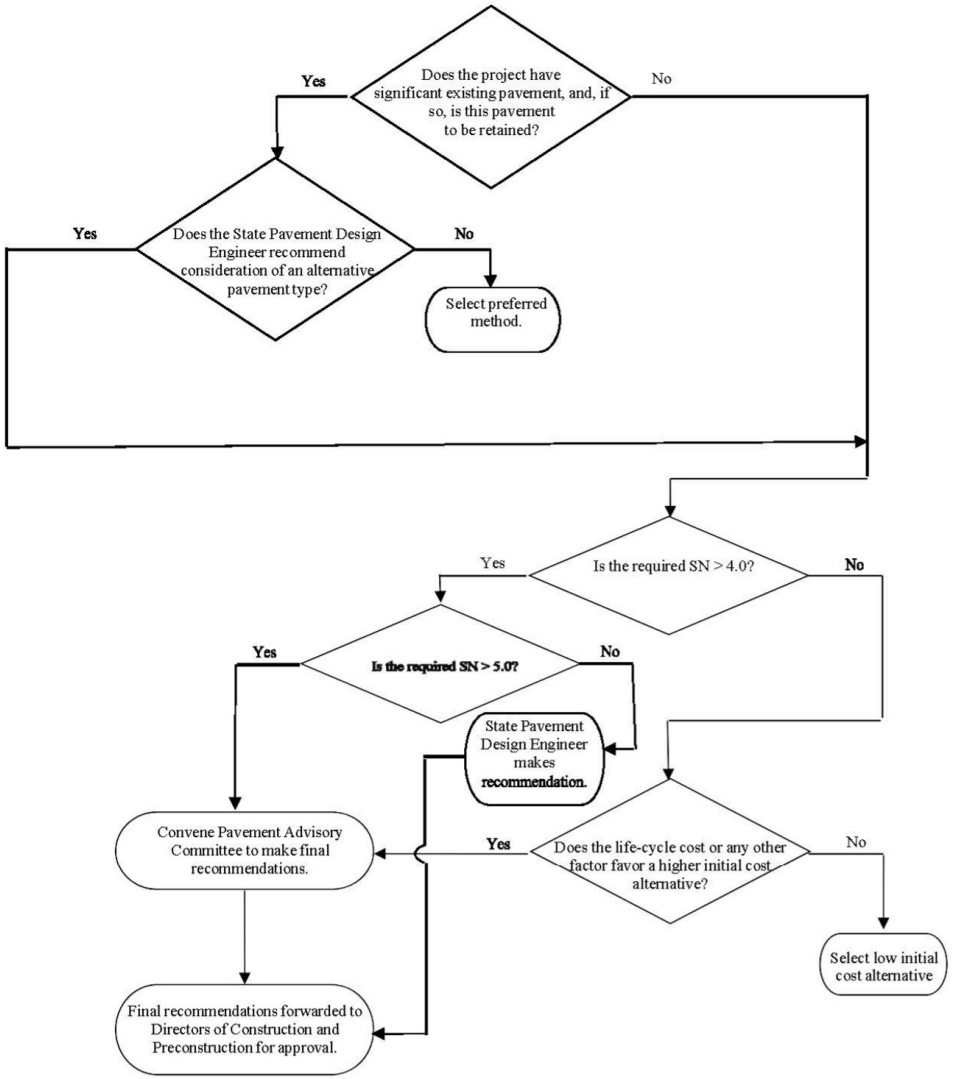
The Pavement Advisory Committee will consist of the Materials and Research Engineer, and permanent representatives from Maintenance, Construction, Traffic Engineering, and FHWA. The design manager for

the project and the District Construction Engineer where the project will be located will also be members. The State Pavement Design Engineer will provide preliminary design and cost information via e-mail to the committee for their review. The Materials and Research Engineer will then convene a meeting of the committee to discuss the information and make pavement recommendations. If the committee reaches a consensus, the recommendations will be forwarded to the Directors of Construction and Preconstruction for their review. The Directors may concur, request additional review by the Pavement Advisory Committee, or override the Pavement Advisory Committee recommendations. The recommendations will then be forwarded to the design manager for inclusion in the plans.

If the Pavement Design Committee is unable to reach a consensus, the Directors of Construction and Preconstruction will be consulted for a final decision. If in any instance the Directors of Construction and Preconstruction are unable to agree on the pavement type selection, the Deputy Secretary for Engineering will make the final decision.

Submitted by:	Todd Steagall _____ Director of Construction	Lead:	Director of Construction
Recommended by:	Kenneth B. Eargle, Interim _____ Chief Engineer for Operations	History:	Issued December 8, 2003 First Revision on July 27, 2005 Second Revision on June 1, 2007 Third Revision on July 16, 2009 Fourth Revision on July 15, 2014
Approved:	Christy A. Hall _____ Deputy Secretary for Engineering		

Flowchart of Pavement Type Selection Process



Appendix – Pavement Type Selection Factors

The selection of pavement type is not an exact, objective process, but one in which the pavement designer must make judgments on many varying factors. The pavement type selection may be dictated by an overriding consideration for one or more of these factors. The predominant factors in the selection process are given below.

The selection process may be facilitated by comparison of alternate structural designs for one or more pavement types using theoretical or empirically derived methods. However, such methods are not so precise as to absolutely guarantee a certain level of performance from any one alternate or comparable service for all alternates.

Comparative cost estimates can be applied to alternate pavement designs to aid in the decision- making process. The cost for the service of the pavement would include not only the initial cost but also subsequent costs to maintain the service level desired. It should be noted that these procedures are also imprecise due to the lack of information on costs attributable to future events such as maintenance, salvage value, and the value of reduced service to the road user.

Even if structural design and cost comparison procedures were perfected, by their nature they would not encompass all factors that should be considered in pavement type selection. Such a selection should properly be one of professional engineering judgment based on the consideration and evaluation of all factors applicable to a given highway section.

Beyond economic analysis, a variety of factors affect the pavement type selection process. These factors are:

1. Construction Considerations: Staged construction of the pavement structure may dictate the type of pavement selected. Other considerations such as speed of construction, accommodating traffic during construction, safety of traffic during construction, ease of replacement, anticipated future widening, seasons of the year when construction must be accomplished, and others might have a strong influence on paving type selections in specific cases.

2. Initial Cost:While it is desirable to compare pavement costs on the basis of the entire life- cycle, it must be recognized that available resources are finite. In cases where a pressing need for construction exists, deferring needs until adequate resources are available to build a more expensive structure may not be an option. In these cases, first cost becomes an overriding concern in the selection process.

3. Adjacent Existing Pavement: Provided there is no major change in conditions, the choice of a pavement type may be influenced by adjacent existing sections that have given adequate service. The resultant continuity of pavement type serves to simplify maintenance and rehabilitation activities.

4. Stimulation of Competition: It is desirable that monopoly situations be avoided and that improvement in products and methods be encouraged. These goals are aided by healthy competition among industries involved in the production of paving materials.

5. Ease of Maintenance: Certain pavement alternatives may provide a superior life-cycle cost, but may also entail frequent or complex maintenance activities. While SCDOT strives to provide excellent maintenance for its facilities, there is no assurance that additional resources may be available for options that require unusual levels of maintenance. Consequently, pavement designs should be considered realistically when their future performance is based on critical maintenance activities.

6. Local Preference and Recognition of Local Industry: While these considerations may seem to be outside the realm of pavement design, highway administrators cannot always ignore them. This is especially true when many other factors involved are indecisive with respect to the selection process.

7. Other: Unique or unusual factors not listed here may also influence or drive the selection process. It is important to retain the ability to select pavement type based on professional engineering judgment in special situations.

South Carolina Department of Transportation

Engineering Directive Memorandum

Number: **52**

Primary Department: **Chief Engineer for Planning, Location, and Design Referrals:**

South Carolina Code of Laws Sections 57 1-370 and 57-1-460

Subject: **Interstate Rehabilitation Project Selection Process**

Act 114 of 2007 established changes to the South Carolina Code of Laws, adding Sections 57-1-370 and 57-1-460, which require the South Carolina Department of Transportation (SCDOT) to promulgate new regulations describing its project selection process. This directive provides details of the engineering ranking process for interstate rehabilitation using the criteria approved by the SCDOT Commission (Commission) at its July 18, 2007 meeting. The engineering ranking of projects may be considered by the Commission in developing a project priority list.

This engineering directive details the process for ranking interstate rehabilitation needs based on an engineering perspective. All projects ranked and presented to the Commission since June 27, 2007 were selected using this process.

SCDOT has approximately 842 centerline miles of interstate. The miles of interstate are segmented based on pavement condition and pavement type. These segments will be ranked individually.

The following commission approved criteria, with weightings as determined by engineering staff, will be used when establishing the engineering ranking for interstate rehabilitation projects:

- Pavement condition (65%). Pavement condition is determined by evaluating the pavement distress level, rideability, and remaining service life.
- Average daily traffic (ADT) (10%). ADT is the average traffic volume per day, including trucks.
- Average daily truck traffic (ADTT) (10%). ADTT is the percentage of ADT that is truck traffic.
- Pavement maintenance costs (10%). Pavement maintenance costs are the total maintenance costs from the previous state fiscal year for the segment being evaluated.
- Location and significance to the community/local businesses (5%). This is a measure of a road's overall functional value to the local area, provided by the engineering district.

Using the weighted criteria, an engineering ranking for segments of interstate in need of repair will be produced on a statewide basis. Under the Interstate Maintenance Program, the highest ranked segments will be grouped into proposed construction contracts that are intended to minimize traffic disruptions and provide efficient contract management opportunities for SCDOT staff. The proposed contracts will be submitted to the Commission for approval and inclusion in the Statewide Transportation Improvement Program (STIP).

In general, the number of projects submitted for Commission approval should be commensurate with the amount of funds available and the time required to advance the projects to construction. Once a project is approved by the Commission, it will retain its priority status until constructed or specifically addressed by the Commission.

Submitted by: John V. Walsh

Chief Engineer for Planning, Location & Design

Submitted by: J. C. Watson

Chief Engineer for Operations

Effective Date: January 13, 2009

Original signed by Deputy Secretary for Engineering Tony L. Chapman, P.E. January 13, 2009. All original engineering directives maintained by the Office of the Deputy Secretary for Engineering.

South Carolina Department of Transportation
Engineering Directive

Directive Number:	**ED-63**
Effective:	**July 25, 2019**
Subject:	**Primary Pavement Improvement Project Prioritization**
Process References:	**Section 57-1-370 of South Carolina Code of Laws, 1976, as amended; S.C. Code of Regulations 63-10, as amended**
Primary Department:	**Maintenance**

In 2007, the South Carolina General Assembly enacted Act 114. One of the landmark items in Act 114 was the requirement that the South Carolina Department of Transportation (SCDOT) establish a project prioritization process. In 2016, the General Assembly enacted Act 275. Act 275 eliminated some of Act 114's requirements but it retained the requirement for project prioritization. This requirement is codified in Section 571370 of the South Carolina Code of Laws, 1976, as amended. Additional detail on the process is found in S.C. Code of Regulations 63-10, as amended.

This engineering directive details the process for ranking primary pavement improvement needs using objective and quantifiable criteria and describes the distribution of funds to the counties. This process does not apply to the selection of roads for preservation. The goal of pavement preservation is to keep good roads in good condition through the timely application of the appropriate preventive maintenance treatment. Roads with a pavement quality index (PQI) range of 3.2 to 4.0 are selected for preservation by the resident maintenance engineer in accordance with the SCDOT Guidelines for Selecting Preventive Maintenance Treatments and approved by the district. SCDOT has approximately 24,031 lane miles of primary routes. Available funding will be used for pavement improvement and preservation. Funding will be distributed to each county based on the county's percentage of primary lane miles compared to the statewide total of primary lane miles. A minimum of ten percent of the funding allocation will be used for the application of preservation treatments with the remaining funding used for rehabilitation and reconstruction.

The following relevant criteria and associated weightings will be used when calculating the scores to rank pavement improvement candidates on a scale of 0 to 1,000 points. The higher the point value a road segment receives, the higher the priority for pavement improvement.

- Pavement Quality Index (PQI) (40% weight, 0 to 400 points) – PQI is a numerical value representing the overall condition of the pavement surface based on observable and measurable data related to the road segment in question. PQI is based on a 5 point scale, with 0.0 being the worst and 5.0 being the best. Because PQI is the criterion that primarily supports the purpose and need for pavement improvement projects, it has therefore received the highest weighting among the relevant criteria.
- International Roughness Index (IRI) (15% weight, 15 to 150 points) – IRI is a measured numerical value for the roughness of a pavement. A pavement can be structurally sound and have poor ride quality. This criterion has an effect on safety and the public's perception of the quality of the pavement and the need for resurfacing. The 15% weighting reflects this importance.
- Average Daily Traffic (ADT) (15% weight, 15 to 150 points) – ADT is the average traffic volume per day. Pavements are designed to carry loads expressed as equivalent single axle loads (ESALS). The higher the average daily traffic the faster a pavement will reach the end of its design life and need to be rehabilitated or reconstructed. Therefore, the amount of traffic a pavement carries directly affects its service life. The 15% weighting reflects this importance.
- Percent Patching (5% weight, 5 to 50 points) – This factor gives the estimated percentage of a road segment that has been patched or is in need of patching. This criterion is an

indication of the corrective maintenance performed on the pavement and the need for overall resurfacing. It is also a factor included in the computation of PQI and therefore is given a lower weighting as a stand-alone criterion.

- Average Daily Truck Traffic (ADTT) (5% weight, 5 to 50 points) – ADTT is the percentage of ADT that is truck traffic, converted to truck volume. While an important contributor to the deterioration of a pavement, it is already a factor in the calculation of ADT. Therefore, it is given a lower weighting as a stand-alone criterion.
- State Freight Network (5% weight, 0 to 50 points) – This criterion is used to give some added emphasis to roads on the freight network. Recent federal funding legislation emphasizes improving the condition of the freight network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the designated freight network, then it receives full value for this criterion. If not, it receives no value.
- Strategic Corridor Network (5% weight, 0 to 50 points) – This criterion is used as a supplemental criterion to give some added emphasis to roads on the strategic corridor network. Recent federal funding legislation emphasizes improving the condition of the strategic corridor network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the strategic corridor network, then it receives full value for this criterion. If not, it receives no value.
- Functional Classification (5% weight, 10 to 50 points) – This criterion factors in the functional classification of the roadway. It is given a lower rating because functional class is also a function of the criteria used to designate routes on the freight and strategic corridor networks. More significant functional classifications are valued higher within this criterion than lower classifications.
- State Safety Programs (5% weight, 0 to 50 points) – This criterion is used to give emphasis to road segments that are also included in the safety program. Since it is a supplemental criterion, it is given a lower weighting. If the road segment is included in a safety program, then it receives full value for this criterion. If not, it receives no value.

The weighted criteria are entered into a ranking formula that provides a numerical priority ranking score (PRS). Primary routes will be qualified based on a threshold score for inclusion in a pool of candidates. Once eligible candidates are identified, field engineers will use the following field review criteria, which are worth a maximum of 400 points, to complete the ranking process:

- **Relative Condition (minus 100 to 100 points)** – This criterion is used so that PQI data accurately reflects the current condition of the pavement due to localized improvements made by SCDOT maintenance forces or accelerated deterioration due to increased loads.
- Corridor Continuity (0 to 100 points) – This criterion is used for route segments that would complete the resurfacing of, or add to the completion of the resurfacing of, a route corridor through a county or a district.
- Connectivity (0 to 100 points) – This criterion is used for routes that provide connectivity to economic centers, schools, emergency facilities or other key points of public interest.
- Contractibility (0 to 100 points) – Contractibility can be the grouping of roads in a specific geographical area into one project to achieve economies of scale or group roads with like treatments into a single project to reduce project costs.

The following Act 114 criteria were considered but deemed **not relevant** as they relate to the pavement improvement program, as they do not support the **purpose and need** of this program category.

- Financial Viability – Not relevant as part of the prioritization process since rehabilitation and reconstruction are normal steps in the life cycle of a pavement.
- Potential for Economic Development – Not relevant as part of the prioritization process since these projects consist of the rehabilitation and reconstruction of existing routes.
- Environmental Impact – Not relevant as part of the prioritization process since these projects consist of the rehabilitation and reconstruction of existing pavements.
- **Alternative Transportation Solutions** – Not relevant to the Pavement Improvement Program category.
- **Consistency with Local Land Use Plans** – Not relevant to the prioritization process since this program category consists of the rehabilitation and reconstruction of existing roads.

Upon completion of the prioritization and pavement improvement project development process, the prioritized list of primary routes that fulfill each

county's funding allocation will be presented to the SCDOT Commission for approval.

All raw data used by the districts to determine the final ranking of candidates selected from the pool must be included when the project packages are submitted to the Director of Maintenance for review. All data used for project prioritization will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedules.

Submitted by: David B. Cook, P.E.

Director of Maintenance

Recommended by: Andrew T. Leaphart, P.E.

Chief Engineer for Operations

Approved by: Leland Colvin, P.E.

Deputy Secretary for Engineering

History:
Issued on January 13, 2017
First Revision on June 17, 2019
Second Revision on July 25, 2019

South Carolina Department of Transportation

Engineering Directive

Directive Number:	**ED-64**
Effective:	**July 25, 2019**
Subject:	**Federal-Aid Secondary Pavement Improvement Project Prioritization Process**
References:	**Section 57-1-370 of South Carolina Code of Laws, 1976, as amended; S.C. Code of Regulations 63-10, as amended**
Primary Department:	**Maintenance**

In 2007, the South Carolina General Assembly enacted Act 114. One of the landmark items in Act 114 was the requirement that the South Carolina Department of Transportation (SCDOT) establish a project prioritization process. In 2016, the General Assembly enacted Act 275. Act 275 eliminated some of Act 114's requirements but it retained the requirement for project prioritization. This requirement is codified in Section 57-1-370 of the South Carolina Code of Laws, 1976, as amended. Additional detail on the process is found in S.C. Code of Regulations 63-10, as amended.

This engineering directive details the process for ranking **federal-aid (FA) secondary** pavement improvement needs using objective and quantifiable criteria and describes the distribution of funds to the counties.This process does not apply to the selection of roads for preservation.The goal of pavement preservation is to keep good roads in good condition through the timely application of the appropriate preventive maintenance treatment. Roads with a pavement quality index (PQI) range of 3.2 to 4.0 are selected for preservation by the resident maintenance engineer in accordance with the SCDOT Guidelines for Selecting Preventive Maintenance Treatments, and approved by the district.

SCDOT has approximately 21,271 lane miles of FA secondary roads. Available funding will be used for pavement improvement and preservation. Funding will be distributed to each county based on the county's percentage of FA secondary lane miles compared to the statewide total of FA secondary lane miles. A minimum of ten percent of the funding allocation will be used for the application of preservation treatments with the remaining funding used for rehabilitation and reconstruction.

The following relevant criteria and associated weightings will be used when calculating the scores to rank pavement improvement candidates on a scale of 0 to 1,000 points. The higher the point value a road segment receives, the higher the priority for pavement improvement.

- **Pavement Quality Index (PQI) (40% weight, 0 to 400 points)** – PQI is a numerical value representing the overall condition of the pavement surface based on observable and measurable data related to the road segment in question. PQI is based on a 5 point scale, with 0.0 being the worst and 5.0 being the best. Because PQI is the criterion that primarily supports the purpose and need for pavement improvement projects,it has therefore received the highest weighting among the relevant criteria.

- **International Roughness Index (IRI) (15% weight, 15 to 150 points)** – IRI is a measured numerical value for the roughness of a pavement. A pavement can be structurally sound and have poor ride quality. This criterion has an effect on safety and the public's perception of the quality of the pavement and the need for resurfacing.The 15% weighting reflects this importance.

- **Average Daily Traffic (ADT) (15% weight, 15 to 150 points)** – ADT is the average traffic volume per day. Pavements are designed to carry loads expressed as equivalent single axle loads (ESALS). The higher the average daily traffic the faster a pavement will reach the end of its design life and need to be rehabilitated or reconstructed. Therefore, the amount of traffic a pavement carries directly affects its service life. The 15% weighting reflects this importance.

- **Percent Patching (5% weight, 5 to 50 points)** – This factor gives the estimated percentage of a road segment that has been patched or is in need of patching. This criterion is an indication of the corrective maintenance performed on the pavement and the need for overall resurfacing. It is also a factor included in the computation of PQI and therefore is given a lower weighting as a stand-alone criterion.

- **Average Daily Truck Traffic (ADTT) (5% weight, 5 to 50 points)** – ADTT is the percentage of ADT that is truck traffic, converted to truck volume. While an important contributor to the deterioration of a pavement, it is already a factor in the calculation of ADT. Therefore, it is given a lower weighting as a stand-alone criterion.

- **State Freight Network (5% weight, 0 to 50 points)** – This criterion is used to give some added emphasis to roads on the freight network. Recent federal funding legislation emphasizes improving the condition of the freight network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the designated freight network, then it receives full value for this criterion. If not, it receives no value.

- **Strategic Corridor Network (5% weight, 0 to 50 points)** – This criterion is used as a supplemental criterion to give some added emphasis to roads on the strategic corridor network. Recent federal funding legislation emphasizes improving the condition of the strategic corridor network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the strategic corridor network, then it receives full value for this criterion. If not, it receives no value.

- **Functional Classification (5% weight, 10 to 50 points)** – This criterion factors in the functional classification of the roadway. It is given a lower rating because functional class is also a function of the criteria used to designate routes on the freight and strategic corridor networks. More significant functional classifications are valued higher within this criterion than lower classifications.

- **State Safety Programs (5% weight, 0 to 50 points)** – This criterion is used to give emphasis to road segments that are also included in the safety program. Since it is a supplemental criterion, it is given a lower weighting. If the road segment is included in a safety program, then it receives full value for this criterion. If not, it receives no value.

The weighted criteria are entered into a ranking formula that provides a numerical priority ranking score (PRS). FA secondary routes will be qualified based on a threshold score for inclusion in a pool of candidates. Once eligible candidates are identified, field engineers will use the following field review criteria, which are worth a maximum of 400 points, to complete the ranking process:

- **Relative Condition (minus 100 to 100 points)** – This criterion is used so that PQI data accurately reflects the current condition of the pavement due to localized improvements made by SCDOT maintenance forces or accelerated deterioration due to increased loads.

- **Corridor Continuity (0 to 100 points)** – This criterion is used for route segments that would complete the resurfacing of, or add to the completion of the resurfacing of, a route corridor through a county or a district.

- **Connectivity (0 to 100 points)** – This criterion is used for routes that provide connectivity to economic centers, schools, emergency facilities or other key points of public interest.

- **Contractibility (0 to 100 points)** – Contractibility can be the grouping of roads in a specific geographical area into one project to achieve economies of scale or group roads with like treatments into a single project to reduce project costs.

The following Act 114 criteria were considered but deemed **not relevant** as they relate to the pavement improvement program, as they do not support the **purpose and need** of this program category.

- **Financial Viability** – Not relevant as part of the prioritization process since rehabilitation and reconstruction are normal steps in the life cycle of a pavement.
- **Potential for Economic** Development – Not relevant as part of the prioritization process since these projects consist of the rehabilitation and reconstruction of existing routes.
- **Environmental Impact** – Not relevant as part of the prioritization process since these projects consist of the rehabilitation and reconstruction of existing pavements.
- **Alternative Transportation Solutions** – Not relevant to the Pavement Improvement Program category.
- **Consistency with Local Land Use Plans** – Not relevant to the prioritization process since this program category consists of the rehabilitation and reconstruction of existing roads.

Upon completion of the prioritization and pavement improvement project development process, the prioritized list of FA secondary routes that fulfill each county's funding allocation will be presented to the SCDOT Commission for approval.

All raw data used by the districts to determine the final ranking of candidates selected from the pool must be included when the project packages are submitted to the Director of Maintenance for review. All data used for project prioritization will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedules.

Submitted by: David B. Cook, P.E.

Director of Maintenance

Recommended by: Andrew T. Leaphart, P.E.

Chief Engineer for Operations

Approved by: Leland Colvin, P.E.

Deputy Secretary for Engineering

History: Issued on January 13, 2017
First Revision on July 25, 2019

South Carolina Department of Transportation

Engineering Directive

Directive Number: **ED-65**

Effective: **July 25, 2019**

Subject: **Non-Federal Aid Secondary Pavement Improvement Project Prioritization Process References: Section 57-1-370 of South Carolina Code of Laws, 1976, as amended; S.C. Code of Regulations 63-10, as amended**

Primary Department: Maintenance

In 2007, the South Carolina General Assembly enacted Act 114. One of the landmark items in Act 114 was the requirement that the South Carolina Department of Transportation (SCDOT) establish a project prioritization process. In 2016, the General Assembly enacted Act 275. Act 275 eliminated some of Act 114's requirements but it retained the requirement for project prioritization. This requirement is codified in Section 57-1-370 of the South Carolina Code of Laws, 1976, as amended. Additional detail on the process is found in S.C. Code of Regulations 63-10, as amended.

This engineering directive details the process for ranking **non-federal aid (NFA) secondary** pavement improvement needs using objective and quantifiable criteria and describes the distribution of funds to the counties. This process does not apply to the selection of roads for preservation. The goal of pavement preservation is to keep good roads in good condition through the timely application of the appropriate preventive maintenance treatment. Roads with a pavement quality index (PQI) range of 3.2 to 4.0 are selected for preservation by the resident maintenance engineer in accordance with the SCDOT Guidelines for Selecting Preventive Maintenance Treatments and approved by the district.

SCDOT has approximately 41,393 lane miles of NFA secondary routes. Available funding will be used for pavement improvement and preservation. Funding will be distributed to each county based on the county's percentage of NFA secondary lane miles compared to the statewide total of NFA secondary lane miles. A minimum of ten percent of the funding allocation will be used for the application of preservation treatments with the remaining funding used for rehabilitation and reconstruction.

The following **relevant** criteria and associated weightings will be used when calculating the scores to rank pavement improvement candidates on a scale of 0 to 1,000 points. The higher the point value a road segment receives, the higher the priority for pavement improvement.

- **Pavement Quality Index (PQI) (40% weight, 0 to 400 points)** – PQI is a numerical value representing the overall condition of the pavement surface based on observable and measurable data related to the road segment in question. PQI is based on a 5 point scale, with 0.0 being the worst and 5.0 being the best. Because PQI is the criterion that primarily supports the purpose and need for pavement improvement projects, it has therefore received the highest weighting among the relevant criteria.

- **International Roughness Index (IRI) (15% weight, 15 to 150 points)** – IRI is a measured numerical value for the roughness of a pavement. A pavement can be structurally sound and have poor ride quality. This criterion has an effect on safety and the public's perception of the quality of the pavement and the need for resurfacing. The 15% weighting reflects this importance.

- **Average Daily Traffic (ADT) (15% weight, 15 to 150 points)** – ADT is the average traffic volume per day. Pavements are designed to carry loads expressed as equivalent single axle loads (ESALS). The higher the average daily traffic the faster a pavement will reach the end of its design life and need to be rehabilitated or reconstructed. Therefore, the amount of traffic a pavement carries directly affects its service life. The 15% weighting reflects this importance.

- **Percent Patching (5% weight, 5 to 50 points)** – This factor gives the estimated percentage of a road segment that has been patched or is in need of patching. This criterion is an indication of the corrective maintenance performed on the pavement and the need for overall resurfacing. It is also a factor included in the computation of PQI and therefore is given a lower weighting as a stand-alone criterion.

- **Average Daily Truck Traffic (ADTT) (5% weight, 5 to 50 points)** – ADTT is the percentage of ADT that is truck traffic, converted to truck volume. While an important contributor to the deterioration of a pavement, it is already a factor in the calculation of ADT. Therefore, it is given a lower weighting as a stand-alone criterion.

- **State Freight Network (5% weight, 0 to 50 points)** – This criterion is used to give some added emphasis to roads on the freight network. Recent federal funding legislation emphasizes improving the condition of the freight network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the designated freight network, then it receives full value for this criterion. If not, it receives no value.

- **Strategic Corridor Network (5% weight, 0 to 50 points)** – This criterion is used as a supplemental criterion to give some added emphasis to roads on the strategic corridor network. Recent federal funding legislation emphasizes improving the condition of the strategic corridor network. Because it is only a supplemental criterion, it is given a lower weighting. If the road segment is on the strategic corridor network, then it receives full value for this criterion. If not, it receives no value.

- **Functional Classification (5% weight, 10 to 50 points)** – This criterion factors in the functional classification of the roadway. It is given a lower rating because functional class is also a function of the criteria used to designate routes on the freight and strategic corridor networks. More significant functional classifications are valued higher within this criterion than lower classifications.

- **State Safety Programs (5% weight, 0 to 50 points)** – This criterion is used to give emphasis to road segments that are also included in the safety program. Since it is a supplemental criterion, it is given a lower weighting. If the road segment is included in a safety program, then it receives full value for this criterion. If not, it receives no value.

The weighted criteria are entered into a ranking formula that provides a numerical priority ranking score (PRS). NFA secondary routes will be qualified based on a threshold score for inclusion in a pool of candidates. Once eligible candidates are identified, field engineers will use the following field review criteria, which are worth a maximum of 400 points, to complete the ranking process:

- **Relative Condition (minus 100 to 100 points)** – This criterion is used so that PQI data accurately reflects the current condition of the pavement due to localized improvements made by SCDOT maintenance forces or accelerated deterioration due to increased loads.

- **Corridor Continuity (0 to 100 points)** – This criterion is used for route segments that would complete the resurfacing of, or add to the completion of the resurfacing of, a route corridor through a county or a district.

- **Connectivity (0 to 100 points)** – This criterion is used for routes that provide connectivity to economic centers, schools, emergency facilities or other key points of public interest.

- **Contractibility (0 to 100 points)** – Contractibility can be the grouping of roads in a specific geographical area into one project to achieve economies of scale or group roads with like treatments into a single project to reduce project costs.

The following Act 114 criteria were considered but deemed **not relevant** as they relate to the pavement improvement program, as they do not support the **purpose and need** of this program category.

- **Financial Viability** – Not relevant as part of the prioritization process since rehabilitation and reconstruction are normal steps in the life cycle of a pavement.

- **Potential for Economic Development** – Not relevant as part of the prioritization process since these projects consist of the rehabilitation and reconstruction of existing **routes**.

- **Environmental Impact** – Not relevant as part of the prioritization process since these projects consist of the **rehabilitation** and reconstruction of existing pavements.
- **Alternative Transportation Solutions** – Not relevant to the Pavement Improvement Program **category**.
- **Consistency with Local Land Use Plans** – Not relevant to the prioritization process since this **program** category consists of the rehabilitation and reconstruction of existing roads.

Upon completion of the prioritization and pavement improvement project development process, the prioritized list of NFA secondary routes that fulfill each county's funding allocation will be presented to the SCDOT Commission for approval..

All raw data used by the districts to determine the final ranking of candidates selected from the pool must be included when the project packages are submitted to the Director of Maintenance for review. All data used for project prioritization will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedules.

Submitted by: David B. Cook, P.E.
Director of Maintenance

Approved by: Leland Colvin, P.E.
Deputy Secretary for Engineering

Recommended by: Andrew T. Leaphart, P.E.
Chief Engineer for Operations

History: Issued on January 13, 2017
First Revision on July 25, 2019

South Carolina Department of Transportation

Engineering Directive

Directive Number:	**ED-68**
Effective:	**March 10, 2017**
Subject:	**NHS Bridge Replacement Project Prioritization Process**
References:	**Section 57-1-370 of South Carolina Code of Laws, 1976, as amended; S.C. Code of Regulations 63-10, as amended**
Primary Department:	**Maintenance**

In 2007, the South Carolina General Assembly enacted Act 114. One of the landmark items in Act 114 was the requirement that the South Carolina Department of Transportation (SCDOT) establish a project prioritization process. In 2016, the General Assembly enacted Act 275. Act 275 eliminated some of Act 114's requirements but it retained the requirement for project prioritization. This requirement is codified in Section 57-1-370 of the South Carolina Code of Laws, 1976, as amended. Additional detail on the process is found in S.C. Code of Regulations 63-10, as amended.

This engineering directive details the process for ranking **NHS** bridge replacement needs using objective and quantifiable criteria.

SCDOT has approximately 1,740 bridges on the NHS system. Only bridges that are structurally deficient will be considered for replacement. NHS bridges will be ranked on a statewide priority basis.

The following **relevant** criteria along with the bridge management system (BrM) will be used when calculating the scores to rank bridge replacement candidates on a scale of 0 to 1,500 points. The higher the point value, the higher the priority for replacement. An initial candidate list will be generated from BrM using a scale of 0 to 1,000 points. The bridge with the highest cost benefit ratio will receive 1,000 points, with the remaining bridges receiving a percentage of points based on their cost benefit ratio compared to the bridge with the highest cost benefit ratio.

BrM uses the following criteria to rank bridges for replacement based on the cost benefit ratio calculated for each structure by the software. The output from BrM is the criterion that primarily supports the **purpose and need** of this program category. For that reason, this criterion received the highest weighting of 1,000 points among the relevant criteria.

- **Structural Condition** – Structural condition is the bridge's condition as compared to a new condition and is determined by detailed inspection data.
- **Traffic Status** – Traffic status is a reflection of the actual operational status of the structure (closed, load-restricted, or recommended for load restriction).
- **Average Daily Traffic (ADT)** – ADT is the average traffic volume per day.
- **Average Daily Truck Traffic (ADTT)** – ADTT is the percentage of ADT that is truck traffic, converted to truck volume.
- **Detour Length** – Detour length is the additional distance one would have to travel if the bridge must be closed or load-restricted.

Once the pool of prospective bridge candidates has been ranked by BrM, bridges will be sorted by engineering district and sent to the district engineering administrators for the completion of the field review criteria, which will be worth 0 to 500 points. The districts will score each bridge using the criteria listed below and return the results to the State Bridge

Maintenance Engineer. The points from the field review will be added to the points received from the BrM prioritization, and bridges will be ranked from highest total score to the lowest total score.

Route Continuity and River Basin Upgrades (0 to 125 points) – This criterion ensures that needed route upgrades are justified and provide both short and long-term benefit. It also provides a mechanism to ensure that our river basins receive additional consideration since these bridges are generally larger, carry more traffic, and also have significant detours if major work or restrictions are required. The 125 point maximum for this criterion reflects this importance.

- **District Repair Feasibility (0 to 75 points)** – This item is used to evaluate bridge repair history, needs, and effectiveness.

- **Improved Emergency Services and Emergency Evacuation Routes (0 to 75 points)**

– This criterion ensures that emergency services such as fire and ambulance are considered and that interruptions are minimal. It also ensures that hurricane evacuation routes are maintained to a high level, as well as primary and secondary lifeline routes for seismic response.

- **State Freight Network (0 to 50 points)** – This criterion is used to give some added emphasis to roads on the freight network. Recent federal funding legislation emphasizes improving the condition of the freight network. If the road segment is on the designated freight network, then it receives full value for this criterion. If not, it receives no value.

- **Strategic Corridor Network (0 to 50 points)** – This criterion is used as a supplemental criterion to give some added emphasis to roads on the strategic corridor network. Recent federal funding legislation emphasizes improving the condition of the strategic corridor network. If the road segment is on the strategic corridor network, then it receives full value for this criterion. If not, it receives no value.

- **New Schools and/or Changes in Bus Routes (0 to 50 points)** – These developments should be analyzed in terms of how much impact new schools have when constructed. Since school bus routes are relative to the population and location of school-aged students and can change from year to year, close coordination with school districts is necessary.

- **Known Commercial Routes (0 to 50 points)** – This criterion ensures that SCDOT considers the movement of goods and the impacts that structurally deficient bridges may have on known commercial routes.

- **Future Economic Development (Residential/Commercial) (0 to 25 points)** – This criterion is used to measure current and future needs and benefits provided to existing or future developments.

The following Act 114 criteria were considered but deemed **not relevant** as they relate to the bridge replacement program category priority list, as they do not support the **purpose and need** of this program category.

- **Financial Viability** – Not relevant as part of the prioritization process since rehabilitation and replacement are normal steps in the life cycle of a bridge. Replacement cost is considered when determining the type of replacement structure, but not in the ranking process.

- **Pavement Quality Index (PQI)** – Not relevant as part of the prioritization process since PQI is not calculated for, nor applicable to bridge decks.

- **Environmental Impact** – Not relevant as part of the prioritization process. The environmental permitting process is a part of every bridge replacement project and may have a large impact on the time it takes to develop the project, but it is not used to prioritize bridge replacements.

- **Alternative Transportation Solutions** – Not relevant to Bridge Replacement Program category.

- **Consistency with Local Land Use Plans** – Not relevant to the prioritization process since this program category consists of the rehabilitation and replacement of existing bridge structures.

Upon completion of the selection and vetting process, the prioritized list of bridge replacement candidates will be presented to the SCDOT Commission for approval.

All data used for project prioritization will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedule

Submitted by: James J. Feda, Jr., P.E.

Director of Maintenance

Recommended by: Andrew T. Leaphart, P.E.

Chief Engineer for Operations

Approved by: Leland Colvin, P.E.

Deputy Secretary for Engineering

History: Issued on March 10, 2017

MEMORANDUM OF RECORD

Date: October 31, 2017

Re: ED-69, Non-NHS Bridge Replacement Project Prioritization Process

Engineering Directive 69, Non-NHS Bridge Replacement Project Prioritization Process, has been canceled. Off-system bridges are addressed in the load-restricted program.

Leland Colvin, P.E.
Deputy Secretary for Engineering

South Carolina Department of Transportation

Engineering Directive

Directive Number:	**ED-70**
Effective:	**March 10, 2017**
Subject:	**Load Restricted Bridge Replacement Project Prioritization Process**
References:	**Section 57-1-370 of South Carolina Code of Laws, 1976, as amended; S.C. Code of Regulations 63-10, as amended**
Primary Department:	**Maintenance**

In 2007, the South Carolina General Assembly enacted Act 114. One of the landmark items in Act 114 was the requirement that the South Carolina Department of Transportation (SCDOT) establish a project prioritization process. In 2016, the General Assembly enacted Act 275. Act 275 eliminated some of Act 114's requirements but it retained the requirement for project prioritization. This requirement is codified in Section 57-1-370 of the South Carolina Code of Laws, 1976, as amended. Additional detail on the process is found in S.C. Code of Regulations 63-10, as amended.

This engineering directive details the process for ranking **load restricted** bridges for replacement using objective and quantifiable criteria.

The number of load restricted bridges varies from month to month, with the number usually ranging from 300 to 350 bridges. Load restricted bridges will be ranked on a statewide priority basis.

The following **relevant** criteria along with the bridge management system (BrM) will be used when calculating the scores to rank bridge replacement candidates on a scale of 0 to 1,500 points. The higher the point value, the higher the priority for replacement. An initial candidate list will be generated from BrM using a scale of 0 to 1,000 points. The bridge with the highest cost benefit ratio will receive 1,000 points, with the remaining bridges receiving a percentage of points based on their cost benefit ratio compared to the bridge with the highest cost benefit ratio.

BrM uses the following criteria to rank bridges for replacement based on the cost benefit ratio calculated for each structure by the software. The output from BrM is the criterion that primarily supports the **purpose and need** of this program category. For that reason, this criterion received the highest weighting of 1,000 points among the relevant criteria.

- **Structural Condition** – Structural condition is the bridge's condition as compared to a new condition and is determined by detailed inspection data.
- **Traffic Status** – Traffic status is a reflection of the actual operational status of the structure (closed, load-restricted, or recommended for load restriction).
- **Average Daily Traffic (ADT)** – ADT is the average traffic volume per day.
- **Average Daily Truck Traffic (ADTT)** – ADTT is the percentage of ADT that is truck traffic, converted to truck volume.
- **Detour Length** – Detour length is the additional distance one would have to travel if the bridge must be closed or load restricted.

Once the pool of prospective bridge candidates has been ranked by BrM, bridges will be sorted by engineering district and sent to the district engineering administrators for the completion of the field review criteria, which will be worth 0 to 500 points. The districts will score each bridge using the criteria listed below and return the results to the State Bridge Maintenance Engineer. The points from the field review will be added to the points received from the BrM prioritization, and bridges will be ranked from highest total score to the lowest total score.

- **Route Continuity and River Basin Upgrades (0 to 125 points)** – This criterion ensures that needed route upgrades are justified and provide both short and long-term benefit. It also provides a mechanism to ensure that our river basins receive additional consideration since these bridges are generally larger, carry more traffic, and also have significant detours if major work or restrictions are required. The 125 point maximum for this criterion reflects this importance.

- **District Repair Feasibility (0 to 75 points)** – This item is used to evaluate bridge repair history, needs, and effectiveness.

- **Improved Emergency Services and Emergency Evacuation Routes (0 to 75 points)**

– This criterion ensures that emergency services such as fire and ambulance are considered and that interruptions are minimal. It also ensures that hurricane evacuation routes are maintained to a high level, as well as primary and secondary lifeline routes for seismic response.

- **State Freight Network (0 to 50 points)** – This criterion is used to give some added emphasis to roads on the freight network. Recent federal funding legislation emphasizes improving the condition of the freight network. If the road segment is on the designated freight network, then it receives full value for this criterion. If not, it receives no value.

- **Strategic Corridor Network (0 to 50 points)** – This criterion is used as a supplemental criterion to give some added emphasis to roads on the strategic corridor network. Recent federal funding legislation emphasizes improving the condition of the strategic corridor network. If the road segment is on the strategic corridor network, then it receives full value for this criterion. If not, it receives no value.

- **New Schools and/or Changes in Bus Routes (0 to 50 points)** – These developments should be analyzed in terms of how much impact new schools have when constructed. Since school bus routes are relative to the population and location of school-aged students and can change from year to year, close coordination with school districts is necessary.

- **Known Commercial Routes (0 to 50 points)** – This criterion ensures that SCDOT considers the movement of goods and the impacts that structurally deficient bridges may have on known commercial routes.

- **Future Economic Development (Residential/Commercial) (0 to 25 points)** – This criterion is used to measure current and future needs and benefits provided to existing or future developments.

The following Act 114 criteria were considered but deemed **not relevant** as they relate to the bridge replacement program category priority list, as they do not support the **purpose and need** of this program category.

- **Financial Viability** – Not relevant as part of the prioritization process since rehabilitation and replacement are normal steps in the life cycle of a bridge. Replacement cost is considered when determining the type of replacement structure, but not in the ranking process.

- **Pavement Quality Index (PQI)** – Not relevant as part of the prioritization process since PQI is not calculated for, nor applicable to bridge decks.

- **Environmental Impact** – Not relevant as part of the prioritization process. The environmental permitting process is a part of every bridge replacement project and may have a large impact on the time it takes to develop the project, but it is not used to prioritize bridge replacements.

- **Alternative Transportation Solutions** – Not relevant to Bridge Replacement Program category.

- **Consistency with Local Land Use Plans** – Not relevant to the prioritization process since this program category consists of the rehabilitation and replacement of existing bridge structures.

All data used for project prioritization will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedules.

Upon completion of the selection and vetting process, the prioritized list of bridge replacement candidates will be presented to the SCDOT Commission for approval.

Submitted by: James J. Feda, Jr., P.E.

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Director of Maintenance

Recommended by: Andrew T. Leaphart, P.E.

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Chief Engineer for Operations

Approved by: Leland Colvin, P.E.

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Deputy Secretary for Engineering

History: Issued on March 10, 2017

Bridge Risk Registry						
Type of Risk or Opportunity	**Risk Consequences/Impacts**	**Original Risk Severity Score**	**Policy Control Measures (Primary (P) and Secondary (S))**	**Possible Risk Management Action Plan Items**	**Final Adjusted Risk Severity Score**	**Risk Owner**
Additional bridges are added to the load-restricted or "poor" rating lists	Delays in program; Increase in cost.	**Extreme** **25.0**		Explore increase in rehab options; Robust Preservation Program.	**High** **20.0**	Maintenance
Costs inflate substantially on a program level	Delays in project delivery due to scope expansion and requests for additional funds; Unmet agency goals and customer expectations.	**Extreme** **25.0**	(P) Agency Policies, Procedures, Design Criteria; (P) Develop contingencies for the successful delivery of projects considering many different scenarios of cost inflation; (S) Partner with contractors, manufacturers, and industry to develop long-term material needs and supply plan for Bridge program.	Allowance for increased risk of low-volume bridge design manual; Growing District in-house Bridge capabilities; Explore increase in rehab options.	**Medium-High** **17.5**	Planning Finance Maintenance Preconstruction
Ability to deliver projects impacted by lack of qualified internal workforce	Can delay project and program delivery times; Can lead to unmet system performance.	**High** **20**	(P) HR Retention; Outsourcing Labor	Research on Technology and Efficiency Assessments to reduce staff workload; Utilitize Consultant services More Flexible HR Programs.	**Medium-Low** **6.0**	HR

Bridge Risk Registry						
Low-priority bridges consume resources disproportionately	Resources beyond risk appetite are consumed.	**High (20.0)**	(P) Agency Policies, Procedures, Design Criteria; (P) Develop contingencies for the successful delivery of projects considering many different scenarios of cost inflation; (P)Silo-prioritized Plans; (S) Partner with contractors, manufacturers, and industry to develop long-term material needs and supply plan for Bridge program.	Allowance for increased risk of low- volume bridge design manual; Growing District in-house Bridge capabilities; Agency-wide prioritized Plans; Focus on Strategic Alternative Corridors.	**Low (4.0)**	Planning Maintenance Preconstruction
The ability to deliver projects impacted by lack of qualified external contractors	Can delay project and program delivery times; Can lead to unmet system performance.	**Medium- High (17.5)**	(P) Meet with bridge contractors periodically Agency-wide prioritized Plans; to determine their capacity and their plans for capital improvements and increased workforce; (S) Partner with contractors, manufacturers, and industry to develop long-term material needs and supply plan for Bridge program.	Agency-wide prioritized Plans; Automate Bridge List for Contractors Use low volume bridge design process Strategic Contracting based on Market Sectors	**Medium (10.0)**	Construction
Federal Funding Cuts	Reduce ability to complete program.	**Medium- High (15.0)**	(P) Communication with Congressional delegation.		**Medium (12.5)**	Finance

Bridge Risk Registry					
Bridges are damaged by extreme weather events	Disruption to system operations; Excessive costs in replacing or rebuilding bridges.	**Medium- Low (8.0)**	(P) Agency Policies, Procedures, Design Criteria; (P) SCDOT obtain ER and FEMA Funds; Document events, develop a flood pattern and identify vulnerable regions, develop GIS base maps and identify scour critical bridges; (P) Identify vulnerable regions, develop heat maps within the state, and develop contingency plans for quick response, recovery, and rebuilding process; (P) Utilize existing NBI system (P) Document events and develop emergency response plans that identify vulnerable zones, districts, or assets and prepare for prompt response actions; (P) Incorporate earthquake resistant designs in high risk areas to improve resiliency during earthquakes. (P) Develop effective countermeasures and criteria for affected bridges to reduce the rate of scour and damage to bridges where practical.	**Low (5.25)**	Preconstruction Maintenance
Ability to deliver projects	Can delay project and program delivery times; Can lead to unmet system performance.	**Low (5.0)**		**Low (5.0)**	Construction
	Reduce ability to complete program.	**(Low) (5.0)**		**Low (4.0)**	Finance
	Reduces impact of lack of funding issues.	**Low (4.0)**		**Low (4.0)**	Finance
	Congestion due to bridge posting or closures may cause significant traffic delays in movement of people, goods and services; Unplanned repair costs may affect scheduled programs or delivery of projects.	**Minimal (2.5)**	(P) Develop emergency response plans for affected routes to maintain safe traffic flow and traffic operations upon asset failure; (P) Identify vulnerable locations and build protective barriers, or delineate highly vulnerable assets.	**Minimal (2.5)**	Maintenance

Pavement Risk Registry						
Type of Risk or Opportunity	**Risk Consequences/Impacts**	**Original Risk Severity Score**	**Policy Control Measures (Primary (P) and Secondary (S))**	**Possible Risk Management Action Plan Items**	**Final Adjusted Risk Severity Score**	**Risk Owner**
Loss or lack of Institutional Knowledge	Loss of productivity, quality of work, delays, increase in cost.	**High** **20.0**	Recruitment and Retention Plans; Workshops and Trainings for Internal Staff and Contractors; Outsourcing.	Target Operating Model (TOM) put in place	**Medium** **16.0**	HR
Project costs inflate substantially	Delays in project delivery due to scope expansion and requests for additional funds; Unmet agency goals and customer expectations.	**High** **18.0**	(P) Develop contingencies for the successful delivery of projects considering many different scenarios of cost inflation.	Optimize the blend of investment; Corridor Management; Increasing daytime work; Strategic grouping in value for packaging of projects	**Medium** **13.5**	Planning Finance Preconstruction / Alternative Delivery
Inaccurate condition prediction models	Will impact the pavement program financial plan and target setting process.	**Medium** **12.0**	(P) Regularly Update Cost in Models; Deterioration Curves Development; (S) Develop Pavement Management Data Quality Management Plan.	Add age of concrete; Follow Engineering Directive Add a structural evaluation; Ongoing research project to update deterioration curves; Add a construction history (going forward)	**Medium-Low** **6.0**	Road Data Services
The ability to deliver projects impacted by lack of qualified contractors	Can delay project and program delivery times; Can lead to unmet system performance.	**Medium** **12.0**	(P) Diversify our pavement treatment types; (P) Meet with paving contractors periodically to determine their capacity and their plans for capital improvements and increased workforce.		**Medium** **10.0**	Construction

Pavement Risk Registry						
Pavements are damaged by extreme weather events (hurricane, floods, snow/ice)	Disruption to system operations; Excessive costs in replacing or rebuilding roads.	**Medium** **12.0**	(P) Identify vulnerable regions, develop heat maps within the state, and develop contingency plans for quick response, recovery and rebuilding process (P) Use of ER and FEMA Funds	Document events, develop a flood pattern and identify vulnerable regions, develop GIS base maps and implement consistent drainage inspection program to identify maintenance and upgrade needs	**Medium- Low** **6.0**	Maintenance Construction
The ability to deliver projects impacted by material shortage	Can delay project and program delivery times; Can lead to unmet system performance.	**Medium 9.0**	(P) Partner with contractors, manufacturers, and industry to develop long-term material needs and supply plan for pavement program.		**Medium- Low** **6.0**	Construction
Inaccurate pavement condition data	Will impact the pavement program financial plan and target setting process.	**Medium- Low** **8.0**	Develop Pavement Management Data Quality Management Plan.		**Low 4.0**	Road Data Services
Opportunity: Receipt of additional State funding	Capacity of industry to match additional work.	**Low 3.75**			**Low 3.75**	Finance
Pavements are damaged or destroyed by Earthquakes	Disruption to system operations; Excessive costs in replacing or rebuilding roads.	**Minimal 2.5**	(P) Document events and develop emergency response plans that identify vulnerable zones, districts, or assets and (P) Identify vulnerable regions, develop heat maps within the state, and develop contingency plans for quick response, recovery, and rebuilding process.		**Minimal 2.5**	Maintenance Construction
Pavements are destroyed by vehicle impacts/ fires	Congestion due to lane closures may cause significant traffic delays in movement of people, goods and services; Unplanned repair costs may affect scheduled programs or delivery of projects.	**Minimal 2.5**	(P) Develop emergency response plans for affected routes to maintain safe traffic flow and traffic operations upon asset failure.		**Minimal 2.5**	Maintenance
State Funding Cuts	Adjustment of programs.	**Minimal 2.6**			**Minimal 2.5**	Finance

SCDOT PERFORMANCE MEASURES AND TARGET SETTING - BRIDGE

1. FEDERAL REQUIREMENTS

The Federal Highway Administration (FHWA) published in the Federal Register (82 FR 5886) a final rule establishing performance measures for State Highway Agencies (SHA)s to use in managing pavement and bridge performance on the National Highway System (NHS). The NHS is the Interstate Highway System plus additional roads important to the nation's economy, defense, and mobility. The National Performance Management Measures: Assessing Pavement Condition for the National Highway Performance Program and Bridge Condition for the National Highway Performance Program Final Rule addresses requirements established by the Moving Ahead for Progress in the 21st Century (MAP-21) Act and reflects passage of the Fixing America's Surface Transportation (FAST) Act. The rule is effective May 20, 2017. SHAs are required to:

- Establish targets for all bridges carrying the NHS, which includes on- and off-ramps connected to the NHS within a State, and bridges carrying the NHS that cross a State border, regardless of ownership.
- Establish statewide 2- and 4-year targets by May 20, 2018, and report by October 1, 2018. (Every 4 years thereafter)
- Adjust targets at the Mid Performance Period Progress Report if necessary (October 1, 2020). (Every 4 years thereafter)

23 CFR 650.305 defines a bridge as "a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening."

Metropolitan Planning Organizations (MPOs) are required to support the SHA's 4 year target or establish their own, quantifiable target by 180 days after the SHA's target is established.

Bridge performance measures are detailed in 23 CFR Part 490 Subpart D: National Performance Management Measures for Assessing Bridge Condition. The regulation also establishes minimum condition requirements for NHS bridges.

Performance Measures	Penalties
• Percentage of NHS bridges classified as in Good condition • Percentage of NHS bridges classified as in Poor condition	If more than 10% of total deck area of NHS bridges are classified as structurally deficient for three consecutive years then NHPP funds need to be obligated for eligible bridge projects on the NHS.

23 CFR Part 490.407 and 490.409 define the metric thresholds for each applicable bridge, the performance measures for determining condition are based on the minimum NBI rating values for deck, superstructure, substructure and culverts (as shown in Table 1.1). 23 CFR 490.411 provides the definition for Structurally Deficient bridge: "…Beginning with calendar year 2018 and thereafter, a bridge will be classified as Structurally Deficient when one of its NBI Items, 58--Deck, 59--Superstructure, 60-- Substructure, or 62--Culverts, is 4 or less."

Table 1.1 Bridge Condition Thresholds (§490.407, §490.409)

NBI Rating Scale (from 0 – 9)	9 - 8 - 7 Good	6 - 5 Fair	4 - 3 - 2 - 1 - 0 Poor		
Deck (Item 58)	≥ 7	5 or 6	≤ 4		If: Min ≥ 7 → Good Min ≤ 4 → Poor
Superstructure (Item 59)	≥ 7	5 or 6	≤ 4		
Substructure (Item 60)	≥ 7	5 or 6	≤ 4		
Culvert (Item 62)	≥ 7	5 or 6	≤ 4		

The condition values are weighted by the respective deck area of each bridge and express condition totals as a percentage of the total deck area of bridges in a state. Deck area for each bridge is calculated based on length from NBI item 49 (structure length) and width from NBI item 52(deck width) or item 32 (approach roadway width). This method for calculating bridge condition is illustrated below.

$$\text{Percent of NHS bridges in good condition} = 100 \frac{\sum_{g=1}^{\text{GOOD}} [\text{Length} * \text{Width}]_{\text{Bridge } g}}{\sum_{g=1}^{\text{Total}} [\text{Length} * \text{Width}]_{\text{Bridge } t}} * \quad (1\text{-}1)$$

$$\text{Percent of NHS bridges in poor condition} = 100 \frac{\sum_{g=1}^{\text{POOR}} [\text{Length} * \text{Width}]_{\text{Bridge } p}}{\sum_{g=1}^{\text{Total}} [\text{Length} * \text{Width}]_{\text{Bridge } t}} * \quad (1\text{-}2)$$

2. BRIDGE INVENTORY DATA

The initial National Bridge Inspection Standards (NBIS) were established as part of the Federal-Aid Highway Act of 1970 that were limited to bridges on the Federal-aid highway system. Currently, the NBIS regulations apply to all publicly owned highway bridges longer than twenty-feet located on public roads. NBIS are federal regulations (23 CFR 650) establishing requirements for bridge inspection procedures, frequency of inspections, qualifications of personnel, inspection reports, and maintenance of bridge inventory. Information from these inspections is stored in the National Bridge Inventory (NBI) database, created in 1972. The NBI is the aggregation of structure inventory and appraisal data collected by each state to fulfill the requirements of NBIS. The NBI database contains condition information on five aggregate structural units (deck, superstructure, substructure, channel, and culvert) by assigning a condition rating to each of these components of a bridge on a scale from 9 (perfect) to 1 (severe deterioration/failure) that are needed for bridge condition calculation using Equation 1-1 and 1-2.

The NBI database is maintained by the Federal Highway Administration (FHWA). These encoded alpha-numeric text files are available to download for program years beginning in 1992. SHAs are required to inspect bridges under their jurisdictions at regular intervals and to submit NBI data files with updated information to FHWA in March of each year. FHWA conducts annual reviews of state bridge inspection programs to ensure compliance with federal regulations.

SCDOT's bridge inspection program started in the 1970's. The SCDOT Bridge Maintenance Office manages the bridge inspection program. SCDOT performs inspection on non-load restricted bridges biennially and annually on load restricted bridges. SCDOT's bridge inspection data are stored in the Roadway Information Management System (RIMS) and in the SCDOT Bridge Management System (BrM).

3. BRIDGE INVENTORY

For this initial bridge performance target setting, South Carolina bridge inventory data files (1992–2017) in ASCII format were downloaded from FHWA's NBI website (https://www.fhwa.dot.gov/bridge/nbi/ascii.cfm). A data import script was created to import these text files into an Access table with fields as defined in the FHWA Recording and Coding Guide. Each year's data from 1992 to 2012 were imported into Access as separate tables. All data analyses in this report are based on the NBI dataset.

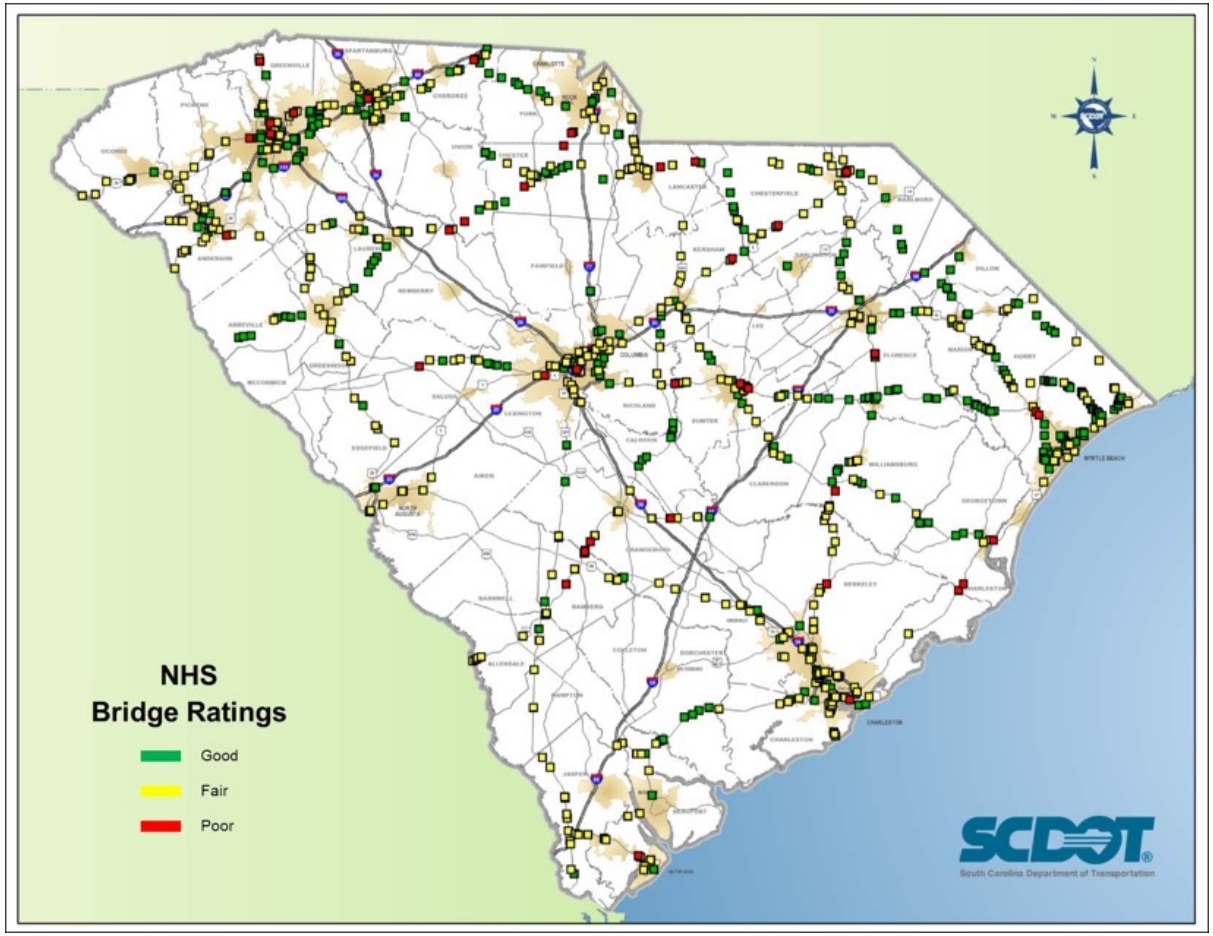
3.1 Bridges in South Carolina

Table 3.1 shows bridges in South Carolina based on data submission to NBI as of Q4 in 2021, which includes 937 local agency owned bridges. Figure 3.1 shows the locations of the 1,771 NHS bridges by condition rating. Note, there are no poor rated bridges on the Interstate system.

Table 3.1. South Carolina Bridge Inventory

Functional Class	Count	Bridge Deck Area (ft^2)
NHS	1,771 (18.9%)	40,688,354 (54.9%)
Non-NHS	7,609 (81.1%)	33,443,787 (45.1%)
Total	9,380	73,152,009

Figure 3.1. South Carolina Bridges on National Highway System



3.2 Border Bridges

The FHWA requires that SHAs coordinate with all relevant bridge owners, such as federal agencies that own NHS bridges and other state SHAs that share NHS bridges that cross state borders. South Carolina has twenty-six border bridges with Georgia and North Carolina (as shown in Table 3.3). Eight bridges maintained by Georgia Department of Transportation (GDOT) are on the NHS. GDOT was contacted and verified its inventory information.

Table 3.3. Border Bridges between South Carolina and Georgia/North Carolina

Owner	NHS				Non-NHS		Total	
	Interstate		Non-Interstate					
	Count	Deck Area (ft^2)	Count	Deck Area (ft^2)	Count	Deck Area (ft^2)	Count	Deck Area (ft^2)
GA	4	335,876	4	417,330	4	157,389	12	910,595
NC					2	12,461	2	12,461
SC	3	219,642	2	93,117	7	325,616	12	638,376

3.3 SCDOT Maintained Bridge Conditions

Based on the 2021 NBI dataset, 48% of bridges by count and 30% by deck area were built or reconstructed from the 1960's to 1970's during the construction boom related to the development of the Interstate Highway System. About 35% of the bridges by count and 11% by deck area built or reconstructed prior to the 1970's were concrete bridges. Overall, about 47% of bridges by count and 69% by deck area were built or reconstructed since the 1980's (Figure 3.2 and Figure 3.3). A sizable proportion (40% by count and 23% by deck area) of the inventory is 45 years old or older. These structures have either exceeded or will soon exceed their originally anticipated design service life of 50 years. Border bridges are not included in the data analysis in this section.

Figure 3.2. South Carolina NHS Bridges Count by Year Built/Reconstructed

Table 3.3. Border Bridges between South Carolina and Georgia/North Carolina

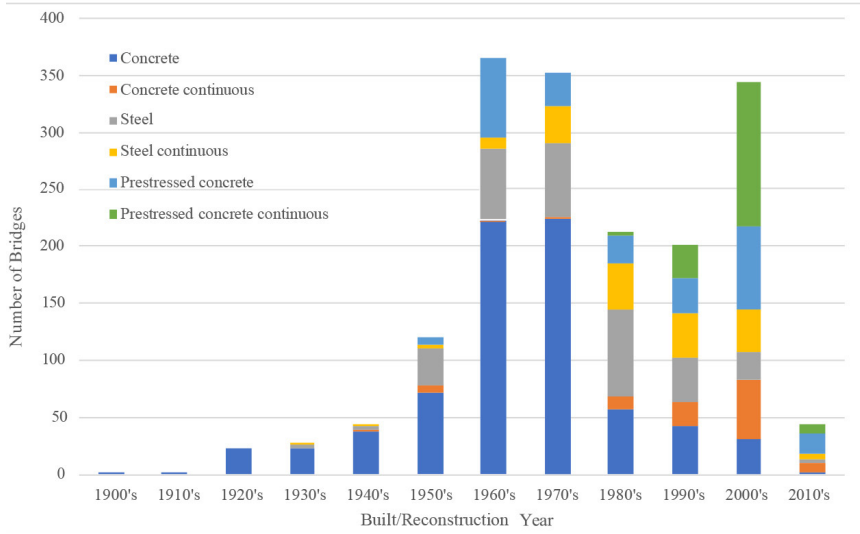
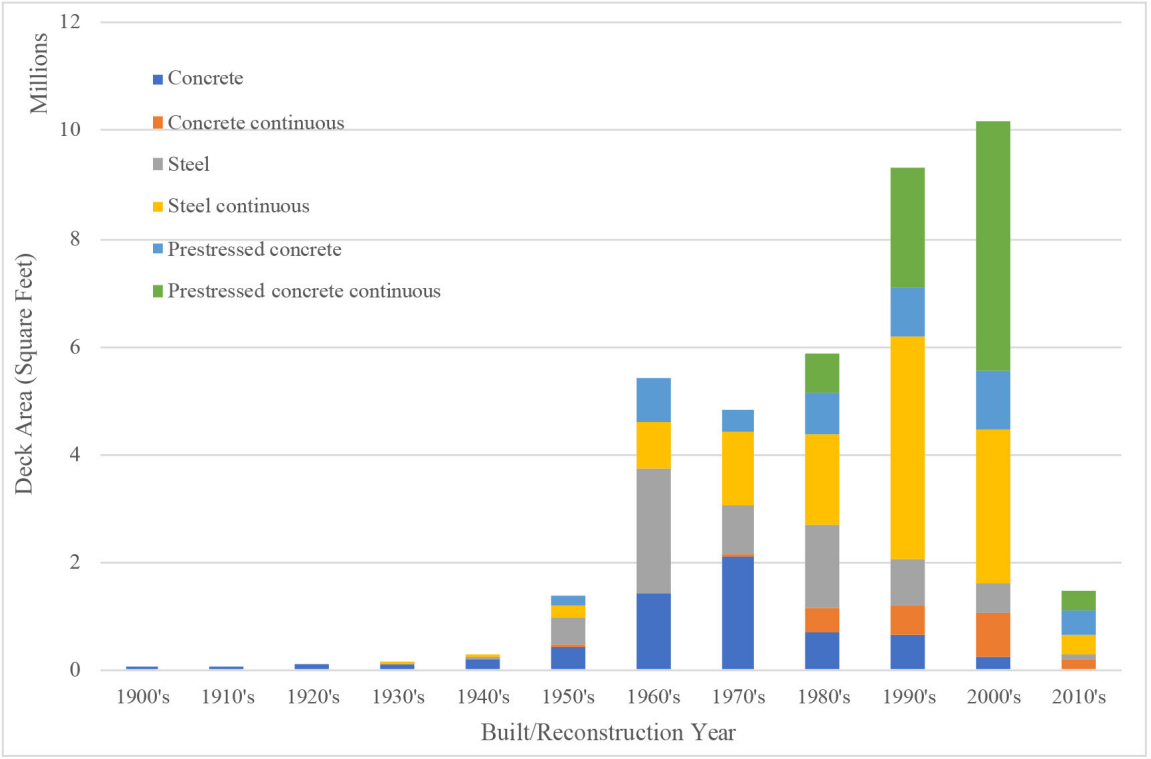


Figure 3.3. South Carolina NHS Bridges Deck Area by Year Built/Reconstructed

Figure 3.3. South Carolina NHS Bridges Deck Area by Year Built/Reconstructed



With the development of high-strength steel wire technology in the 1950's, 24% of the bridges by count and 32% by deck area are prestressed concrete bridges. Steel continuous bridges account for about 30% of the NHS bridge deck area, but only 9.9% by count, or 172 bridges (Figure 3.4).

Figure 3.4. South Carolina NHS Bridges by Structure Type

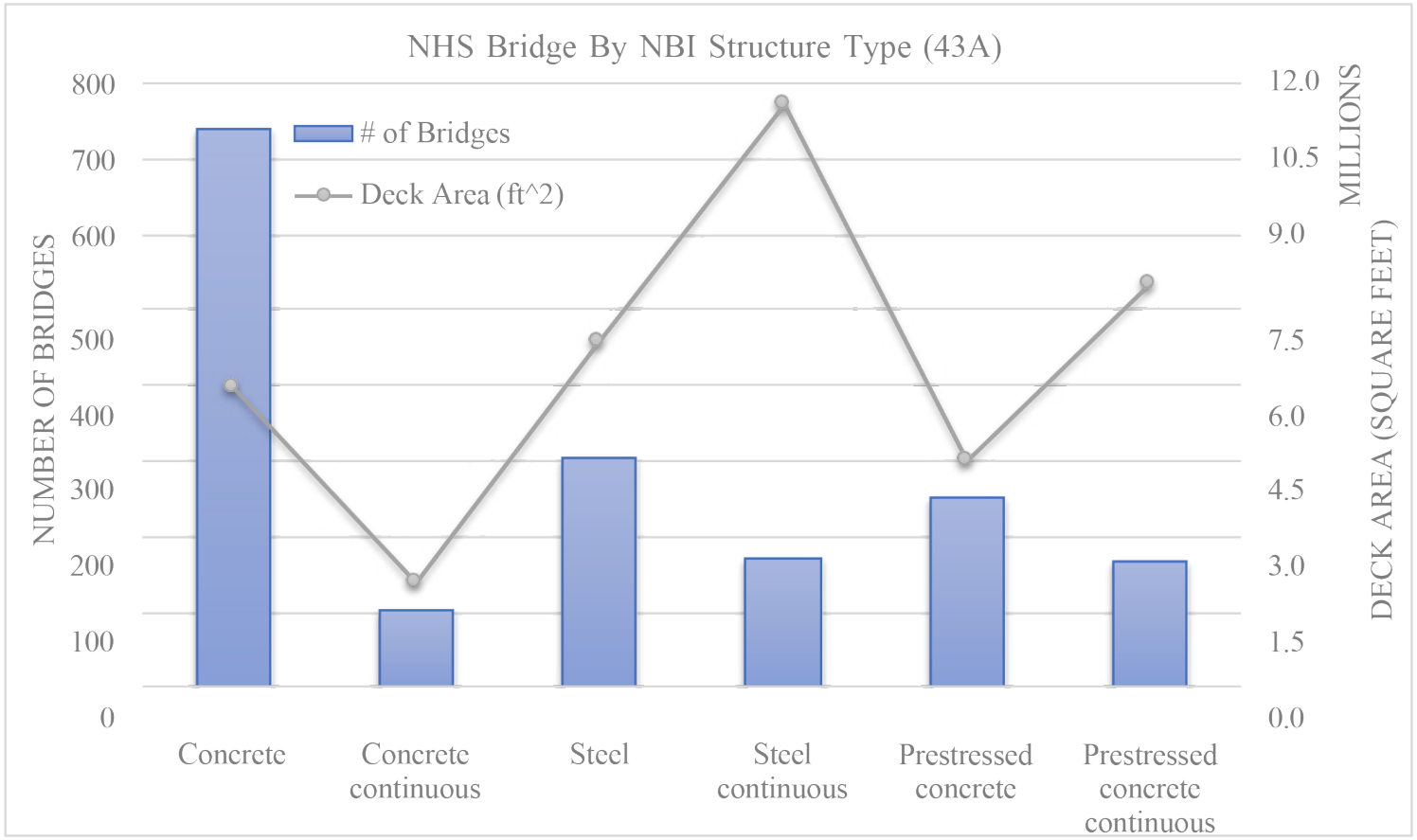


Figure 3.5. 2021 NHS Bridges by Element Rating, including Culverts (By Count)

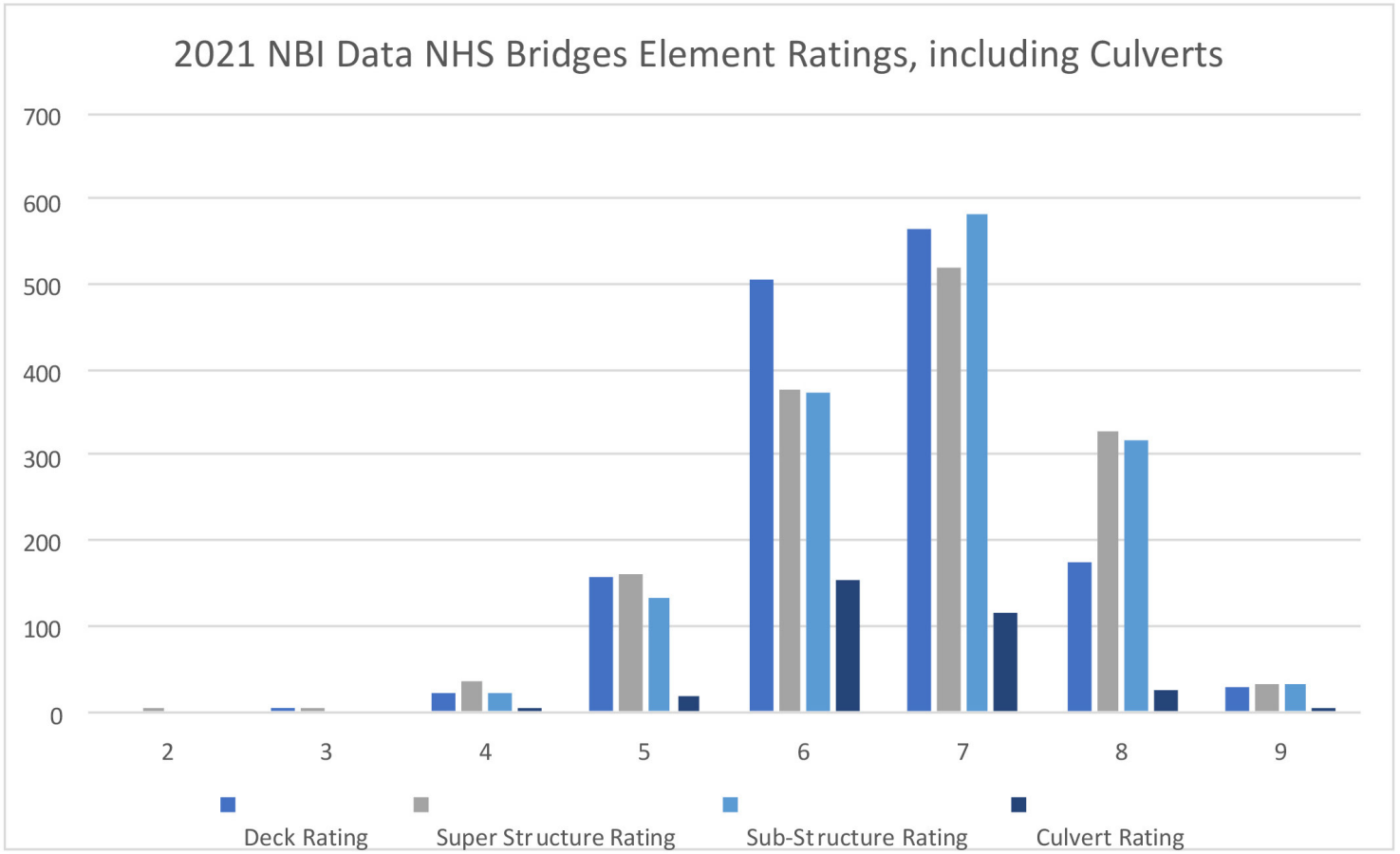


Figure 3.6. 2021 NHS Bridges by Major Component Rating, including Culverts

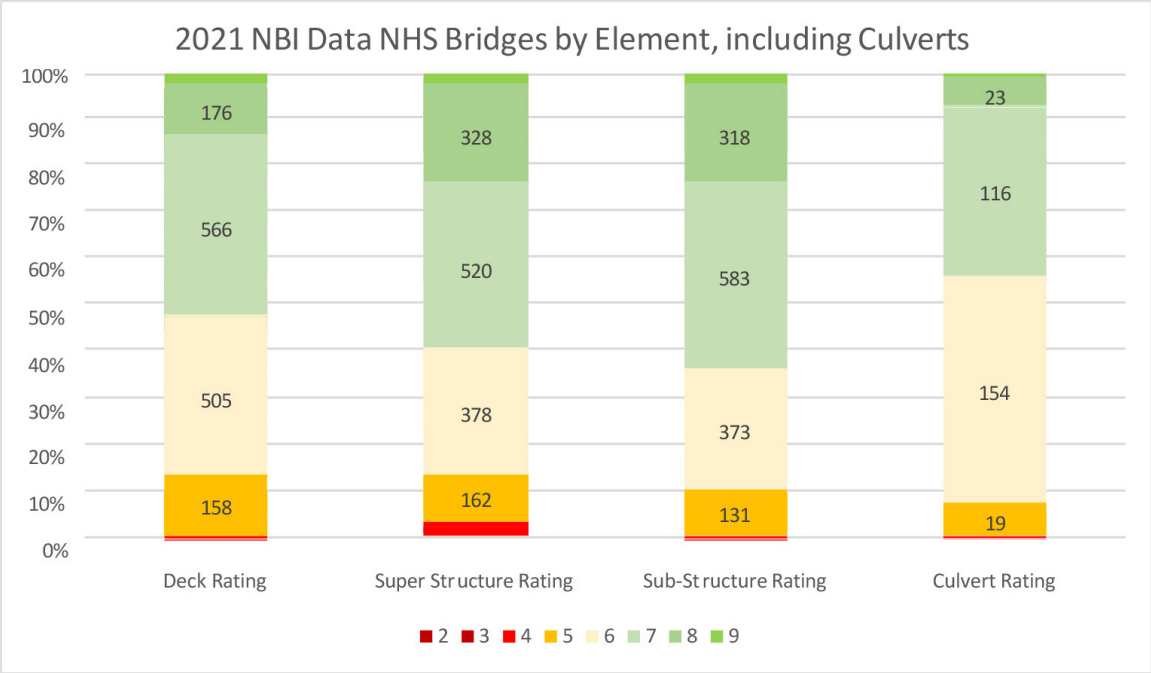
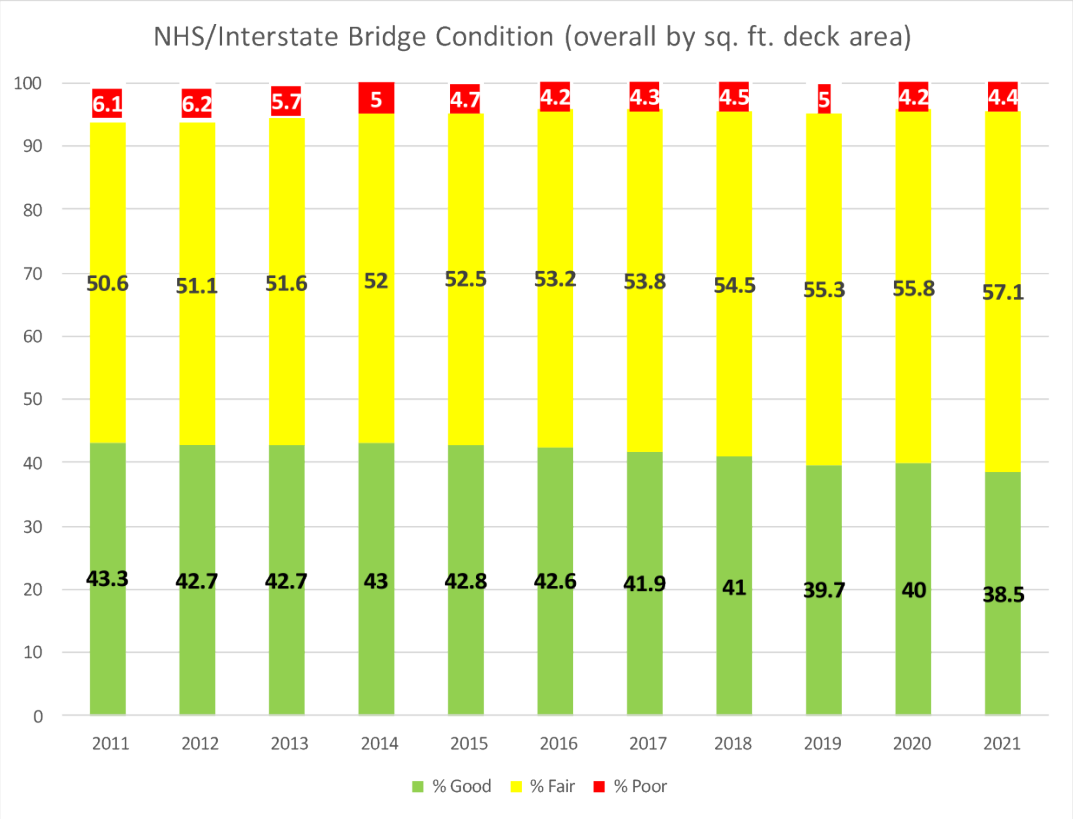


Figure 3.5 and 3.6 shows the 2021 NHS bridge element condition ratings based on NBI data by count. For bridges on the NHS there are slightly more super structures that are rated in poor condition (2, 3 and 4) and those with a rating of "5" that will most likely fall into the poor category in the coming years. The data also shows that there are more bridge decks components in fair condition that the other bridge elements. This is an area to make note of for preservation and rehab projects to keep the deck components from slipping from the "Fair" to "Poor" categories.

Figure 3.7 show the NHS bridge conditions based on thresholds defined by §490.407 and §490.409 between 2011 and 2021. As shown in Figure 3.7, the percentage of poor bridges by deck area has been well below 10% over the past decade. Based on 2021 NBI data, 4.4% of NHS bridges by overall sq. feet of deck area were rated poor. The percentage of poor bridges has been reduced by approximately 1.7 percentage points by deck area between 2011 and 2021 However, the percentage of good bridges also decreased by 4.8 percentage points, by deck area, during the same time period with the percentage of bridges in the fair category also increasing by 6.5 percent.

Figure 3.7. 2007 - 2017 NHS Bridge Condition Based on Federal Metrics – by Deck Area



4. TARGET SETTING PROCESS

The target setting process at SCDOT was developed as an alternative to the agency's bridge management system and its availability to support target development and future target projections. A working group consisting of representatives from the Office of Planning, Bridge Maintenance Office, Pre-Construction and Deputy Directors of Engineering and Intermodal Planning worked together to develop the recommendations for performance targets.

Approximately 40% percent of NHS bridges by count are approaching or have exceeded their theoretical design life and may need various levels of repairs, rehabilitation, or replacement. With limited resources and increasing travel demands, these circumstances require SCDOT to become more strategic by adopting and implementing performance and risk based approaches to address the bridge program needs.

The target setting process started with a kick-off meeting in November 2021, with participants from Office of Planning. The meeting discussed data collection cycles on bridges, as well as historical SCDOT bridge rating practices vs. federal metrics. Office of Planning staff were tasked to develop the bridge performance targets as required by 23 CFR Part 490.

The bridge performance target setting process includes the following steps:

- Obtaining historical South Carolina NBI data from FHWA;
- Obtaining available data and data sources from Road Data Services, Construction, Preconstruction, Program Controls, and Maintenance offices;
- Reviewing data;
- Analyzing data;
- Reviewing data analysis results with working group members;
- Making necessary modifications; and
- Combining data analysis results and setting preliminary targets.

4.1 Data Source

To set performance targets, the following data sources were utilized:

- NBI: National Bridge Inventory – Managed by FHWA
- RIMS: Road Inventory Management System – Managed by Road Data Services
- P2S: Project Programming System – Managed by Program Controls
- SiteManager – Managed by Director of Construction Office
- Statewide Transportation Improvement Program – Managed by Planning
- Bridge Project List from Pre-Construction
- Spreadsheets kept for potential project programming from Director of Maintenance Office

As stated in Section 3, historical NBI data for South Carolina bridges were downloaded and imported into Excel. Upon inspection, it was noted that there were two systematic changes in the unique bridge identifiers (NBI item 8 Structure Number) in the 25 years of data history. The first change occurred in the 2006 NBI data submission and the second in the 2013 NBI data submission. For 2012-2013, 2013 NBI item Structure Numbers did not appear to have a pattern when they were updated to a sequential sequence when compared to the ordering of 2012 Structure Numbers. In addition, there was not an available translation table to correlate 2012 and 2013's Structure Numbers. Queries were created to link available historical data such as structure type, deck area, element ratings to 2021 NHS bridges included in the dataset where possible.

4.2 Data Analysis Method and Analysis

To set targets for future bridge conditions, it is important to understand bridge deterioration. Deterioration is a long-term process of decline in bridge conditions due to environmental factors, degradation of material, and vehicular loading. Different structural types of bridges, such as concrete slab, steel, and prestressed concrete, may have similar response and loading mechanisms; however, no two bridges are the same in all respects, especially in their deterioration and aging characteristics. In the absence of a mechanistic-based bridge deterioration model that requires quantitative contribution of each structure element's physical property, environmental effects, and maintenance constraints, it is difficult to accurately predict deterioration for all types of bridges using the same condition analysis framework.

Most bridge deterioration models are based on statistical regression and/or stochastic modeling. Deterministic models are dependent on a mathematical regression formula for the relationship between the factors affecting bridge deterioration and the measure of a bridge's condition. The output of such models is expressed by deterministic values that represent the average predicted conditions. The models can be developed using straight-line extrapolation, regression, and curve-fitting methods. Staff ran three different data analysis methods including: Threshold, Markov Chain and Trendline. Staff ran a model for each method and concurred that Trendline analysis

was the best approach with highest confidence level to analyze the data for target setting.

To run this analysis the System Performance Group obtained NBI data from 2001 through 2021 and defined the data into subsets to look for specific trends in the datasets. The subset included categories for the Upstate, Midlands and Low Country and further divided bridge types of Concrete, Steel, Prestress and Culverts. For each NHS bridge in the NBI dataset, its inspection history from 2001 to 2021 was created for each 2021 NHS bridge, its bridge type, deck area, condition ratings for deck, superstructure, substructure, or culvert. See the definitions for each subset in Table 4.1 and an example screenshot of how the data was organized in the Excel spreadsheet by subsets for each year in Figure 4.1.

Table 4.1. Defining Each Subset for NBI Data

Defining Each Subset			
Bridge Type	Upstate	Midlands	Lowcountry
Concrete	CU	CM	CL
Steel	SU	SM	SL
Prestress	PU	PM	PL
Culvert	VU	VM	VL

Figure 4.1. Example Screenshot of Data in Spreadsheet Broken into Subsets

Observed Good Deck Area in Each Sub-category										
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CU	329,526	275,933	247,032	247,032	226,074	267,881	267,881	267,881	263,899	263,899
CM	762,645	784,926	765,249	765,249	734,228	765,572	765,551	709,772	720,019	722,398
CL	3,671,128	3,611,669	3,747,025	3,872,274	3,580,948	3,502,189	2,314,983	2,302,680	1,704,379	1,422,677
SU	1,270,475	1,368,276	1,518,465	1,474,451	1,490,242	1,707,339	1,721,903	1,721,903	1,721,903	1,708,803
SM	2,282,519	2,285,662	2,176,247	1,980,538	1,980,538	2,235,115	2,235,115	2,235,115	2,214,179	2,014,584
SL	4,568,408	4,532,909	4,747,745	5,261,292	5,137,786	5,104,429	4,444,806	5,585,705	3,895,308	3,845,385
PU	327,352	432,505	744,820	761,181	795,474	968,354	934,878	962,261	988,816	967,611
PM	965,146	921,025	837,142	846,646	844,892	839,133	828,401	906,149	899,142	899,142
PL	2,273,575	2,255,642	2,251,390	3,995,650	3,987,846	4,001,527	2,626,297	2,914,092	2,934,576	2,741,783
VU	17,696	20,301	80,912	80,094	81,192	123,882	142,041	145,916	145,916	143,332
VM	53,830	53,830	145,550	145,550	149,489	162,158	170,070	178,950	178,950	178,649
VL	163,633	169,435	260,960	266,837	245,988	287,192	304,220	293,758	280,271	272,381
Statewide	16,685,987	16,647,313	17,522,612	19,696,847	19,254,751	19,964,836	16,756,189	18,224,236	15,947,411	15,180,719

Figure 4.2 and Figure 4.3 show the percentage of bridges by subset and their distribution of percent good and poor bridges by deck area.

Figure 4.2. 2021 NBI Data Subsets for NHS Bridges, % Good (Deck Area)

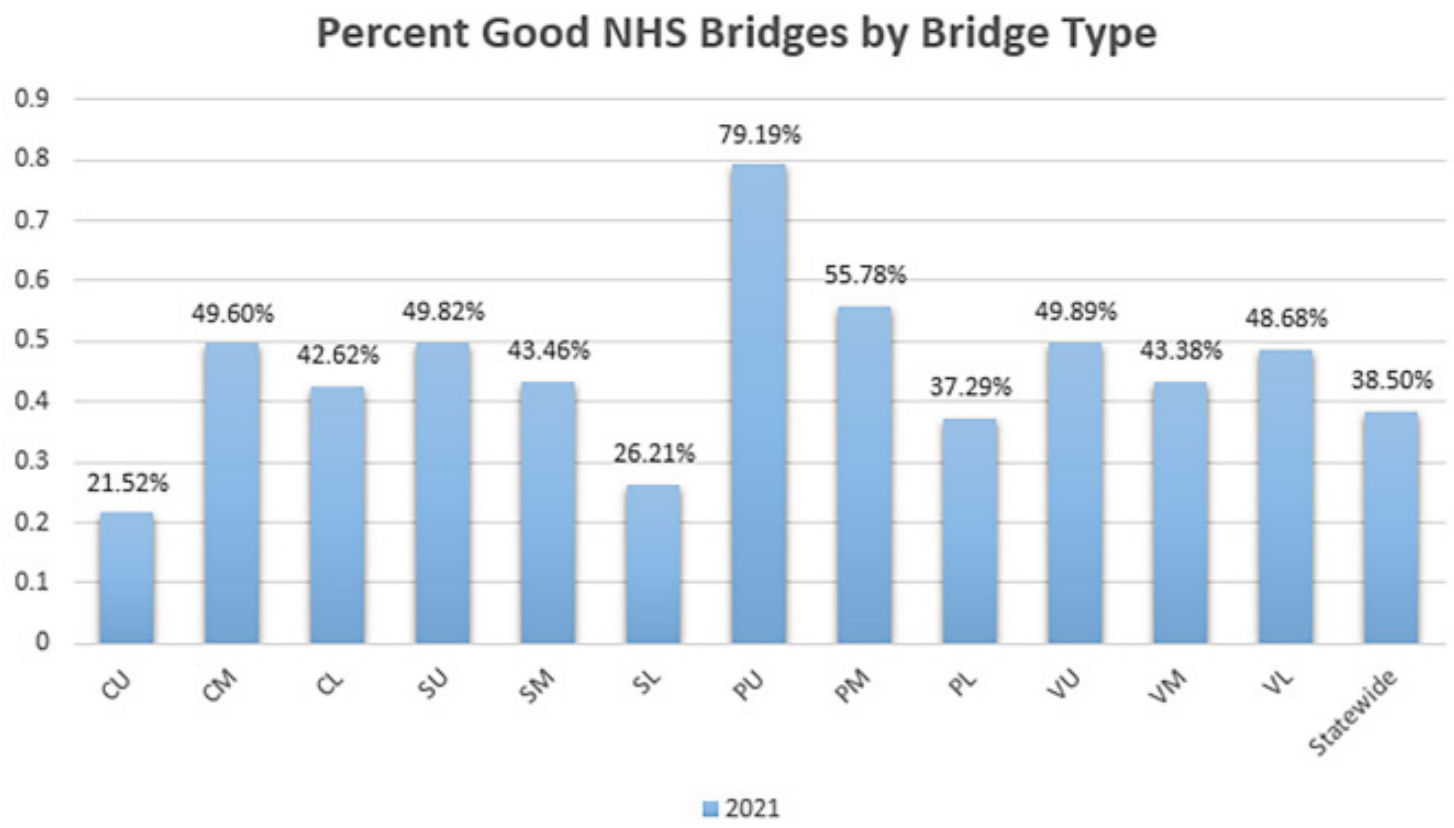
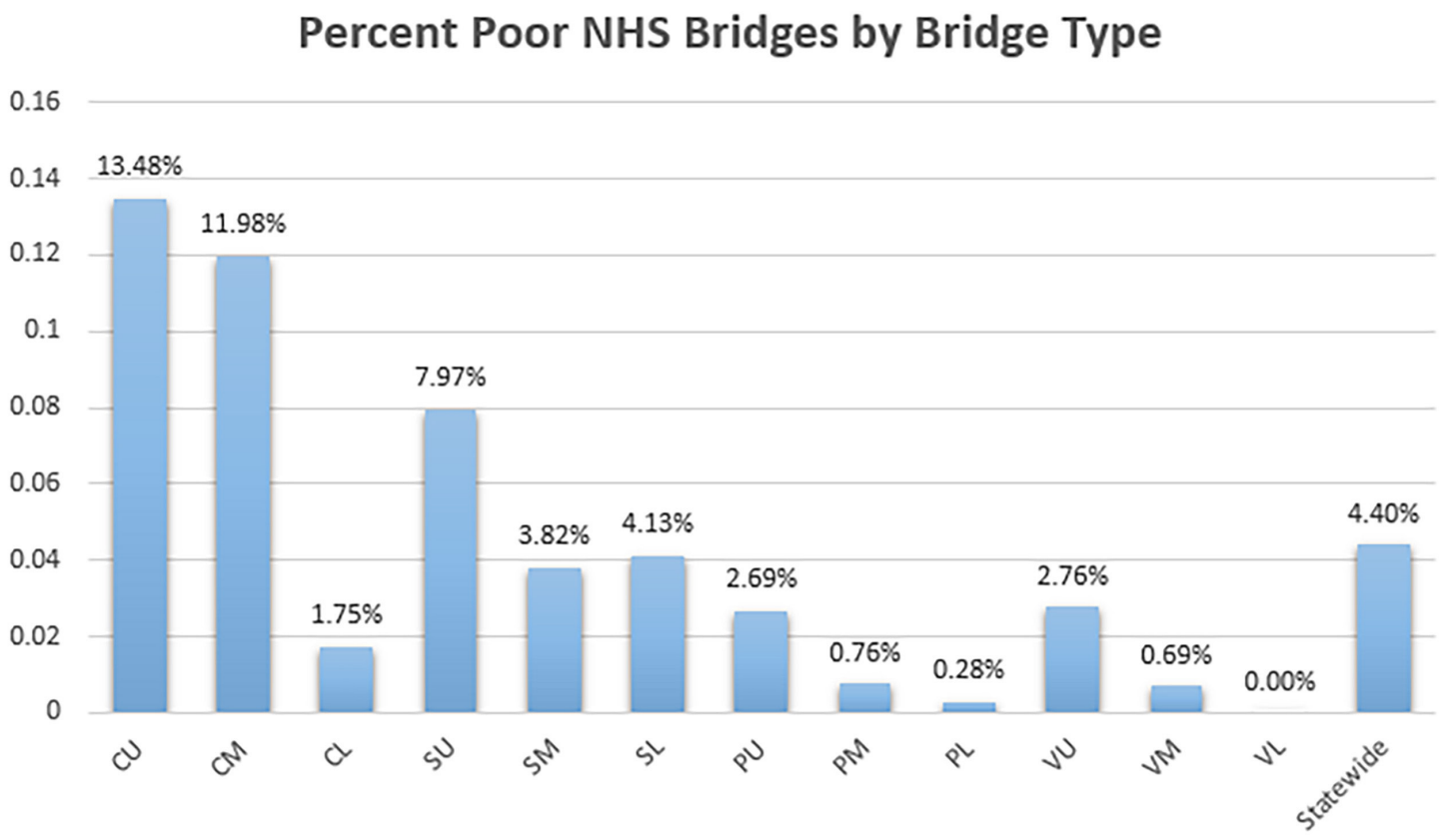


Figure 4.3. 2021 NBI Data Subsets for NHS Bridges, % Poor (Deck Area)



After the data was broken into subsets and observation of trends for specific areas and bridge types was completed, the Office of Planning created a trendline based on the historical behavior and deterioration of bridges on the NHS. The trendline analysis was completed with modeled targets which were presented to a Working Group for Target Setting. The recommendations from the Working Group are shown in Section 6.

5. TARGETS

5.1 NHS Bridges

For the 1st performance period (1/1/2022 – 12/31/2025), 2 and 4-year targets are required for NHS bridges. SCDOT is required to report data to FHWA annually on the condition and functional adequacy for all bridges statewide. As a result, bridge projects with potential completion dates between 1/1/2022 and 12/31/2023 need to be included for the 2-year target. Projects with potential completion dates between 1/1/2024 and 12/31/2025 need to be factored into the 4-year target. Table 5.1 shows typical bridge preservation/rehabilitation/reconstruction project types and potential improvements for deck, superstructure, substructure, and culvert based on historical data and subject matter experts' opinions. Preservation projects, such as bridge painting, joint repair, spall repair, are not factored in the target setting as it is hard to quantify how much improvement these types of project would make on a bridge.

Table 5.1. Potential Bridge Construction Project Improvements

Project Type	Potential Results			
	Deck	Superstructure	Substructure	Culvert
Bridge Replacement	Good	Good	Good	Good
Deck Overlay	Good	N/A	N/A	N/A
Deck full/partial depth repair	Some Improvement	N/A	N/A	N/A
Bridge Painting	N/A	N/A	N/A	N/A
Expansion Joint Repair	Some Improvement	N/A	N/A	N/A
Bearings, spalls on girders, joints repair	N/A	Some Improvement	N/A	N/A

Existing and planned NHS bridge rehabilitation and replacement project information was obtained from the eSTIP, P2S, SiteManager and obtaining data from Regional Production Groups (RPGs) and the Director of Maintenance and Director of Construction Offices. Active construction project scopes were compared to contracts and plans to determine contract time, new deck area, if available, and potential impacts to bridge condition for rehabilitation projects. Preconstruction and the Maintenance office were contacted to verify project scope and potential contract time for planned projects.

A total of 36 bridge construction projects have been or are planned to be completed between 1/2022 and 12/2025 that will move Interstate/NHS bridges from poor and fair categories to good category. Among the 36 bridge replacement/rehabilitation projects, 32 are replacements and 4 are repairs/rehabilitation. Of these 36 bridges, 25 bridges were rated as "poor" according to 2021 NBI data. For bridge replacement projects, the change in deck area is factored into the 2021 projections if bridge plans are available.

An important note for planned projects is that when the Office of Planning was developing the trendline model and gathering data on planned projects the Bridge Program was also completely restructured. At the time the model was created projects from Pre-Construction and Director of Maintenance office were included but the Office of Alternative Delivery were not included. The Office of Alternative Delivery will be delivering 7 packages of bridge projects that are a mix of primary and secondary routes with a schedule that aims to have bridges under construction contract by the end of 2024. With a 15-18 month typical bridge construction time frame the majority of these bridges would be completed past the end of the new performance period. The bridges projects on the NHS that were included in modeling are listed in Table 5.2.

Table 5.2. NHS Bridge Construction Projects, *Estimated

Project Type	Planned Completion <01/2022 – 12/2023		Planned Completion 01/2022 – 12/2025	
	Number of Bridges	Deck Area (ft2)	Number of Bridges	Deck Area * (ft2)
Replacement	8	121,498	32	463,498
Deck rehab	4	52,376	4	52,376

The bridge deterioration trendline model was developed based on historical data and deterioration behavior with improvement projects incorporated. Figure 5.1 shows the modeled 2023 (2-year) and 2025 (4-year) NHS bridge conditions statewide percent good based on deck area. Figure 5.2 shows the modeled 2023 (2-year) and 2025 (4-year) NHS bridge conditions statewide percent good based on deck area, with improvements incorporated from Table 5.2.

Figure 5.3 shows the modeled 2023 (2-year) and 2025 (4-year) bridge conditions statewide for NHS bridges percent poor, based on deck area. Figure 5.4 shows the modeled 2023 (2-year) and 2025 (4-year) bridge conditions statewide for NHS bridges percent poor based on deck area, with improvements incorporated from Table 5.2 that would move bridges from the poor category. For the percent poor Figures 5.3 and 5.4 note the "Performance Threshold" line that is set at 6%. %. This is the performance target that the working group has set for percent poor NHS bridges (by deck area).

Figure 5.1. Statewide NHS Bridges, Percent Good (Deck Area), No Improvements

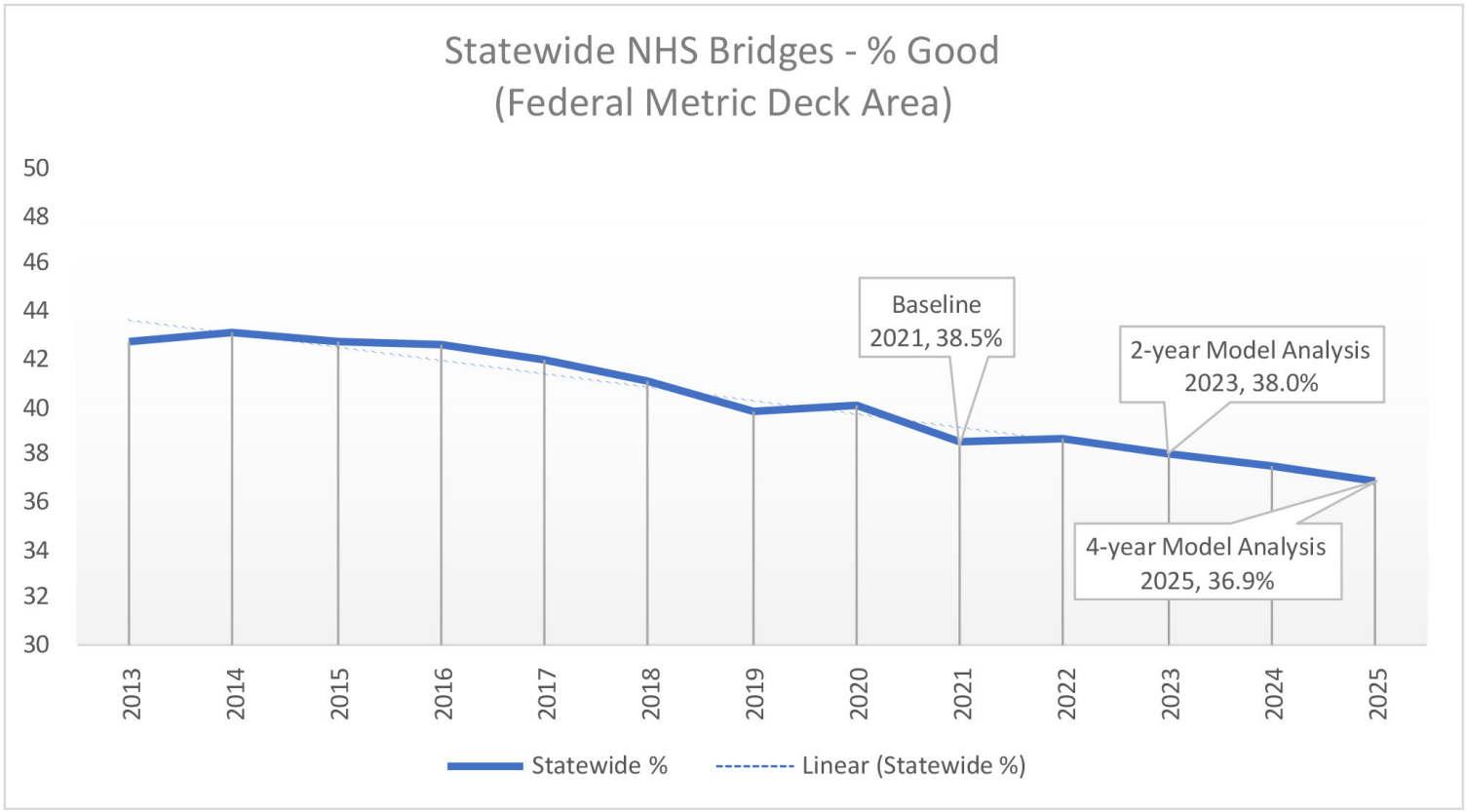


Figure 5.2. Statewide NHS Bridges, Percent Good (Deck Area), With Improvements

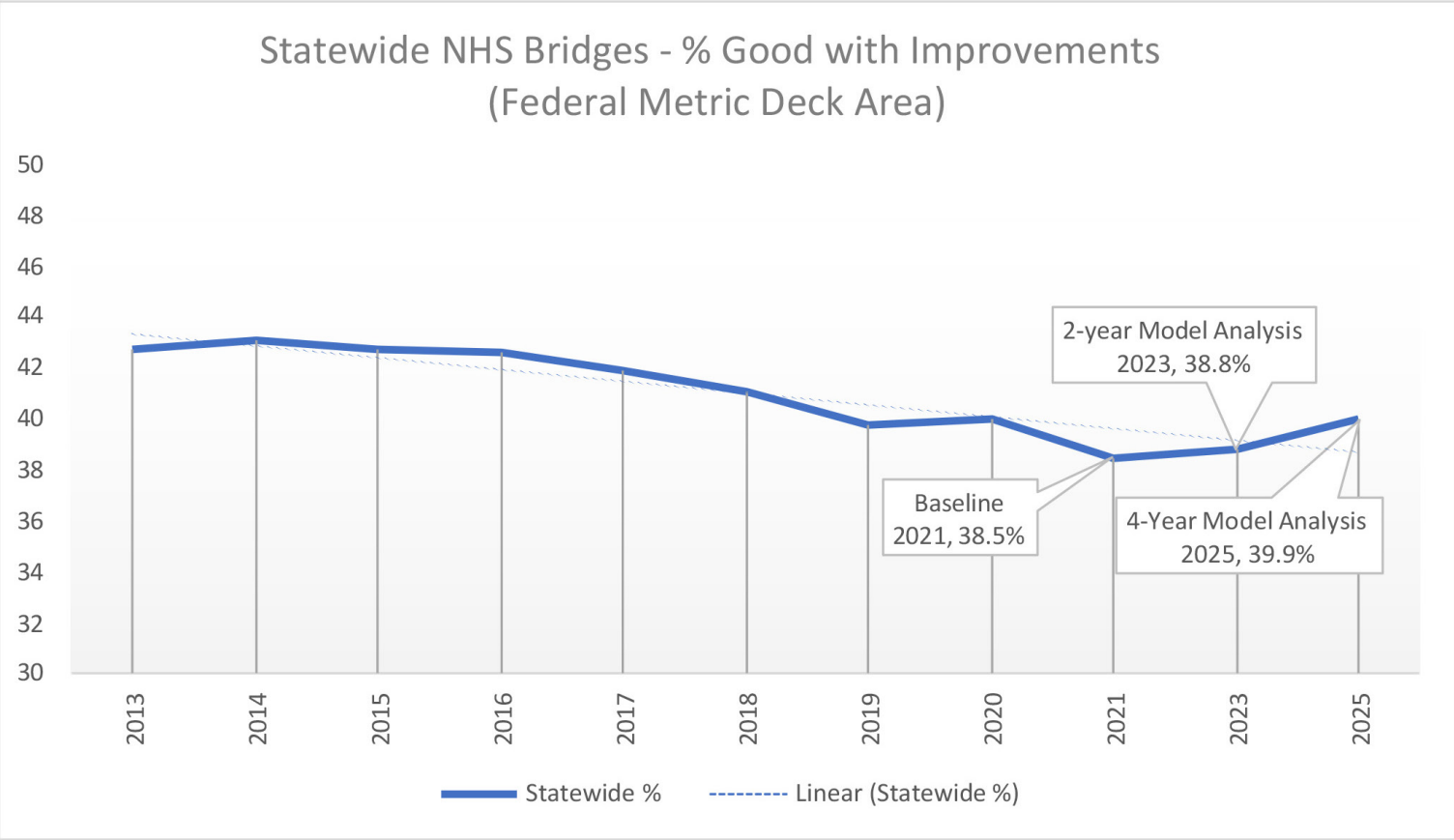


Figure 5.3. Statewide NHS Bridges, Percent Poor (Deck Area), No Improvements

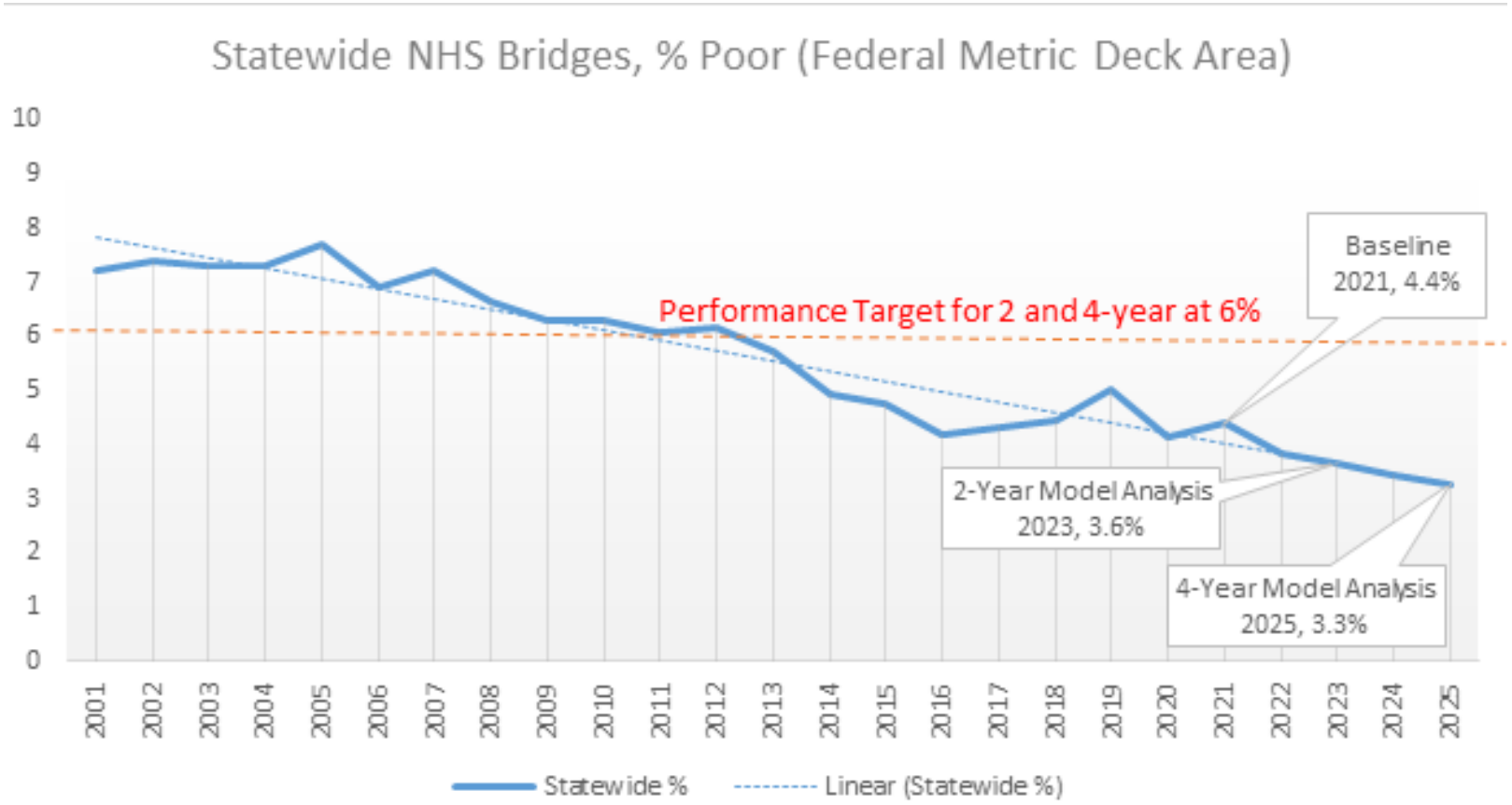
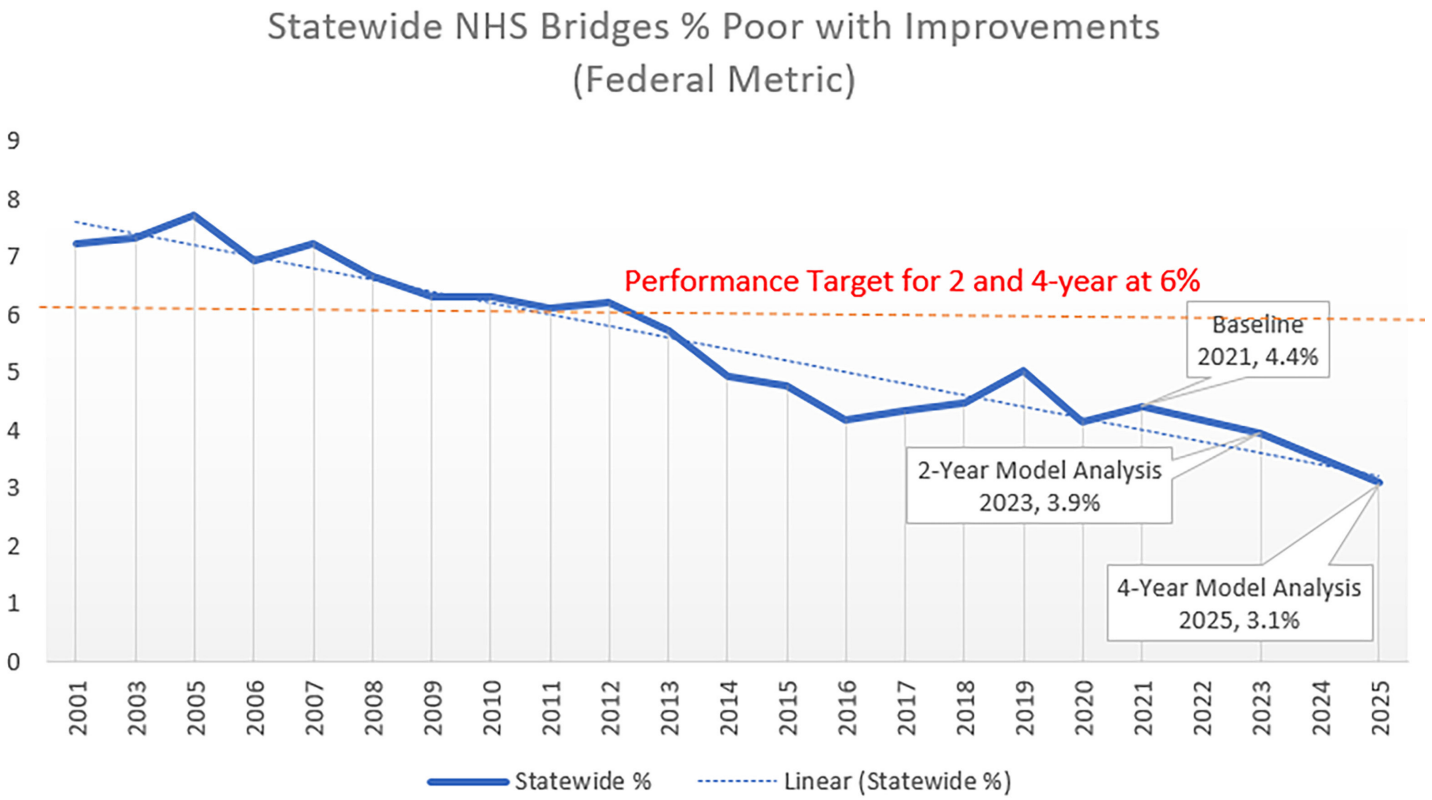


Figure 5.4. Statewide NHS Bridges, Percent Poor (Deck Area), With Improvements



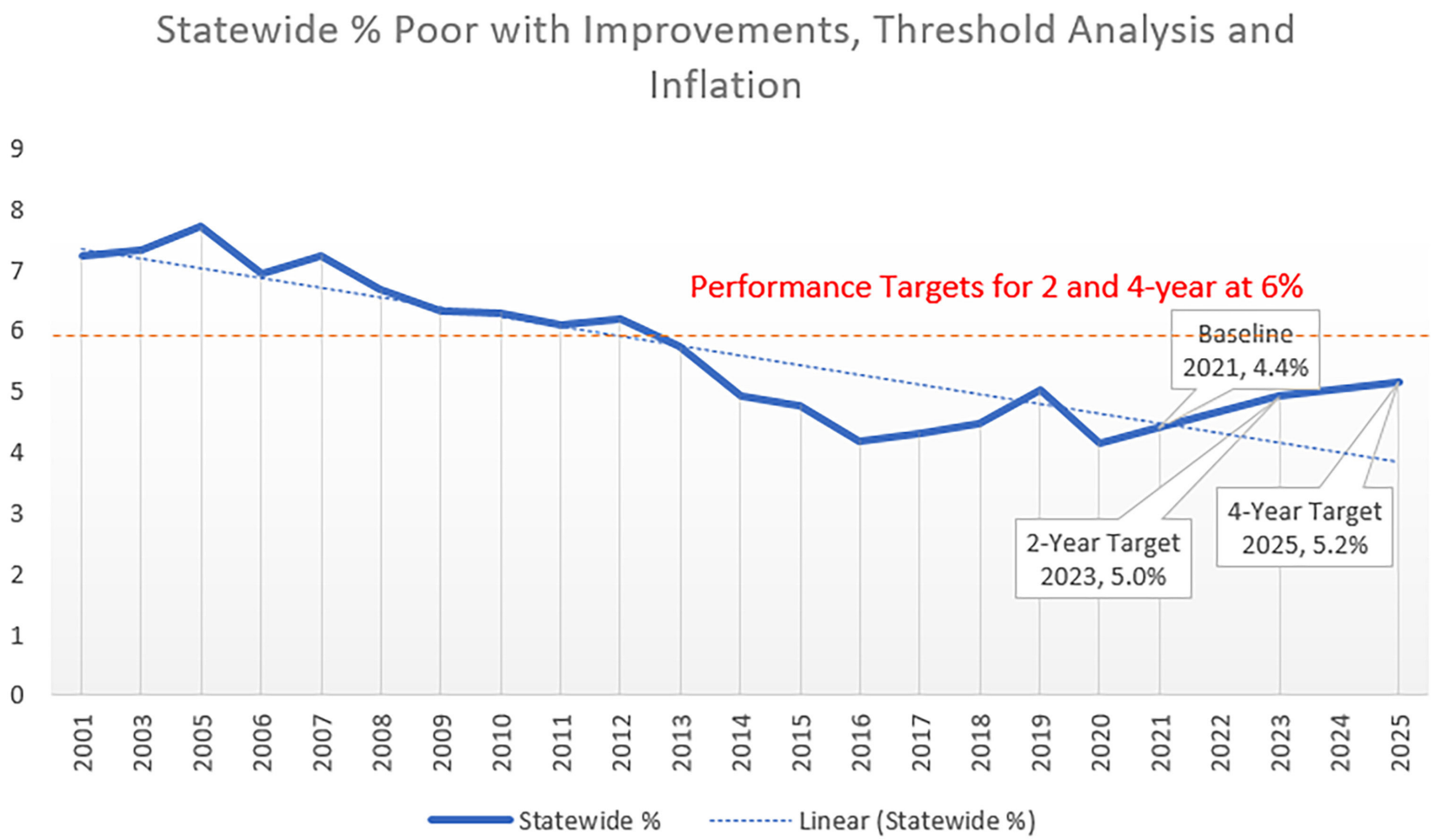
After modeling was completed with the trendline analysis, the working group incorporated the threshold analysis looking at the percentage of bridges that will move from 5 to 4. With a more robust inspection program the working group expects more fair rated bridges to move to the poor category over the next performance period.

Over a 5-year average approximately 90% of bridges with the lowest element rating of 5 will stay at a 5, and 10% will move to a 4. Table 5.3 shows the amount of bridge deck area that is projected to move to a 5 at 691,913 square feet near the end of the 1st performance period incorporating the threshold analysis. In Figure 5.5 the results are shown adjusted with this threshold data. The working group recommended to set the performance target at 6% for poor bridges based on the trendline modeling, threshold analysis, and the assumption that a more robust inspection program will move more bridges from the fair category to poor. In addition this model assumes that all programmed projects will be completed on budget and on time; however, the current state of inflation and economy may affect the lettings of bridge projects over the next 4 years. Consulting with the Construction Office, inflation has increased current lettings by 20%, as of June 2022, with the expectation that it will continue to rise before inflation will begin to level off. This inflation has been incorporated into the final recommendations.

Table 5.3 Threshold Analysis Metrics with Inflation Incorporated

	Count	Bridge Deck Area	10% of bridges
Number of bridges with lowest combined rating of 5	279	6,919,138 sq ft	691,913 sq ft

Figure 5.5 Statewide % Poor with Improvements and Threshold Analysis and Inflation Incorporated



5.2 MINIMUM THRESHOLD

Per 23 CFR part 490 subpart D, State DOTs are required to maintain a minimum condition level of NHS bridges. FHWA's Office of Bridges and Structures will determine annually if a State DOT meets the minimum threshold based on NBI data by July 1st of each year and notify the State DOT of its compliance by October 1st of the year. FHWA will make the 2021 annual determination whether States meet this threshold requirement by October 1 based on 2019, 2020, and 2021 NBI data submissions. Per 23 CFR 490.411 and 490.413, if for three consecutive years more than 10.0% of a State DOT's NHS bridges' total deck area is classified as Structurally Deficient, the State incurs a penalty the following fiscal year. If a State does not meet the minimum condition requirements in 23 CFR 490.411, an amount equal to 50 percent of the State's Highway Bridge Program apportionment amount from 2009 will be set aside from the State's NHPP annual apportionment and obligated the same fiscal year the penalty is incurred for eligible projects. The obligation and set aside requirement is only for eligible projects on bridges on the NHS as described in 12 U.S.C. 144.

When setting its percent poor targets for NHS bridges, SCDOT will strive to ensure it meets the minimum condition rating as outlined in federal law.

5.3 MPO Condition Data

Within 180 days after the State DOT's target is established, MPOs can decide to adopt and support the State DOT's 4-year target or establish their own, quantifiable targets. For the first target setting process, SCDOT recommended to MPOs to adopt and support the State's 4 year target. Table 5.4 shows 2021 Q4 condition data by MPO using the federal metric.

Table 5.4. MPO 2021, Q4 - NHS Bridge Condition Data

MPO	Bridge Counts	Deck Area (ft2)	Condition	By Count	By Deck Area
ANATS	34	525,212	Good	26.47%	17.38%
			Poor	2.94%	0.82%
ARTS	43	612,897	Good	39.53%	61.75%
			Poor	2.33%	1.44%
CHATS	141	11,477,338	Good	24.11%	22.61%
			Poor	1.42%	0.86%
COATS	171	4,066,969	Good	56.14%	52.67%
			Poor	1.17%	5.08%
FLATS	59	759,247	Good	47.46%	38.43%
			Poor	0.0%	0.0%
GPATS	148	2,238,222	Good	57.43%	56.75%
			Poor	7.43%	11.57%
GSATS	107	3,708,142	Good	65.13%	75.70%
			Poor	7.52%	2.80%
LATS	45	2,123,262	Good	13.33%	2.28%
			Poor	2.22%	4.13%
RFATS	34	669,790	Good	14.71%	24.52%
			Poor	2.94%	0.62%
SPATS	95	1,187,829	Good	54.74%	62.17%
			Poor	3.16%	3.66%
SUATS	15	198,963	Good	33.33%	64.01%
			Poor	13.3%	10.94%

6. RECOMMENDATIONS

SCDOT is faced with significant challenges in addressing the highway bridge preservation and replacement needs. In 2018 the agency began the Statewide Loading Effort that was completed after three years in 2021. The $75 million effort has provided SCDOT with invaluable new data points that exposed the vulnerability of the system if left unaddressed could impact the movement of people and goods across the state impacting commerce and the economy. With the results of the Load Rating Effort and increased funding the Bridge Program was completely restructured.

The new Bridge Program brings a balanced approach to bridge preservation, rehabilitation and replacement with approval by Commission on December 9, 2021. The new priorities of the program are listed under the Bridge Management Section 4.5 of the STAMP.

The shifting priorities of the new Bridge Program and new prioritized bridge list was taken into account with target setting. In addition to the restructured Bridge Program the Working Group also took into account the Inspection and Compliance Program. The Inspection and Compliance Program has been ramped up with a dedicated program budget of $25 million. As better data is collected through inspections and underwater inspections on bridges the agency noted that more fair bridges may shift to the poor category. Based on the criteria and methodology outlined in this document and the recommendations of the Working Group on April 4, 2022, the following NHS condition targets are shown in Table 6.1. The agency remains well below the 10% threshold for percent poor. The Working Group also recommended that MPOs adopt and support the statewide 4-year NHS bridge condition target.

Table 6.1 NHS Bridge condition target recommendations

NHS Bridge Target	By Deck Area	
	% Good	% Poor
2-year	35.0%	6.0%
4-year	34.0%	6.0%

SCDOT PERFORMANCE MEASURES AND TARGET SETTING - PAVEMENT

1. FEDERAL REQUIREMENTS

The Federal Highway Administration (FHWA) published in the Federal Register (82 FR 5886) a final rule establishing performance measures for State Highway Agencies (SHA)s to use in managing pavement and bridge performance on the National Highway System (NHS). The NHS is the Interstate Highway System plus additional roads important to the nation's economy, defense, and mobility. The National Performance Management Measures: Assessing Pavement Condition for the National Highway Performance Program and Bridge Condition for the National Highway Performance Program Final Rule addresses requirements established by the Moving Ahead for Progress in the 21st Century (MAP-21) Act and reflects passage of the Fixing America's Surface Transportation (FAST) Act. The rule is effective May 20, 2017.

SHAs are required to:

- Set targets for the full extent of the interstate and non-interstate NHS, regardless of ownership.
- Establish statewide 2- and 4-year targets for the non-interstate NHS and 4-year targets for the interstate by May 20, 2018, and report by October 1, 2018. (and every 4-years thereafter)
- Adjust targets at the Mid Performance Period Progress Report if necessary (October 1, 2020). (every 4-years thereafter)

Metropolitan Planning Organizations (MPOs) are required to support the relevant SHA's 4year target or establish their own quantifiable target within 180 days after the SHA's target is established.

Pavement performance measures are detailed in 23 CFR Part 490 Subpart C: Measures for Assessing Pavement Condition. The regulation also establishes minimum condition requirements for interstate pavements.

Performance Measures	Penalties
• Percentage of pavements of the Interstate System in Good condition • Percentage of pavements of the Interstate System in Poor condition • Percentage of pavements of the non-Interstate NHS in Good condition • Percentage of pavements of the non-Interstate NHS in Poor condition	If 5% of interstate pavements are in poor condition then the agency must obligate NHPP funds on interstate pavement.

23 CFR Part 490.311 defines the metric thresholds for each 0.1-mile pavement segment, as well as the pavement measures calculation (as shown in Table 1.1 and Table 1.2)

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	Table 1.1 - Pavement Condition Thresholds [23 CFR 490.313]			
	Good	Fair		Poor
IRI (in./mile)	<95	[95, 170]		>170
Cracking Percent (%)	<5	CRCP:	[5, 10]	>10
		JPCP:	[5, 15]	>15
		AS-PHALT:	[5, 20]	>20
Rutting (in.)	<0.20	[0.20, 0.40]		>0.40
Faulting (in.)	<0.10	[0.10, 0.15]		>0.15

Table 1.2 - Pavement Measures Calculation [23 CFR 490.313]

For each 0.1-1ane mile segment:	Pavement Type			
	Asphalt and JPCP	CRCP		Measure
Overall Section Condition Rating	3 Metric Ratings (IRI, Cracking, and Rutting/Faulting)	2 Metric Ratings (IRI, Cracking,)		
Good	All 3 metrics rated "Good"	Both metrics rated "Good"	→	Percentage of lane- miles in "Good" Condition
Poor	≥ 2 metrics rated "Poor"	Both metrics rated "Poor"	→	Percentage of lane- miles in "Poor" Condition
Fair	All other combinations	All other combinations		

Based on pavement condition and inventory data, which include facility type, through lanes, functional system, surface type, structure type, and urban code, the percentage of pavements in good and poor conditions are calculated as:

$$\% \text{ Pavements in Good condition} = 100 \times \frac{\sum_{g=1}^{\text{Good}} \{(\text{End\_Point} - \text{Begin\_point}) \times \text{Through\_lanes}\}_{\text{section } g}}{\sum_{g=1}^{\text{Total}} \{(\text{End\_Point} - \text{Begin\_point}) \times \text{Through\_lanes}\}_{\text{section } t}}$$

$$\% \text{ Pavements in Poor condition} = 100 \times \frac{\sum_{g=1}^{\text{Poor}} \{(\text{End\_Point} - \text{Begin\_point}) \times \text{Through\_lanes}\}_{\text{section } p}}{\sum_{g=1}^{\text{Total}} \{(\text{End\_Point} - \text{Begin\_point}) \times \text{Through\_lanes}\}_{\text{section } t}}$$

2. SCDOT PAVEMENT INVENTORY

2.1 Inventory

Figure 1.1 shows the centerline miles and lane-miles maintained by SCDOT. Figure 1.2 shows the NHS routes in South Carolina. The agency has developed its 10-Year targets based on its Pavement Quality Index (PQI) prior to the promulgation of the federal metrics. Under MAP-21, about 8.7% of centerline miles and 14.5% of lane-miles are subject to the target setting requirements based on federal metrics.

Figure 1.1. 2021 SCDOT Pavement Inventory

System Functional Tier	State-maintained Centerline-miles	State-maintained Lane-miles	Daily Vehicle Miles Traveled (DVMT)
Interstate (SHS)	851	3,866	45,575,948 (31%)
Non-Interstate NHS (SHS)	2,749	9,391	39,868,469 (27%)
Non-NHS Primary (SHS)	6,765	14,930	30,201,491 (20%)
Federal Aid Secondary (SHS)	10,349	21,270	23,707,180 (16%)
Non-Federal Aid Secondary (SHS)	20,591	41,271	8,946,010 (6%)
TOTAL	41,295	90,728	148,299,098 (100%)

Figure 1.2. South Carolina National Highway System

2.2 Current Asset Condition

Figure 2.1 shows the current asset condition as of Q4 for 2021 on the Interstate and Non-Interstate NHS Systems.

Figure 2.1 2021 Asset Inventory and Condition

System Functional Tier	State-maintained Center-line-miles	State-maintained Lane-miles	Daily Vehicle Miles Traveled (DVMT)	Percent Good	Percent Fair	Percent Poor
Interstate (NHS)	**851 (2.0%)**	**3,866 (4.2%)**	**45,575,948 (31%)**	**78%**	**15%**	**8%**
Non-Interstate NHS (NHS)	**2,749 (6.6%)**	**9,391 (10.4%)**	**39,868,469 (27%)**	**52%**	**18%**	**30%**

Figure 2.2 Interstate System Historical Condition

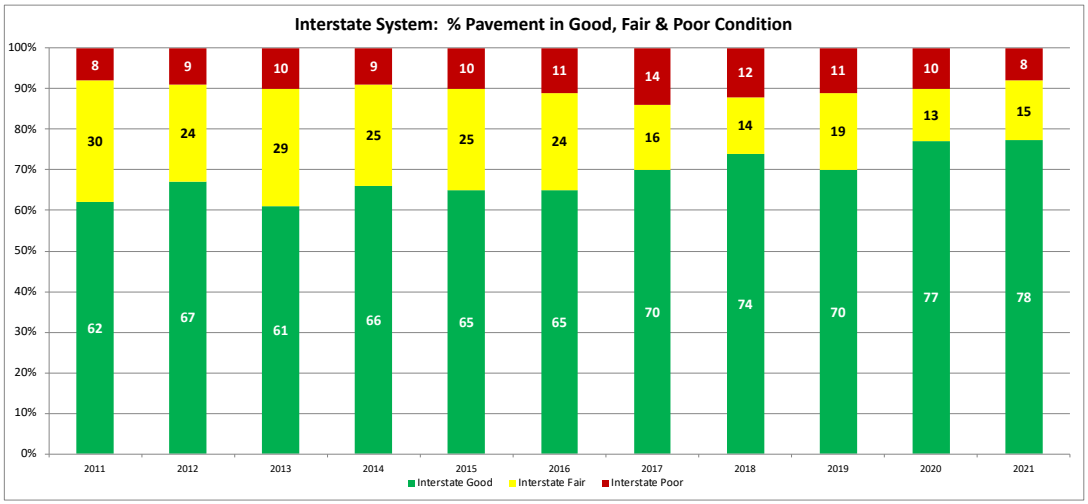
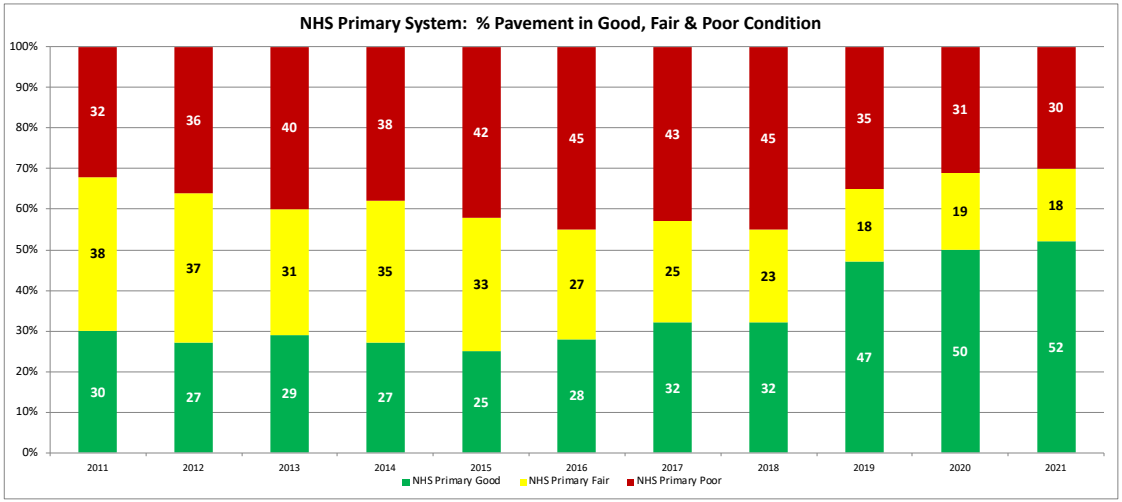


Figure 2.3 Non-Interstate NHS System Historical Condition



3. Gaps and Challenges

3.1 PQI vs. Federal Metrics

Since its inception in 1978, FHWA's Highway Performance Monitoring System (HPMS) has evolved into a robust national repository of data on the extent, condition, performance, use, and operating characteristics of the nation's highways. States report a variety of pavement condition statistics to HPMS each year for roads on the NHS, including, but not limited to, International Roughness Index (IRI) information, cracking, rutting and faulting data. Prior to MAP-21, each State decided its own index on pavement quality measurement.

SCDOT started collecting pavement condition data in 2000. In the early 2000s, SCDOT began measuring its pavement condition using PQI, which is a unique pavement index developed for SCDOT.

PQI is calculated based on Pavement Serviceability Index (PSI) and Pavement Distress Index (PDI) into an overall index (Equation 1). PSI is used to represent roughness in the SCDOT HPMA Index models. PDI is used to convert distress measurements into a composite distress index. PDI is customized for SCDOT based on a modified version of the PCI Method (ASTM D 6433 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys).

$$PQI = PDI^{0.76} \times PSI^{0.20} \quad (1)$$

Where:

$PSI = 5e^{-0.004(IRI)}$

PDI = $5 - ADV$

IRI: International Roughness Index in inches/mile

Adjusted Deduct Value: $ADV = 10(0.0014 - 0.3958 \log10(NED) + 0.9565 \log10(TDV))$

Number of Equivalent Distresses (NED) is calculated by putting the sum of the deduct values (TDV) over DVmax.

Equivalent Distress: $ED = DVi / DVmax$

Deduct value: $DV = 10(a + b \log10(PDA))$

PDA: percent distressed area (extent value)

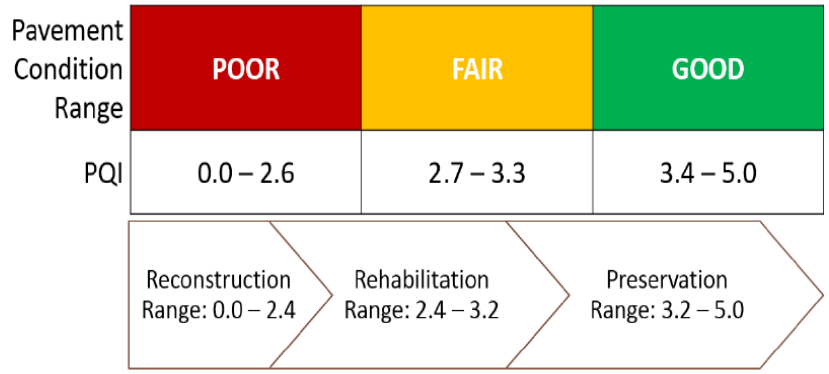
a and b: model coefficients

Both PQI and federal metrics are indices intended for evaluating pavement surface characteristics. SCDOT has traditionally used PQI to evaluate pavement surface conditions and as part of the pavement preservation/rehabilitation project programming selection criteria.

SCDOT chooses pavement preservation candidates based on the PQI of the roadway section. Once PQI is calculated, a candidate list of potential pavement preservation projects is developed. The type of treatment selected depends on several factors, including traffic condition, cost and location.
A set of trigger values used for selecting pavement preservation projects for each route system in South Carolina are as follows:

- US and SC Routes: PQI greater than or equal to 3.2 but less than 4.0
- Federal-aid Secondary Routes: PQI greater than or equal to 3.2 but less than 4.0
- Secondary Routes: PQI greater than or equal to 3.0

Figure 3.1. PQI Ranges and Trigger Values.



The national pavement condition measure requirements pose some challenges for the Department's data collection capabilities that require additional investment to meet the Federal requirements in terms of both data collection cycle and methods. Prior to 2018, only IRI data were collected biennially on non-interstate pavements, all other data were collected triennially. In addition, the Department did not process rutting, cracking and faulting in the same manner as identified in the federal rulemaking. Currently, the only metric identified in the Federal rules that the Department collects in a manner consistent with FHWA's definitions is IRI. The gaps in data collected and familiarity with new cracking, rutting, and faulting analysis approaches will need to be overcome in order to meet the federal requirements.

Differences between data collection required by 23 CFR 490.111 and SCDOT collection methods are shown in Table 3.1. Starting January 2018, SCDOT fully adopted all 23 CFR 490.111 data collection requirements for data collection on NHS routes.

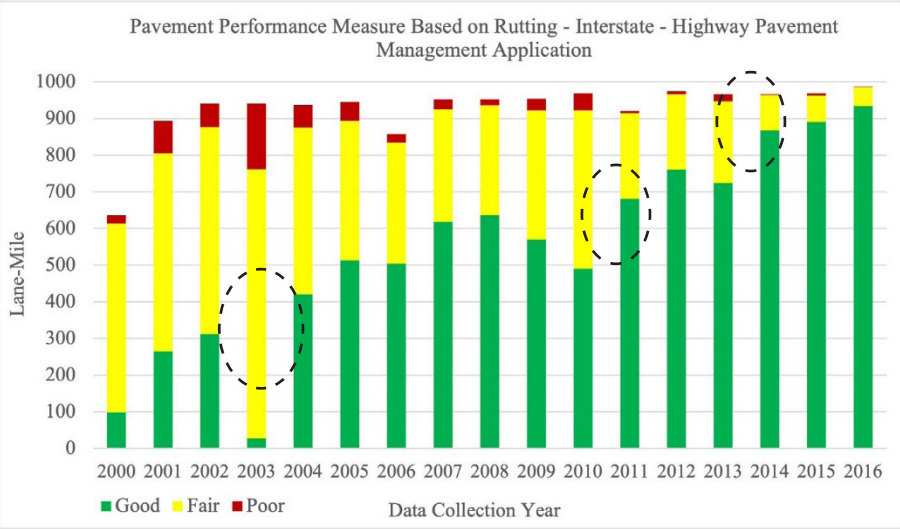
Table 3.1 – Data Collection Method Differences

	Data Collection Method	
	23 CFR 490.111 Requirements	SCDOT Collection Prior to 2017
Equipment	AASHTO Standard M328-14	AASHTO Standard M328-14
IRI (in./mile)	AASHTO Standard R43-13 AASHTO Standard R57-14	AASHTO Standard R43-13 AASHTO Standard R57-14
Cracking Percent (%)	AASHTO Standard R 55-10 AASHTO Standard R67-10 AASHTO Standard PP 68-10	Visual observation
Rutting (in.)	AASHTO Standard R48-10 AASHTO Standard PP 69-10 AASHTO Standard PP 70-10	Used 3-sensors rather than 5-sensors
Faulting (in.)	AASHTO Standard R36-13	Visual observation

3.2 Data Consistency

Based on conversations with Road Data Service staff, equipment and data collection technology were changed several times over the past 18 years. This has led to some inconsistencies in the data that make it very difficult to accurately model the changes that have occurred in rutting and rideability during the periods of these procedural changes. For example, Figure 3.2 shows the asphalt pavement performance measure based on rutting on interstate routes. It can be observed that there are data shifts for the data collection years of 2004, 2011, and 2014. Road Data Services staff confirmed that there were equipment changes for those years.

Figure 3.2. Pavement Performance Measure Based on Rutting - Interstate – Hot Mixed Asphalt Pavement



3.3 Target Setting

The National Highway Performance Program Final Rule requires DOTs to set statewide 2- and 4-year targets based on the national performance measures for the non-Interstate NHS and 2- and 4-year targets for the interstate by October 1, 2022.

The target setting process for pavement is based on analyzing historical IRI, cracking, rutting/faulting data, pavement structure data, pavement preservation/rehabilitation history, traffic condition, historical construction costs, and potential funding. The process provides the optimal preservation/ rehabilitation choices and achievable targets within a defined period.

4. Target Setting Process

Due to environmental conditions and traffic loading, pavements deteriorate with age. Well-designed, constructed, and maintained roadways are a vital component of any transportation system. One of the main goals of performance-based planning is to apply the right preservation/rehabilitation method to the right pavement at the right time. Proper preventive maintenance treatments are a cost-effective means of obtaining the maximum life and performance from the pavement. Treatments applied too soon add little benefit and treatments applied too late are ineffective, failing to prolong the life of the pavement. The potential savings from following a cost-effective approach to meeting performance objectives for pavements could be significant.

The target setting process started with a kick-off meeting on January 27, 2022, with participants from Planning, Road Data Services, and Maintenance. The meeting discussed data collection cycles on different road systems, as well as a comparison of the current SCDOT pavement rating index (PQI) vs. federal metrics.

The process includes the following steps:

- Query available data and data sources from the Road Data Services, Construction, Program Control, and Maintenance offices.
- Data review
- Data analysis
- Review data analysis results with working group members
- Make necessary modifications
- Combine data analysis results and set preliminary targets

4.1 Data Source

To set performance targets, the following data sources are utilized:

- HPMA: Highway Pavement Management Application – Managed by Road Data Services
- RIMS: Road Inventory Management System – Managed by Road Data Services
- P2S: Project Programming System – Managed by Program Controls
- SiteManager – Managed by Director of Construction Office
- Statewide Transportation Improvement Program – Managed by Planning
- SCDOT Rideability Quality Acceptance database – Managed by Office of Material and Research
- Spreadsheets kept for potential project programming from Director of Maintenance Office and Office of Material and Research

4.2 Data Analysis Method and Analysis

After reviewing data from various data sources, the following analyses were performed:

- Number of total sections

As required by 23 CFR 490.313 - Calculation of performance management measures, the total number of sections are defined as "…total number of mainline highway Interstate System sections excluding bridges, unpaved surface and "other" surface types, and missing data sections, described in paragraph (f)(1) and (b)(4)(i) of this section…"

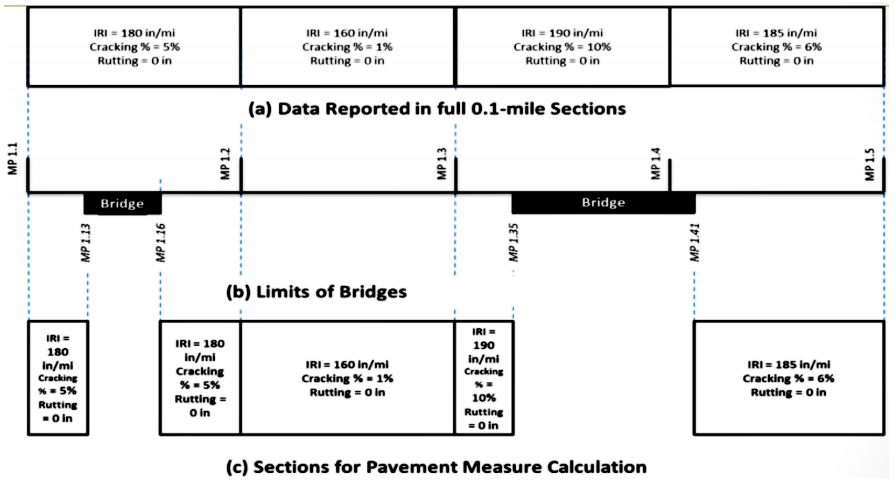
Based on information provided by the Pavement Management Engineer, During the 1st collection period data were collected on both directions for divided highways and one direction for un-divided highways. Bridges were not marked during the data collection.

Table 4.1. Mileage of Divided and Undivided NHS

System	Divided (miles)	Undivided (miles)
Interstate	850.59	
Non-interstate NHS	947.75	1,945.23
Total = (850.59 + 947.78)*2 + 1945.23 = 5,541.97 miles		

To remove bridges from the roadway condition data, bridge location data were obtained from RIMS. Bridge middle mile points were located to adjacent roadway section mile points. Bridge lengths were subtracted from sections where bridges were located. Pavement condition data were applied to the <0.1-mile sections adjacent to bridges as shown in Figure 4.1.

Figure 4.1 – Illustration of Bridge Exclusion on 0.1-Mile Pavement Sections



➢ Pavement deterioration rate

The Department currently has a deterioration model based on PQI. However, to set targets based on national performance measures outlined in 23 CFR Part 490 Subpart C, the agency needs to develop a deterioration model to project changes of the four pavement condition indices required in the federal regulations. With the historical information available the Pavement Management Team was able to analyze data and estimate potential IRI, cracking, rutting, and faulting changes in 2- and 4-years, existing pavement condition data collected between the year of 2000 and 2021 were analyzed. In the 1st performance period, the following steps were taken for each index:

- Reviewed the percentage of good, fair, poor for each data collection year
- Estimated yearly change rate for each index. To estimate the changing rate:
  - Each index collected between 2000 and 2016 for each 0.1-mile segment was examined.
  - Assumed that each segment had no more than one rehabilitation or reconstruction between 2000 and 2016.
  - Recorded initial index value and collection year (could be year 2000 or later), then found the next index value and collection year for the same 0.1-mile segment that either had a significant change from the next collected value, had a phase change, or reached the last collection year for the segment. A phase is defined based on the good, fair, and poor condition ranges outlined in 23 CFR Part 490 Subpart C. It is assumed that if significant changes occurred, these changes are due to rehabilitation or reconstruction, which may result in a significant improvement in score. If the collection year of the second index is less than 2016, then a second set of data were identified.

After the data sets were identified, annual average rates of increase were calculated as:

$$\text{Annual Average Rate of Increase} = \frac{(\text{Value2} - \text{Value1})}{(\text{Year2} - \text{Year1})}$$

Where:

$Value_1$ is the index value collected at the beginning of a period
$Year_1$ is the collection year for $Value_1$
$Value_2$ is the index value collected at the end of a period
$Year_2$ is the collection year for $Value_2$

For rutting data, due to the data inconsistency noted in section 3.2, the annual average rates of increase were calculated for three time periods: 2004-2010, 2011-2013, and 2014-2016.

For cracking data, Appendix Figure C.4 shows the distribution of cracking data on interstate CRCP sections. The data showed all CRCP sections had 99% cracking during the last 12 years. Further inspection on interstate CRCP cracking data are needed. As a result, cracking data on CRCP sections will not be used.

For faulting data, Appendix Figure D.2 shows the distribution of faulting data on non-interstate NHS JPCP sections. The data showed nearly none of the non-interstate NHS JPCP sections had any faulting. As a result, faulting data on non-interstate NHS JPCP sections will not be used.

Assumptions made:

- ✓ Pavement generally deteriorates under traffic load and environment effects, resulting in poorer condition over time.
- ✓ Pavement sections may have had a preservation/rehabilitation/ reconstruction during the period; however, the change in value was not significant. For example, a pavement segment with IRI value of 80in./mile had an overlay project that improved the IRI values to 70in./mile. Without actual project data, it would be impossible to tell if the 10in./mile difference in IRI was due to error or construction improvement. However, the selection of construction projects was more than likely based on much more than just one pavement condition index. A pavement preservation/rehabilitation/reconstruction project often improves many other pavement condition indices and extends pavement life that may not be directly reflected in the pavement condition indices.

- ✓ There may be data errors that were either system, random, or human error.
- Calculated the 75th percentile values of the annual average rate of increase for each pavement type and each route system.
- Calculated an estimate of the deteriorated index value for each year from 2017 to 2020 based on the previous year's index value and the 75th percentile annual average rates of increase.
- Calculated pavement condition (i.e. good, fair, and poor) based on the calculated index values from the step above.

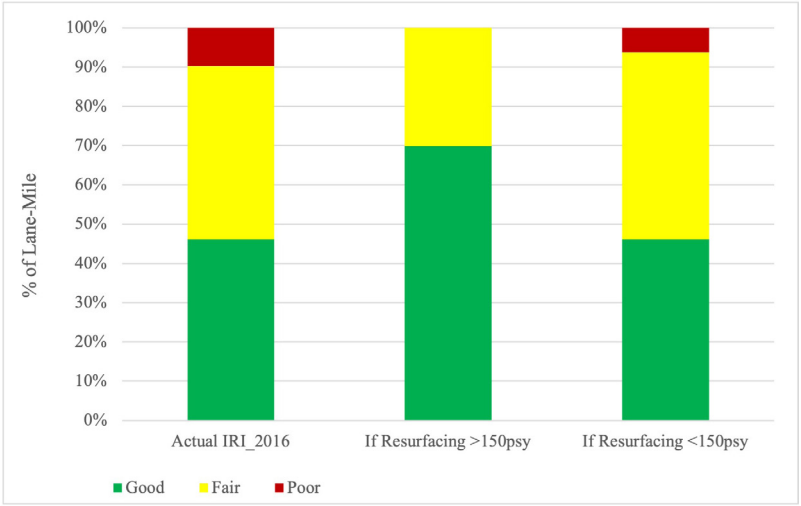
For the 2nd performance period the results of the methodology applied during the 1st performance period were correlated with pavement condition data collected since the 1st performance period. The results were used to derive trend lines showing pavement performance with, and without, system improvements. The trend lines were validated using project and budget data. The 75th percentile value was determined and used as the basis for establishing targets for the 2nd performance period.

- Rideability

SCDOT currently has two supplemental technical specifications, SC-M-403 (Rideability for Asphalt Mixtures) and SC-M-502 (PCC Pavement Rideability). SC-M-403 applies to sections with a minimum 45 mph speed limit and with more than 0.5 mile of pavement without interruptions or exclusions (such as, but not limited to, bridges, stop signs, railroad crossings, speed limit below 45 mph, signalized intersections, or sharp curves posted for less than 35 mph.). SC-M-403 and SC-M-502 require IRI to be collected on 0.1 lane-mile segments. Based on RIMS data, approximately 16.4% of non-interstate NHS routes have speed limits less than 45 mph. Based on SiteManager and P2S data, since 2014, there were 26 contracts with mill/fill or reconstruction on 33 NHS routes that has section lengths less than 0.5-mile. Additional analyses will be needed to identify the percentage of rehabilitation/reconstruction routes that were subjected to the rideablitiy specifications.

Depending on the initial rideability of a pavement, the IRI after an overlay is completed may not be less than 95 and therefore not result in a rating of "good" based on the IRI ranges defined in 23 CFR 490.313. For example, under SCM-403, contractors may still receive 100% of the contracted amount even if the IRI results in a "fair" or "poor" determination if the initial IRI was sufficiently high. Hypothetically, if all asphalt pavement segments on non-interstate NHS received overlays with application rates of 150psy or greater were to achieve an upper limit of 100% pay band defined in SC-M-403 within a short period of time, then the % of good NHS pavements would be about 70% and % of poor would be 0% based on IRI ranges defined in 23 CFR 490.313. If all asphalt pavement segments on non-interstate NHS received overlays with application rates of 150psy or less to achieve an upper limit of 100% pay band defined in SCM403 within a short period of time, then the % of good NHS pavements would be about the same as before the treatments and % of poor would be about 6% based on IRI ranges defined in 23 CFR 490.313.

Figure 4.2. Hypothetical 100% Pay IRI Values on Non-Interstate NHS – HMAS



The Office of Material of Research (OMR) collects rideability data for construction projects for QA/QC purposes. OMR's Rideability Quality Acceptance database contains data from 2009 with more than 14,000 miles of data. Figure 4.3 shows the final IRI values from new construction/ rehabilitation/preservation construction projects on interstate routes. Out of 1,920.9 lane-miles of data, 46.6 lane-miles (2.4%) falls in the fair category and 2.4 lane-miles falls in the poor category based on IRI ranges defined in 23 CFR 490.313. Figure 4.3 shows the distribution of the final IRI values from interstate HMAS pavement construction projects.

As discussed previously, only some of the construction segments are subjected to SCM403. Figure 4.4 shows the distribution of final IRI data from 3,978 lane-miles of primary routes (SC and US). Overall, 3,764 lane-miles (94.6%) falls in the good category and 24 lane-miles (0.1%) in the poor category based on IRI ranges defined in 23 CFR 490.313. The figure also shows the distribution of the final IRI values from pavement construction projects on primary routes.

- Cracking

Almost all preservation/rehabilitation methods will improve percentage of cracking by some extent depending on the causes of cracking and the treatment method. Some of the typical causes of pavement cracking include: traffic loading; environment or climate influences; drainage deficiencies; materials quality problems; construction deficiencies; and external contributors, such as utility cuts. In general, it is expected that if proper treatment methods are prescribed at the right time, the pavement should remain in good to fair condition for an expected duration. The agency currently does not have enough historical pavement cracking data for further analyses.

- Rutting

- Rutting is permanent deformation that could occur in one or more layers in a pavement structure due to: insufficient pavement structure, pavement material (e.g. mix design, angular aggregate), increasing traffic load, construction quality (e.g. compaction), and environmental conditions. To improve rutting, reasons for rutting need to be investigated so that proper methods may be prescribed. For example, wear rutting likely could be fixed with leveling and overlay because wear rutting generally occurs in the surface layer due to loss of aggregate particles. On the other hand, structural rutting typically needs to be corrected with reconstruction or heavy rehabilitation methods.

- Faulting

- Faulting is a vertical displacement at the transverse joints creating an elevation difference in the adjacent concrete pavement slabs. Faulting is a concern because it results in incomplete and nonuniform slab support while creating an unpleasant ride. More importantly, it indicates a potential for future slab breakup at those joints. Typical treatment strategies for faulting include dowel bar retrofitting, full depth patching, diamond grinding, or reconstruction.

Table 4.2 shows typical pavement preservation/rehabilitation/reconstruction project types and potential improvement for IRI, cracking, rutting, and faulting based on historical data and subject matter experts' opinions.

Table 4.2. Potential Improvements

Project Type		Potential Results			
		IRI	Cracking	Rutting	Faulting
Interstate	HMAS: Reconstruction	Good	Good	Good	N/A
	JPCP: Reconstruction	Good	Good	N/A	Good
	HMAS: Mill/Fill	Good	Good	Good	N/A
	JPCP/CRCP: patching/diamond grinding	Good	Good	N/A	Good
NHS: HMAS	FD replacement	Good	Good	Good	N/A
	CMRB	Good/Fair	Good	Good	N/A
	Mill/Fill	Good/Fair	Good	Good	N/A
	Single lift overlay	Good/Fair	Good	Good	N/A
	Thin overlay	Good/Fair /Poor	Good/Fair	Good/Fair /Poor	N/A
	PMST	Good/Fair /Poor	Good/Fair	Good/Fair /Poor	N/A
	MicroSurfacing	No improvement	Some improvement	Some improvement	N/A
	Chip Seal	No improvement	Some improvement	No improvement	N/A
	Crack sealing	No improvement	Some improvement	No improvement	N/A
	FDP	No improvement or Worsen	Some improvement	Some improvement	N/A

- Estimate construction costs for non-interstate NHS routes since these construction projects have not been programmed in.

5. Target

5.1 Interstate

For the 2nd performance period (1/1/2022 – 12/31/2025), 2-year and 4-year targets were required for interstate and non-interstate NHS pavements. Performance curves derived from methodologies applied in the 1st performance period were correlated with pavement condition data collected since the previous reporting period. Performance curves were validated using project and budget data for the same period. Trend lines forecasting pavement performance with, and without, system improvements were derived from these curves. The 75th percentile was determined and used as the basis for establishing targets for the 2nd performance period. For the percent poor the working group recommended using a performance threshold for the interstate pavements at 2.5%. The interstate system is a relatively small system in comparison to the state system as a whole with 851 miles total center line miles. The current baseline at 0.57% represents approximately 4.5 center line miles of the system that are in poor condition. The threshold of 2.5% would represent only 20 center line miles giving the agency flexibility within the target due to the expansive amount of interstate work taking place.

Figure 5.1. Projected Interstate Pavement Condition Based on Federal Metrics, % Good

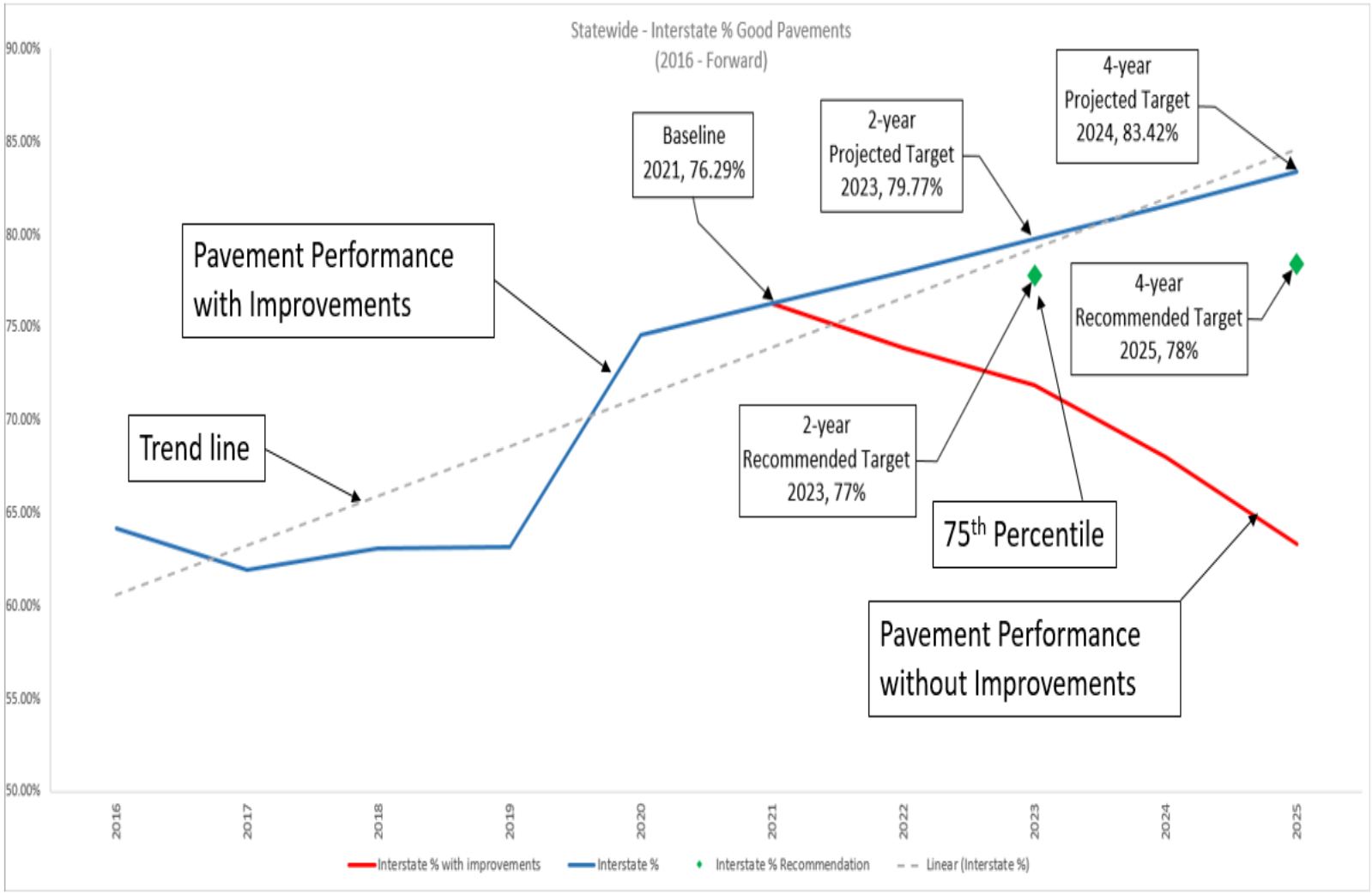
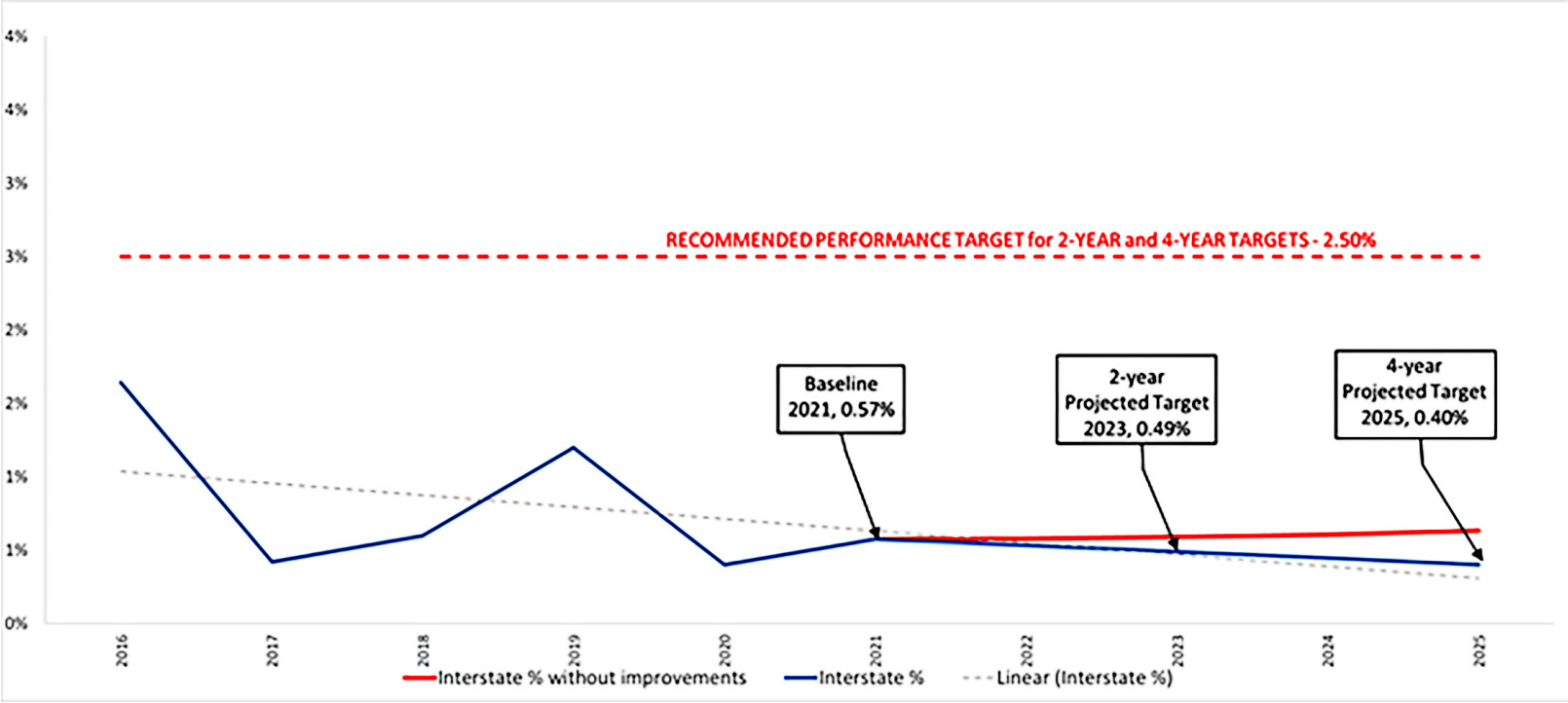


Figure 5.2. Projected Interstate Pavement Condition Based on Federal Metrics, % Poor



5.2. Non-Interstate NHS

For the 2nd performance period (1/1/2022 – 12/31/2025), 2- and 4-year targets are required for non-interstate NHS pavements. Biennial data collection is required with a submission date of Jun. 15. Projects with potential completion dates between 1/1/2022 and 12/31/2023 need to be factored into the 2-year target and projects with completion dates between 1/1/2022 and 12/31/2025 need to be factored into the 4-year target.

Typical construction project types on non-interstate NHS pavement are shown in Table 5.4. Based on subject matter experts' opinion, preservation treatment types should be applied to pavement in "good" conditions in theory and would not have significant changes in pavement conditions in the short-term (2- to 4-years). As a result, preservation projects are not factored in the target setting for the 2nd performance period.

For the 2nd performance period performance curves derived from methodologies applied in the 1st performance period were correlated with pavement condition data collected since the previous reporting period. Performance curves were validated using project and budget data for the same period. Trend lines forecasting pavement performance with, and without, system improvements were derived from these curves. The 75th percentile was determined and used as the basis for establishing targets for the 2nd performance period. For the percent poor the working group recommended setting a performance threshold at 10% based on previous data points and the program being reverted back to a county program in 2020. The districts within each county of South Carolina propose resurfacing projects, with the amount of Non-NHS versus NHS fluctuating from year to year based on needs locally.

Table 5.4. Typical Pavement Preservation/Rehabilitation Types

Treatment		Project type
Rehab type	Reconstruction	Various depth CMRB; RCC; Full-Depth Asphalt replacement
	Heavy Rehab	Uniform mill with intermediate lift and overlay
	Rehab	Single lift asphalt overlay
	Light Rehab	Asphalt lift 125 psy< but <150 psy
Preservation	Chip Seal, Double Chip, Micro Surface, Crack Seal, FDP, PMST, Ultrathin Asphalt Overlay (<125psy)	

Figure 5.3. Projected Non-Interstate NHS Pavement Condition Based on Federal Metrics, % Good

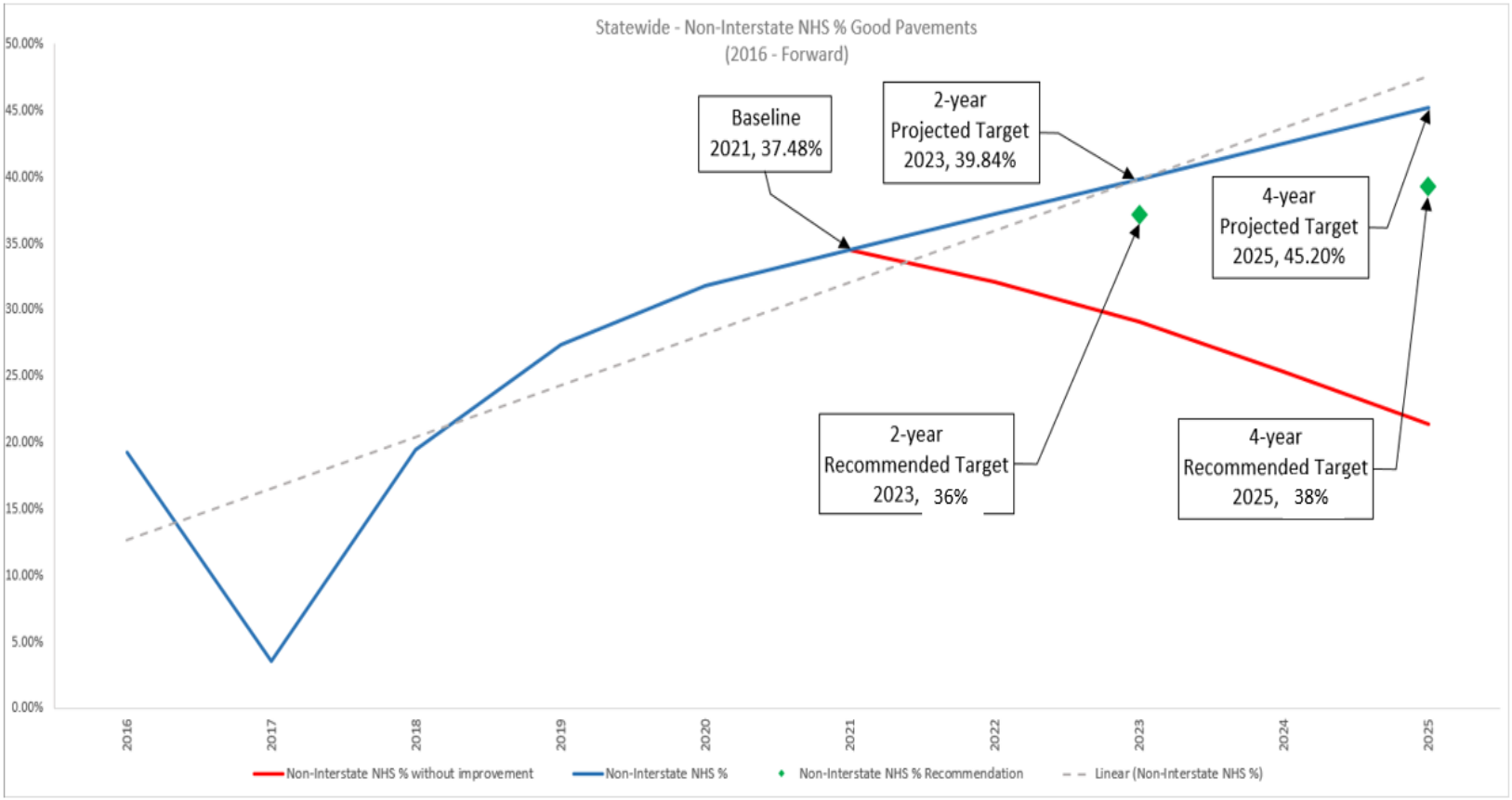
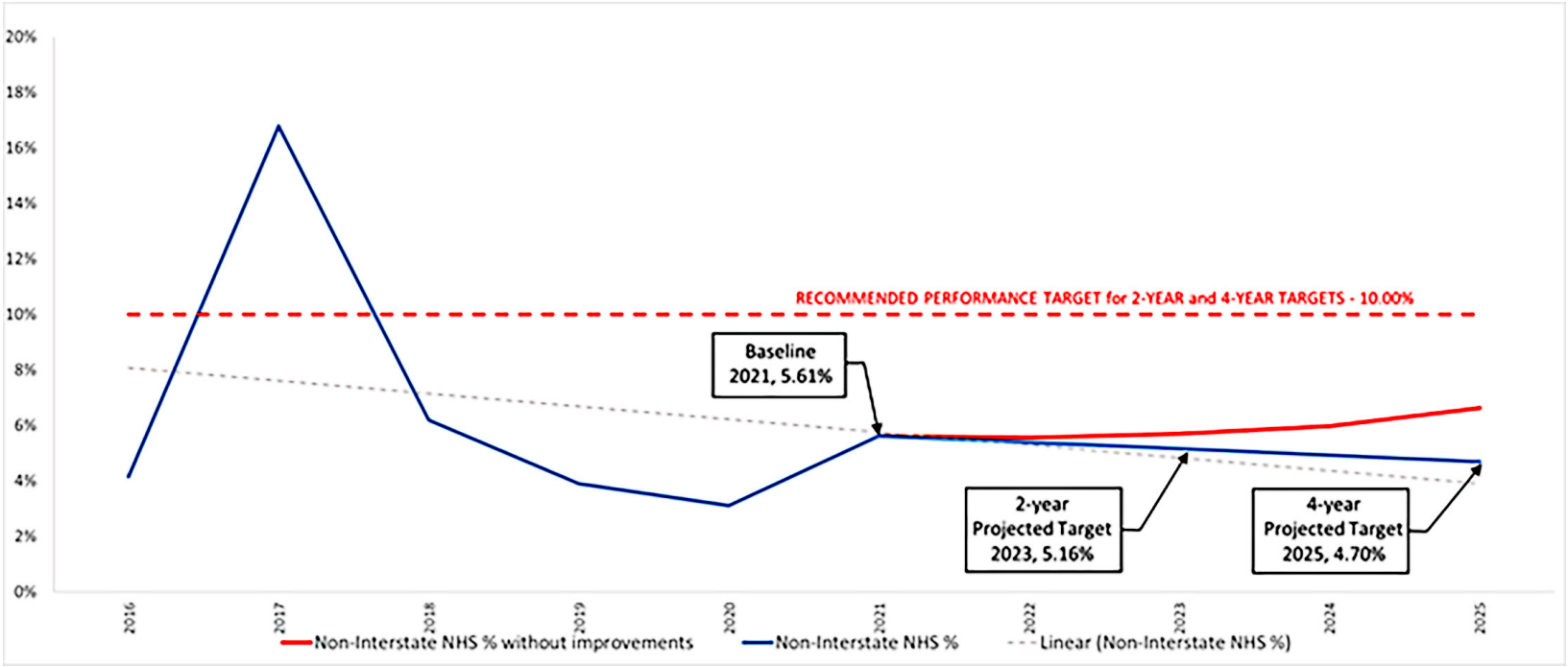


Figure 5.4. Projected Non-Interstate NHS Pavement Condition Based on Federal Metrics, % Poor



5.2 MINIMUM THRESHOLD

Per 23 CFR part 490 subpart B, State DOTs are required to maintain a minimum condition level of interstate pavements, defined as less than 5.0 percent poor. If a State's Interstate System condition rating is greater than 5.0% poor, then the State must obligate NHPP funds for Interstate Maintenance that is at least as great as the amount obligated in fiscal year 2009, plus an annual 2% inflationary adjustment from fiscal year 2013 onward and transfer an amount equal to 10% of its 2009 Interstate Maintenance apportionment from its Surface Transportation Program funding to fund interstate projects.

When setting its percent poor targets on the Interstate System, SCDOT will strive to ensure it meets the minimum condition rating as outlined in federal law.

5.3 MPO Condition Data

Within 180 days after the State DOT's target is established, MPOs can decide to adopt and support the State DOT's 4-year target or establish their own, quantifiable targets. For the first target setting process, SCDOT recommended to MPOs to adopt and support the State's 4year target. Table 5.7 provides 2021 condition level data by MPO using the state metric of PQI, and the number of lane miles to which the condition data relates.

Table 5.7. MPO Condition Data

Study Area		2021 Interstate Condition	Interstate Lane Centerline Miles	2021 NHS Condition	NHS Lane Centerline Miles
ANATS	%Good	95.8%	13.7	50.3%	79.9
	%Poor	0.0%		35.0%	
ARTS	%Good	88.9%	60.0	58.1%	260.6
	%Poor	0.0%		26.9%	
CHATS	%Good	64.0%	97.0	53.3%	304.1
	%Poor	4.1%		13.9%	
COATS	%Good	80.0%	243.5	56.3%	469.6
	%Poor	5.3%		20.5%	
FLATS	%Good	94.2%	78.0	80.4%	156.0
	%Poor	5.0%		10.2%	
GPATS	%Good	64.9%	134.3	61.5%	345.9
	%Poor	22.0%		28.8%	
GSATS	%Good	N/A	N/A	54.6%	289.9
	%Poor	N/A		26.0%	
LATS	%Good	84.2%	29.9	68.3%	161.8
	%Poor	1.9%		11.9%	
RFATS	%Good	100.0%	42.6	59.6%	143.1
	%Poor	0.0%		21.0%	
SPATS	%Good	94.8%	107.7	60.7%	218.7
	%Poor	0.1%		26.7%	
SUATS	%Good	N/A	N/A	38.6%	68.2
	%Poor	N/A		48.9%	

6. Recommendations

Based on the criteria and methodology outlined above, the Working Group met on March 18, 2022, and recommended the following pavement condition targets:

Table 6.1. Interstate and non-Interstate NHS pavement condition target recommendations

Target	%Good	%Poor
Interstate 2-year	77%	2.5%
Interstate 4-year	78%	2.5%
Non-Interstate NHS 2 year	36%	10.0%
Non-Interstate NHS 4 year	38%	10.0%

The chosen targets are the projected conditions and performance thresholds using average deterioration rates for the respective systems and planned completed construction projects that will be finished in time to be rated by the Department's pavement condition collection contractor as outlined in the methodology above. The 4-year percent poor target for interstate pavements meets the FHWA 5.0% minimum threshold requirement.

The Working Group also recommended that MPOs adopt and support the statewide 2-year and 4-year interstate pavement condition target and 2- and 4-year non-Interstate NHS pavement condition targets. Particularly for the non-Interstate NHS, SCDOT staff do not have enough data on the location of construction projects during FYs 2022 through 2025 to incorporate that information by MPO planning area boundaries for MPO target setting purposes.

APPENDIX H: TABLE OF ASSETS DAMAGED BY CLIMATE EMERGENCY EVENTS SINCE 1998 & SUPPORTING DOCUMENTS

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
DBRI001	VARIOUS LOCATION IN THE COASTAL REGION/ETC. , DEBRIS CLEAN-UP DUE TO HURR. FLOYD		1999	315,934.35	Hurricane Floyd (9/14)
SGNL001	VARIOUS LOCATION IN THE COASTAL REGION, R&R SIGNS DUE TO HURR. FLOYD		1999	-	Hurricane Floyd (9/14)
SGNS001	VARIOUS LOCATION IN THE COASTAL REGION, R&R SIGNS DUE TO HURRICANE FLOYD		1999	1,028,500.00	Hurricane Floyd (9/14)
TRFL001	HURRICANE FLOYD EMERGENCY FUNDS FOR TRAFFIC FLOW.		1999	646,146.35	Hurricane Floyd (9/14)
ER05001	SC04-1 2004 ICE STORM 2004 ICE STORM DISTS 1-7 EMERGENCY FUNDS		2004	977,441.00	Ice Storm (1/26)
ER23001	CLEANUP AND DAMAGE REPAIRS TO FEDERAL AID ROUTES AS A RESULT OF HURRICANE GASTON IN 2004. DAMAGE MANLY ON US 278		2004	282,524.00	Tropical Storm Gaston (8/28)
ER45002	HURRICANE GASTON REPAIRS VARIOUS ROADWAYS IN WILLIAMSBURG COUNTY		2004	-	Tropical Storm Gaston (8/28)
4086300	Safety Section Projects in Richland County along S-222,S-223, and S-37	SC201601	2016	274,844.87	Major Flood (10/1)
5185390	Rehab/Reconst for Kershaw, Lee and Sumter Counties	SC201601	2016	112,403.80	Major Flood (10/1)
BR88042	REPLACE 4 BRIDGES & CONSTRUCT TWO-LANE SECTION APPROACHES OF US 601 WITH STAGING, TO INCLUDE GRASSED SHOULDERS W/DITCHES. FROM	SC201601	2016	279,551.86	Major Flood (10/1)
ER16000	Force Account Work - October 2015 Flood Event (DR-4241	SC201601	2016	5,475,833.63	Major Flood (10/1)
ER16001	Emergency Repairs along I-95 from MM 119-131 - Clarendon County	SC201601	2016	1,389,759.72	Major Flood (10/1)
ER16002	Emergency Replacement of US 176 BR over Cannon Creek in Newberry Co	SC201601	2016	4,804,325.70	Major Flood (10/1)
ER16003	Emergency repairs on SC 642 (Dorchester Rd) in Dorchester Co	SC160001	2016	136,752.90	Major Flood (10/1)
ER16004	Emergency repair on US 1 near Old Mill in Lexington Co	SC160001	2016	127,637.84	Major Flood (10/1)
ER16005	S-69 (Congress Rd) repair - Richland County	SC160001	2016	309,790.80	Major Flood (10/1)
ER16006	US 17 Emergency repairs due to BR approach washout over Wadboo Swamp in Berkeley County	SC160001	2016	159,425.17	Major Flood (10/1)
ER16007	Emergency repairs on SC-51 & S-34 in Florence County	SC201601	2016	932,511.84	Major Flood (10/1)
ER16008	I-526 EB Roadway Repair MM 14.7	SC160001	2016	167,268.87	Major Flood (10/1)

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
ER16009	I-26 EB/WB Roadway Repair MM 211.1	SC160001	2016	171,949.89	Major Flood (10/1)
ER16010	I-526 EB Roadway Repair MM 16.0 /I-26 EB Roadway Repair MM 209	SC160001	2016	89,904.47	Major Flood (10/1)
ER16011	SC 12 Roadway & Drainage Reconstruction /Reconstruct approximately 200' of US 21 (N. Main Street) between Wilkes Road (S-218) and Mason Road (S-219).	SC160001	2016	306,186.62	Major Flood (10/1)
ER16012	Emergency Repairs on SC-48 and S-86 in Richland County	SC201601	2016	317,410.05	Major Flood (10/1)
ER16013	Emergency repair work on S-1139 (NFA), SC41 (NFA), SC41 (NFA), in Florance County and Emergency repair work on US52 in Williamsburg County	SC201601	2016	1,311,938.23	Major Flood (10/1)
ER16014	S-42 (Pennyroyal Rd), US 701, and S-36 (Old Pee Dee River Rd) Road & Drainage Reconstruction	SC160001	2016	313,846.83	Major Flood (10/1)
ER16015	S-78 (Hayne St.) Roadway & Drainage Reconstruction (DR-4241)	SC201601	2016	870,471.56	Major Flood (10/1)
ER16016	S-199 (Trolley Rd) Roadway & Sidewalk Repair (DR-4241)	SC201601	2016	34,575.00	Major Flood (10/1)
ER16017	US 76 BS(Braod Street) Roadway Repair (DR-4241)	SC160001	2016	209,570.65	Major Flood (10/1)
ER16018	Emergency repair work on S-49, US 15, S-51, S-60 (NFA) in Clarendon County.	SC201601	2016	1,069,016.64	Major Flood (10/1)
ER16019	Emergency repair work at intersection of S-327 (NFA), S-739, S-1526 (NFA), S-880 (NFA), S-104 and S-71 in Lexington Co	SC201601	2016	991,134.44	Major Flood (10/1)
ER16020	Emergency repair work on US 521, US 301, S-40, R-8736 (I-95 ramp), S-28 at 1.09 (NFA), and S-28 at 2.5 (NFA) in Clarendon Co	SC201601	2016	1,992,113.10	Major Flood (10/1)
ER16021	Emergency repair work on S-57 between MM 12.95 & MM 15.8, between MM 16.96 & 19.34, and between MM 19.85 & MM 19.900 in Florence County.	SC201601	2016	845,108.01	Major Flood (10/1)
ER16022	US 15 Roadway Repair at Cantey Bay (DR-4241)	SC201601	2016	2,493,660.40	Major Flood (10/1)
ER16023	Emergency repair work on I-95 in Orangeburg County and S-265 (NFA) in Calhoun County.	SC201601	2016	597,106.91	Major Flood (10/1)
ER16024	SC 769 over Cedar Creek and SC 48 over Toms Creek	SC201601	2016	3,689,300.16	Major Flood (10/1)
ER16025	S-58 (Belfast Road) over Garrison Creek (DR-4241)	SC201601	2016	2,104,215.21	Major Flood (10/1)
ER16026	S-537 (Seymour Rd) Roadway Repair (DR-4241)	SC201601	2016	514,070.00	Major Flood (10/1)
ER16027	I-526 WB Roadway Repair MM 15.32 (DR-4241)	SC201601	2016	29,999.06	Major Flood (10/1)
ER16028	SC 174 Roadway Repair (DR-4241)	SC201601	2016	169,958.37	Major Flood (10/1)
ER16029	S-404 (Caughman Rd) Roadway Repair (DR-4241)	SC201601	2016	1,056,006.02	Major Flood (10/1)

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
ER16030	Design-Build -SC 34 over Hellers Creek in Newberry Co, S-101 over Lake Wateree in Fairfield Co, & S-57 over Barfield Mill Creek in Florence Co	SC201601	2016	8,055,882.47	Major Flood (10/1)
ER16031	S-69 over Jumping Run Crk, S-827 over Spring Lake, S-36 over 25 Mile Creek - Emergency Bridge Package 4 (DR-4241)	SC201601	2016	12,208,716.87	Major Flood (10/1)
ER16032	S-26 Bridge Replacement over Big Branch (DR-4241)	SC201601	2016	913,082.45	Major Flood (10/1)
ER16033	S-49 Bridge Replacement over Tearcoat Branch (DR-4241)	SC201601	2016	2,066,551.39	Major Flood (10/1)
ER16034	S-105 (Cleveland Street) Roadway Repairs (DR-4241)	SC201601	2016	497,477.78	Major Flood (10/1)
ER16035	S-37 (Lower Richland Blvd) Approach Repair (DR-4241)	SC201601	2016	304,252.99	Major Flood (10/1)
ER16036	Emergency repair work on SC 51 in Georgetown County and on SC 377, US 521, and S-16 in Williamsburg County.	SC201601	2016	574,677.87	Major Flood (10/1)
ER16037	S-131 (Pearson Road) Repair (DR-4241)	SC201601	2016	808,823.05	Major Flood (10/1)
ER16038	S-67 (Ziegler Rd) Roadway Repair MM 0.26 (DR-4241)	SC201601	2016	405,542.88	Major Flood (10/1)
ER16039	I-26 WB Repair at MP 209.5 in Charleston (DR-4241)	SC201601	2016	43,908.47	Major Flood (10/1)
ER16040	S-9 (Cypress Gardens) Approach Repair (DR-4241)	SC201601	2016	779,155.15	Major Flood (10/1)
ER16041	US 52 (Rivers Ave) over Filben Creek (DR-4241)	SC160001	2016	-	Major Flood (10/1)
ER16042	SC 213 Emergency Slope Repair (DR-4241)	SC201601	2016	543,582.05	Major Flood (10/1)
ER16043	Emergency repair work on US 52 and on SC 41 in Florence Co and on SC 41/51 in Williamsburg Co	SC201601	2016	443,871.99	Major Flood (10/1)
ER16044	US 301 over Black River Swamp Bridge 1,2,3 & 4 - Design-Build Emergency Bridge	SC201601	2016	13,286,695.61	Major Flood (10/1)
ER16045	S-1041 (Rimer Pond Rd) Repair in Richland County (DR-4241)	SC201601	2016	244,513.91	Major Flood (10/1)
ER16046	S-53 Roadway Repair in Richland County (DR-4241)	SC201601	2016	-	Major Flood (10/1)
ER16047	SC 31 Roadway Repair at MP 19.69 & MP 1.91 in Horry County (DR-4241)	SC201601	2016	265,820.84	Major Flood (10/1)
ER16048	S-53 Roadway & Drainage Reconstruction (DR-4241)	SC201601	2016	404,652.06	Major Flood (10/1)
ER16049	SC 48 over Back Swamp - Emergency Bridge Package 6 (DR-4241)	SC201601	2016	6,164,557.05	Major Flood (10/1)
ER16050	S-734 (Old Bluff Road) Emergency Reconstruction (DR-4241)	SC201601	2016	2,502,140.83	Major Flood (10/1)
ER16051	S-32-59 (Devil's Backbone Road) (DR-4241)	SC201601	2016	695,413.02	Major Flood (10/1)
ER16052	US 21 (Wilson Blvd) (DR-4241)	SC201601	2016	2,125,375.53	Major Flood (10/1)
ER16053	S-32-103 (Ramblin Road) (DR-4241)	SC201601	2016	411,059.99	Major Flood (10/1)

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
ER16054	S-32-365 Wilton Road Pond Dam (DR-4241)	SC201601	2016	320,001.54	Major Flood (10/1)
ER16055	S-40-64 (Arcadia Lakes Drive) over Coopers Pond (DR-4241)	SC201601	2016	500,000.00	Major Flood (10/1)
ER16056	US 321 over Crane Creek (DR-4241)	SC201601	2016	6,656,662.41	Major Flood (10/1)
P027353	Federal Aid Secondary Resurfacing in Charleston County	SC201601	2016	191,477.44	Major Flood (10/1)
P027822	2015 Non-Interstate Guardrail (D1)	SC201601	2016	75,003.13	Major Flood (10/1)
ER17002	SC 642 Emergency Repair (DR-4286)	SC201701	2017	101,052.80	Hurricane Matthew (10/4)
ER17003	I-26 EB Emergency Slope Repair (DR-4286) and I-526 EB Emergency Slope Repair(DR-4286)	SC201701	2017	361,050.17	Hurricane Matthew (10/4)
ER17004	S-57 (Old River Rd) Emergency Repair MM 17.34 (DR-4286),S-57 (Old River Rd) MM12.95(DR-4286) and S-57(Old River Rd) Emergengy Repair MM14.14(DR-4286)	SC201701	2017	900,503.90	Hurricane Matthew (10/4)
ER17005	SC 327 (DR-4286) & S-34(DR-4286) in Florence County,and S-44(Mount Calvary Rd)(DR-4286) in Dillon Co	SC201701	2017	592,579.26	Hurricane Matthew (10/4)
ER17007	S-136 (Stagecoach Rd) Emergency Repair (DR-4286) & S-36 (Old Pee Dee Rd) Emergency Repair (DR-4286)	SC201701	2017	193,552.03	Hurricane Matthew (10/4)
ER17011	S-22 (State Park Rd) Emergency Repair (DR-4286), SC 381 Emergency Repair (DR-4286)	SC201701	2017	201,494.91	Hurricane Matthew (10/4)
ER17015	SC 41 Emergency Repair at MM 1.95 (DR-4286), SC 41 Emergency Repair at MM 38.5 (DR-4286)	SC201701	2017	57,814.10	Hurricane Matthew (10/4)
ER17016	SC 41/51 Emergency Repair (DR-4286);SC 51 Emergency Slope Repair (DR-4286)	SC201701	2017	389,803.78	Hurricane Matthew (10/4)
ER17019	Emergeny Repair along US 701,S-31(Red Bluff Rd) & S-45(DR-4286)	SC201701	2017	335,641.71	Hurricane Matthew (10/4)
ER17020	Emergency Repairs along I-95 in Florence and Dillon Cos.(DR-4286)	SC201701	2017	714,308.31	Hurricane Matthew (10/4)
ER17021	S-19 (MM 14.86) Emergency Repair (DR-4286)	SC201701	2017	117,042.98	Hurricane Matthew (10/4)
ER17022	S-19 over Bug Branch, SC41 over Maiden Down S, S-461 over Trib. to Lynches, S-13 over Long Branch - 2016-1A Emergency Bridge Package (DR-4286)	SC201701	2017	9,547,439.15	Hurricane Matthew (10/4)
ER17023	S-23 (Nichols Highway) Roadway & Drainage Reconstruction (DR-4286)	SC201701	2017	1,021,126.34	Hurricane Matthew (10/4)

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
ER17025	S-23 (Old Georgetown Road) Emergency Roadway Repair (DR-4286), S-17 (Pocotaligo Rd) Emergency Roadway Repair (DR-4286)	SC201701	2017	222,418.52	Hurricane Matthew (10/4)
ER17026	I-26 WB Emergency Slope Repair (DR-4286)	SC201701	2017	172,089.34	Hurricane Matthew (10/4)
ER17027	SC 34 (Cashua Ferry Road) Emergency Roadway Repair (DR-4286)	SC201701	2017	2,531,570.51	Hurricane Matthew (10/4)
ER17029	SC 44 MM 6.75- 7.10 Emergency Roadway Repair (DR-4286)	SC201701	2017	472,804.49	Hurricane Matthew (10/4)
ER17032	SC 261 (Kingstree Hwy) Culvert and Road Washout Repair MP 18.92 (DR-4286)	SC201701	2017	1,062,127.26	Hurricane Matthew (10/4)
ER17035	US 301 Culvert and Road Washout Repair MP 3.95 - MP 4.31 (DR-4286)	SC201701	2017	797,678.94	Hurricane Matthew (10/4)
ER17036	SC 6 (Old Number Six Hwy.) & US 301 (Bass Dr.) Intersection Sinkhole Repair	SC201701	2017	374,569.58	Hurricane Matthew (10/4)
ER17037	S-19 Emergency Culvert Replacement MP 2.56 (DR-4286)	SC201701	2017	825,558.97	Hurricane Matthew (10/4)
ER17038	I-95 SB Emergency Repairs at MM 186 in Dillon County	SC201701	2017	367,047.70	Hurricane Matthew (10/4)
ER18201	S-50 (Four Holes Rd) Emergency Demolition over I-26	SC201801	2018	350,651.10	S-50/I26 Truck Crash (3/9)
ER18202	Emergency DB Bridge Package 2018-1	SC201801	2018	3,975,634.86	S-50/I26 Truck Crash (3/9)
ER18301	S-18 (Patrick Highway) Emergency Repair (DR-4394); SC 34 Emergency Slope Repairs (DR-4394)	SC201802	2018	2,283,612.40	Hurricane Florence (9/2018)
ER18302	S-366 (New Hopewell Rd) Emergency Repair (DR-4394)	SC201802	2018	382,211.44	Hurricane Florence (9/2018)
ER18303	Emergency Flood Control along US 378 in Florence County and US 501 in Horry	SC201802	2018	-	Hurricane Florence (9/2018)
ER18304	US 301 Emergency Repairs in Dillon County (DR-4394)	SC201802	2018	848,354.94	Hurricane Florence (9/2018)
ER18305	SC 9 Repair in Dillon County and SC57 Emergency Repair in Dillon County (DR-4394)	SC201802	2018	232,500.52	Hurricane Florence (9/2018)
ER18306	S-165 (Old Wire Rd) Emergency Repair in Marlboro County (DR-4394)	SC201802	2018	159,559.82	Hurricane Florence (9/2018)
ER18307	US 76 Shoulder Repair in Marion County (DR-4394)	SC201802	2018	75,917.14	Hurricane Florence (9/2018)

NHS and STIP Roadways Damaged by Severe Weather Events Since 1998					
Project Number	NHS Roadways / Project Title	**Disaster** Emergency Relief Code	**Disaster Funding Year (FY)**	**Total Cost Amount**	**Event Name**
ER18308	S-22 (State Park Rd.) Emergency Repairs (DR-4394)	SC201802	2018	163,057.73	Hurricane Florence (9/2018)
ER18309	SC 917 Emergency Repairs in Horry County (DR-4394)	SC201802	2018	60,344.30	Hurricane Florence (9/2018)
ER18310	SC 9 Emergency Repair in Horry County (DR-4394)	SC201802	2018	79,176.48	Hurricane Florence (9/2018)
ER18311	SC 145 Paving MP 25.800 (DR-4394)	SC201802	2018	176,074.73	Hurricane Florence (9/2018)
ER18312	US 76 Emergency Roadway & Drainage Repairs in Marion County (DR-4394)	SC201802	2018	1,512,655.40	Hurricane Florence (9/2018)
ER18313	US 501 BS Emergency Bridge Approach Repairs (DR-4394)	SC201802	2018	60,532.09	Hurricane Florence (9/2018)
ER18314	SC 905 (Fourth Ave) Emergency Repair (DR-4394)	SC201802	2018	148,346.60	Hurricane Florence (9/2018)
ER18315	I-95 over Great Pee Dee River Emergency Repair (DR-4394)	SC201802	2018	4,052,601.84	Hurricane Florence (9/2018)
ER18316	I-95 NB - MP 192.2 - Dillon County Emergency Slope Repair I-95 SB - MP 173.2 to 174.8 - Florence County Emergency Slope Repairs (DR-4394)	SC201802	2018	260,815.10	Hurricane Florence (9/2018)
ER18317	US 1 over Husbands Creek Emergency Box Culvert Replacement (DR-4394)	SC201802	2018	1,014,799.00	Hurricane Florence (9/2018)
ER18318	Design Build Package 2A	SC201802	2018	5,499,192.95	Hurricane Florence (9/2018)
ER18319	Design Build Bridge Package 2018-2B	SC201802	2018	7,317,448.09	Hurricane Florence (9/2018)
ER18321	Emergency Bridge Repair to S-26-366 and S-26-62 (DR-4394)	SC201802	2018	75,558.35	Hurricane Florence (9/2018)
ER20101	S-160 Howard Street - Emergency (Severe Weather Event 2/6/20)	SC202001	2020	257,721.65	Severe Weather and Flooding (2/6)
ER20102	Emergency Project - SC 414 (Severe Weather Event 2/6/20)	SC202001	2020	354,899.33	Severe Weather and Flooding (2/6)
ER20103	S-225 Emergency Culvert Extension	SC202001	2020	287,078.42	Severe Weather and Flooding (2/6)
ER20104	S-385 (Richbourg Road) Emergency Repair MP 0.54 - 1.13S-1912 (White Horse Road Extension) Emergency Repair MP 0.32-0.4	SC202001	2020	901,750.45	Severe Weather and Flooding (2/6)

Transportation Asset Management Plan (TAMP) Performance Targets

Updated July 29, 2021

Safety	2016 Baseline Condition		10-Year Target		Year Five: 2021 Interim Target		Year Five: 2021 Actual Values		Average Annual Funding Level	Commission Approval Date
Fatalities (Statewide)	890	5-Year Rolling Average	1139	5-Year Rolling Average	968	5-Year Rolling Average	1059	5-Year Rolling Average	$130M	October 21, 2021 (Funding updated)
Fatality Rate	1.75		1.90		1.68		1.92			March 17, 2022 (10-year target updated)
Number of Serious Injuries	3194		2731		2923		2860			
Serious Injury Rate	6.30		4.56		4.93		4.99			
Non-Motorized Fatalities & Serious Injuries	376		469		377		454			
Emphasis Area: Roadway Departures									$70M Emphasis Area Allocation	
Rural Road Safety Program									$50M	September 2017
Interstate Safety Program									$11M	March 2018
Rumble Strips Installation Program									$9M	March 2018
Emphasis Area: Intersections & Other High-Risk Locations									$22M Emphasis Area Allocation	
Intersection Safety Projects									$13M	March 2018
Railroad Safety Projects									$4M	March 2018
Work zone Enforcement									Included in Project Costs	
Target Zero Law Enforcement Teams									Previously Allocated	
Road Safety Assessments & Implementation									$5M	March 2018
Emphasis Area: Vulnerable Roadway Users									$5M Emphasis Area Allocation	
Pedestrian & Bicycle Safety Projects									$5M	March 2018
Safety Data Analytics									$2M	
Total Average Annual Funding									$99M	March 2018

Pavements	Baseline Centerline Miles	Baseline % VMT	2016 Baseline % Good	2016 Baseline % Poor	10-Year Target % Good	10-Year Target % Poor	2021 Target % Good	2021 Target % Poor	2021 Actual % Good	2021 Actual % Poor	Average Annual Funding Level	Commission Approval Date
Interstate	851	30%	65%	11%	92%	3%	76%	8%	78%	8%	$152M	October 2021
Primary	9,517	46%	23%	55%	53%	30%	35%	45%	42%	42%	$282M	October 2021
Non-Interstate NHS	*2,752*	*26%*	*28%*	*45%*	*72%*	*16%*	*46%*	*33%*	52%	30%	$96M	October 2021
Non-NHS Primaries	*6,765*	*20%*	*20%*	*61%*	*48%*	*37%*	*31%*	*51%*	38%	47%	$186M	October 2021
FA Eligible Secondary	10,370	17%	19%	52%	40%	35%	27%	45%	31%	43%	$113M	October 2021
Non-Federal Aid Eligible Secondary	20,657	7%	15%	55%	25%	45%	19%	51%	22%	45%	$82M	October 2021
Total Average Annual Funding											$628M	

Bridges (by number)	Baseline # Structures	Baseline % VMT	2016 Baseline** % Good	2016 Baseline** % Poor	10-Year Target % Good	10-Year Target % Poor	2021 Target * % Good	2021 Target * % Poor	2021 Actual * % Good	2021 Actual * % Poor	Average Annual Funding Level	Commission Approval Date
NHS	1,745	56%	48%	6%	66%	0%	55%	4%	44%	3%	$190M	October 2021
Non-NHS	3,883	37%	46%	11%	41%	11%	44%	11%	38%	6%	$32M	October 2021
Off-System	2,794	7%	40%	9%	36%	10%	38%	9%	44%	6%	$33M	October 2021

Bridges (by deck area)	Baseline Bridge Deck Area† (square feet)	Baseline % VMT	2016 Baseline** % Good	2016 Baseline** % Poor	10-Year Target % Good	10-Year Target % Poor	2021 Target % Good	2021 Target % Poor	2021 Actual % Good	2021 Actual % Poor	Average Annual Funding Level	Commission Approval Date
NHS	39,110,289	56%	42%	4%	60%	0%	49%	2%	39%	4%	$190M	October 2021
Non-NHS	24,903,895	37%	50%	10%	41%	15%	46%	12%	48%	6%	$32M	Oct-21
Off-System	7,607,110	7%	51%	7%	44%	10%	48%	8%	47%	5%	$33M	October 2021

Bridge Programs	2016 Baseline Condition	10-Year Target	2021 Target (Cumulative)	2021 Actual (Cumulative)	Average Annual Funding	Commission Approval Date
Load Restricted & NHS Structurally Deficient Bridge Program	465 bridges load restricted or structurally deficient	465 bridges replaced, repaired or permanently closed	185 bridges replaced, repaired or permanently closed	217 bridges replaced, repaired or permanently closed	$36.5M	April 2018
Total Average Annual Funding					$190M	October 2021

Pavement condition based on Pavement Quality Index (PQI).
NFA Secondary annual funding of $121M includes estimated $39M in CTC spending.
*Bridge conditions based on Federal Metrics.
Bridge Program Numbers are bridges complete and under construction.

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