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April 30, 2018

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

Dear Ms. Lawton:

We have completed our initial Transportation Asset Management Plan (TAMP), as required by 23 CFR Part 450. The South Carolina Department of Transportation manages over 41,000 centerline miles of roadway and 8,400 bridges, which classifies it as the fourth largest state-owned system in the United States by centerline miles. While federal rule only necessitates inclusion of analysis and investment strategies for pavements and bridges on the National Highway System (NHS), this TAMP includes pavements and bridges on the entire state maintained highway system.

The Department’s 2018-2020 Strategic Plan goals form the guiding principles of our 10-year Investment Strategies, which focus 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.

By implementing our 10-year Investment Plan, we are projecting substantial improvement in all of our state-maintained pavements, when measured by South Carolina’s pavement quality index (PQI). Similarly, we are projecting an overall condition improvement of NHS bridges in South Carolina through implementation of our bridge investment strategies and a significant reduction in the rates of fatalities and serious injuries through the use of targeted safety solutions. These projected asset conditions and system improvements are made possible by the enactment of Act 40 in 2017 by the South Carolina State Legislature, which provides dedicated funding to improve transportation infrastructure in South Carolina through an increase in the State’s gas tax and other fees.

Respectfully submitted,

Christy A. Hall
South Carolina Secretary of Transportation
EXECUTIVE SUMMARY

The South Carolina Department of Transportation (SCDOT) is the state agency in South Carolina responsible for planning, maintaining and operating 41,358 centerline miles of roadway and 8,422 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 below.

The highway system is vital to the increasing growth of South Carolina’s economy. In 2016, nonfarm employment grew by 1.9% according to Bureau of Labor Statistics data. In addition, South Carolina was 10th in the nation for population growth between 2000 and 2010 according to the US Census Bureau and the State’s population increased by 15.3 percent over this period. South Carolina’s population is expected to grow an additional 31 percent by 2040, with a corresponding household growth of 32 percent 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.

**Transportation Asset Management**

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. The Secretary of Transportation and the governing board of the agency, the SCDOT Commission, have reaffirmed the importance of the transportation asset management plan (TAMP) for accountability and transparency regarding the use of tax payer funds especially in light of the recent dramatic increase in state funding for infrastructure in South Carolina. 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’s TAMP is all-inclusive by incorporating state and federal funding together for a more robust plan for the State.

**SCDOT’s Strategic Plan goals**

The leadership team of SCDOT recently deployed a new Strategic Plan, which form 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 five major goals of the SCDOT Strategic Plan are to:

- Improve safety programs and outcomes in high-risk areas;
- Maintain and preserve its existing transportation infrastructure;
- Improve program delivery to increase the efficiency and reliability of the road and bridge network;
- Provide a safe and productive work environment for SCDOT employees; and
- Earn public trust through transparency, improved communications, and audit compliance.

**SCDOT’s 10-year Performance Strategies**

SCDOT has divided its road and bridge work into several major program categories: Safety, Pavements, Bridges, Interstate Upgrades, Metropolitan Planning Organization/Council of Governments (MPO/COG) Programs, and a Freight Program. In developing infrastructure investment priorities, SCDOT aligns the programs to the strategic plan and factors in other
items such as applicable state and federal laws, asset condition and performance trendlines, revenue trends, industry capacity, public input, and asset management principles.

Over the past two years, SCDOT has fully migrated the Safety, Pavement, and Bridge programs to become elements within the TAMP. Additional elements will be added in the future to cover the remaining programs.

As part of the new Strategic Plan, SCDOT has identified some very specific goals for the next ten years for the Safety, Pavement, Bridge, and Interstate Upgrade (capacity) programs:

**Safety**

- Improve 1,000 miles of non-interstate rural roads with tailored safety solutions. South Carolina has the deadliest rural roads in the Nation. SCDOT has developed and implemented a targeted solution to address the “worst of the worst” rural roads in the State.

**Pavements**

- Use a performance-based approach to drive the recovery of South Carolina’s pavements through a blend of preservation, rehabilitation, and reconstruction projects.

**Bridges**

- Specifically target two bridge categories: 1. Load-restricted bridges and 2. Structurally Deficient bridges on the National Highway System. In 2016, there were 348 load-restricted bridges in South Carolina which impacted the movement of goods, school bus routing, and emergency response times in the State. Also, in 2016, there were 51 structurally deficient bridges not yet programmed for replacement or repair on the National Highway System that could significantly hamper South Carolina’s ability to move freight across the major routes in the State.

**Capacity**

- Widen 100+ centerline miles of interstate and address major freight pinch points at interstate-to-interstate interchanges.

**SCDOT’s Investment Plans**

Based on the strategic plan and desired 10-year targets, SCDOT has aligned all available financial resources to fund the various programs at levels predicted to be necessary to achieve the desired results.
## TAMP Ten Year Investment Plan

<table>
<thead>
<tr>
<th>Category</th>
<th>FY 2018</th>
<th>FY 2019</th>
<th>FY 2020</th>
<th>FY 2021</th>
<th>FY 2022</th>
<th>FY 2023</th>
<th>FY 2024</th>
<th>FY 2025</th>
<th>FY 2026</th>
<th>FY 2027</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement*</td>
<td>$401,800,000</td>
<td>$417,000,000</td>
<td>$487,000,000</td>
<td>$562,000,000</td>
<td>$642,000,000</td>
<td>$702,000,000</td>
<td>$702,000,000</td>
<td>$702,000,000</td>
<td>$702,000,000</td>
<td>$702,000,000</td>
</tr>
<tr>
<td>Bridge</td>
<td>$180,000,000</td>
<td>$170,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
<td>$145,000,000</td>
</tr>
<tr>
<td>Interstate Upgrade</td>
<td>$350,493,227</td>
<td>$352,634,891</td>
<td>$373,079,163</td>
<td>$323,254,793</td>
<td>$332,239,411</td>
<td>$340,250,000</td>
<td>$340,950,000</td>
<td>$343,500,000</td>
<td>$346,550,000</td>
<td>$348,400,000</td>
</tr>
<tr>
<td>MPO/COG Programs</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
<td>$138,000,000</td>
</tr>
<tr>
<td>Total Annual Budget</td>
<td>$1,192,604,025</td>
<td>$1,203,606,515</td>
<td>$1,272,755,301</td>
<td>$1,297,930,931</td>
<td>$1,386,915,549</td>
<td>$1,454,926,138</td>
<td>$1,458,176,138</td>
<td>$1,461,226,138</td>
<td>$1,463,076,138</td>
<td>$1,463,076,138</td>
</tr>
</tbody>
</table>
The 10-year investment plan is projected to enable SCDOT to reduce fatalities and serious injuries on South Carolina’s highways, substantially improve the percent of the State’s pavements considered in good quality measured by its pavement quality index (PQI), reduce the number of load-restricted bridges in the State, and widen a substantial amount of the State’s interstates. PQI is a metric specifically designed to measure road quality in South Carolina based on the State’s unique characteristics.

SCDOT is projecting decreases in fatalities and serious injuries within South Carolina during the next ten years based on its strategic investment strategies. SCDOT is forecasting a 23 percent decrease in fatality rate and a 38 percent decrease in the rate of serious injuries on the state highway system by 2026. South Carolina has the highest fatality rate in the nation. Approximately 1,000 people are dying on our roads annually. SCDOT’s rural roads are some of the deadliest roads in the State with approximately 30 percent of fatalities and serious injuries occurring on these roads, which represent only 5 percent of the network.

**SCDOT's 10-Year Safety Performance Targets**

<table>
<thead>
<tr>
<th>Safety</th>
<th>2016 Baseline Condition&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Ten-year Target&lt;sup&gt;1&lt;/sup&gt;</th>
<th>% Change</th>
<th>Average 10-Year Allocation (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatalities (Number)</td>
<td>890</td>
<td>886</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Fatalities (Rate)</td>
<td>1.75</td>
<td>1.34</td>
<td>23.43</td>
<td></td>
</tr>
<tr>
<td>Serious Injuries (Number)</td>
<td>3,194</td>
<td>2,573</td>
<td>19.44</td>
<td></td>
</tr>
<tr>
<td>Serious Injuries (Rate)</td>
<td>6.30</td>
<td>3.89</td>
<td>38.25</td>
<td>$99.3</td>
</tr>
<tr>
<td>Non-Motorized Fatalities and Serious Injuries (Number)</td>
<td>376</td>
<td>368</td>
<td>2.13</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Based on a 5 year rolling average

The 10-year plan also will enable SCDOT to dramatically improve the condition and operation of the backbone of the State’s infrastructure network, the National Highway System (NHS). NHS pavement condition and NHS bridge condition are both predicted to improve and the percent in poor condition is projected to decrease.

These projected asset condition improvements are made possible by the enactment of Act 40 (commonly referred to as the Roads Bill) in 2017 by the South Carolina State Legislature, which provides dedicated funding to improve transportation infrastructure in South Carolina through an incremental increase in the State’s gas tax and other fees over the next six years. At full implementation, SCDOT is poised to receive nearly a doubling of state resources, which will outpace the federal funds coming to the State by 2:1. This increased funding presents 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 management of resources.

**SCDOT’s 10 Year Asset Condition Performance Targets**

<table>
<thead>
<tr>
<th>Pavements</th>
<th>2016 (Actual) % Good</th>
<th>2016 (Actual) % Poor</th>
<th>Ten-year Target % Good</th>
<th>Ten-year Target % Poor</th>
<th>Average 10-Year Allocation (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate¹</td>
<td>65%</td>
<td>11%</td>
<td>92%</td>
<td>3%</td>
<td>$135.0</td>
</tr>
<tr>
<td>Non-Interstate NHS</td>
<td>28</td>
<td>45</td>
<td>72</td>
<td>16</td>
<td>86.5</td>
</tr>
<tr>
<td>Non-NHS Primaries</td>
<td>20</td>
<td>61</td>
<td>48</td>
<td>37</td>
<td>186.0</td>
</tr>
<tr>
<td>Federal Aid Secondary</td>
<td>19</td>
<td>52</td>
<td>40</td>
<td>35</td>
<td>112.5</td>
</tr>
<tr>
<td>Non-Federal Aid Secondary²</td>
<td>15</td>
<td>55</td>
<td>25</td>
<td>45</td>
<td>121.0</td>
</tr>
</tbody>
</table>

**Bridges (by count)**

<table>
<thead>
<tr>
<th>NHS</th>
<th>48</th>
<th>6</th>
<th>66</th>
<th>0</th>
<th>114.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA</td>
<td>46</td>
<td>11</td>
<td>41</td>
<td>11</td>
<td>18.0</td>
</tr>
<tr>
<td>Off System</td>
<td>40</td>
<td>9</td>
<td>36</td>
<td>10</td>
<td>18.5</td>
</tr>
</tbody>
</table>

**Bridges (by deck area)**

<table>
<thead>
<tr>
<th>NHS</th>
<th>42</th>
<th>4</th>
<th>60</th>
<th>0</th>
<th>114.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA</td>
<td>50</td>
<td>10</td>
<td>41</td>
<td>15</td>
<td>18.0</td>
</tr>
<tr>
<td>Off System</td>
<td>51</td>
<td>7</td>
<td>44</td>
<td>10</td>
<td>18.5</td>
</tr>
</tbody>
</table>

* Pavement condition based on PQI scale. Bridge condition is based on the federal NBI scale.
¹ Includes approximately $20 million added value from planned interstate widening projects over the next ten years.
² Includes approximately $39 million projected added value from projects County Transportation Committees program on the State’s Non-Federal Aid Secondary system annually.
The Future of Transportation Asset Management at SCDOT

While SCDOT has embraced transportation asset management in its business practices, the agency constantly strives to improve its efficiency, transparency, and accountability. Particularly, SCDOT has identified areas—grouped under three broad areas: **culture, data, and tools**—that could be enhanced to improve the efficient use of transportation resources. SCDOT is working toward:

- 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; and
- Evaluating securing analytical tradeoff decision-support tools to support transportation asset management decision making.
1. INTRODUCTION

1.1. 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. Effective July 2012, state departments of transportation were required to develop a risk-based Transportation 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 a TAMP.

SCDOT has embraced the philosophies of performance and asset management as a management practice. This document supports SCDOT’s 2018-2020 Strategic Plan, which serves as a roadmap by outlining the agency’s vision, mission, values, and goals. SCDOT has developed this TAMP to document procedures in practicing transportation asset management and is implementing this Plan to achieve the condition targets established by SCDOT.

1.1.1. Vision

The vision of the agency is “to rebuild our transportation system over the next decade in order to provide adequate, safe and efficient transportation services for the movement of people and goods in the Palmetto state.” This statement captures the essence of SCDOT’s focus of getting to a state of good repair for the existing state highway system and recognizing the unique opportunity to turn around the downward decay of the road network that has occurred over the past thirty years. SCDOT has adopted risk-based asset management principles to ensure efficient and cost-effective use of the resources entrusted to SCDOT in reaching its ten-year vision.

1.1.2. Mission

As outlined within its 2018-2020 Strategic Plan, “SCDOT connects communities and drives the economy through the systematic planning, construction, maintenance and

operation of the state highway system and the statewide intermodal transportation and freight system."

1.1.3. Values

SCDOT’s values influence day-to-day activities, inform the decision-making process, and enable the agency to measure progress towards goals. The values are based on the concept of TEAM within the organization as One SCDOT and with its citizens and business stakeholders. In practicing asset management, SCDOT focuses on the following core values to make infrastructure investment decisions:

- Trust
- Excellence
- Accountability
- Make a Difference

1.1.4. Goals

SCDOT’s Strategic Plan goals are to:

- Improve safety programs and outcomes in high-risk areas;
- Maintain and preserve its existing transportation infrastructure;
- Improve program delivery to increase the efficiency and reliability of the road and bridge network;
- Provide a safe and productive work environment for SCDOT employees; and
- Earn public trust through transparency, improved communications, and audit compliance.

These goals directly reflect many aspects of transportation asset management. Specifically, transportation asset management focuses on preservation of existing infrastructure with a more cost-effective and efficient approach. SCDOT also utilizes transportation asset management principles to address mobility by planning for future demands on the system. These actions facilitate safe and efficient movement of citizens, goods and services; thereby, enhancing the performance of state and national commerce.

1.2. 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. For example, SCDOT utilizes transportation asset management principles in allocating transportation resources and delivering the Department’s performance goals. 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.

### 1.3. TAMP RELATIONSHIP TO OTHER PLANNING DOCUMENTS

As a strategic document, the TAMP is used as a supporting tool to improve business practices that lead to better asset preservation and system performance. The TAMP serves as a pivotal document that links 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 TAMP is a key document that bridges these other long- and short-term plans. For example, investment strategies outlined in the TAMP feed projects and programs included in the STIP. Figure 1-1 shows the relationships between the agency’s other plans and the TAMP.
1.4. SCOPE AND STRUCTURE OF THE TAMP

The purpose of this TAMP is to provide a clear and transparent direction in managing the State’s assets. This is achieved by outlining the approach SCDOT is using to effectively manage resources and add value to the highway transportation infrastructure.

SCDOT has adopted transportation asset and performance management as a best management practice and has fully embraced the concept for all of its programs. The Secretary of Transportation and the governing board of the agency, the SCDOT Commission, have reaffirmed the importance of the TAMP for accountability and transparency regarding the use of taxpayer funds especially in light of the recent dramatic increase in state funding for infrastructure in South Carolina. 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’s TAMP is all-inclusive by incorporating state and federal funding together for a more robust plan for the state owned system. However, in accordance with the
requirements of MAP-21 and FAST Act, this TAMP separately reflects road and bridge assets on the National Highway System as well.

The TAMP was developed through a systematic process, which was initiated with a gap assessment documenting and benchmarking transportation asset management within SCDOT. Results of this assessment helped shaped the plan.

The remainder of the document is organized as follows:

- **Chapter 2** presents an overview of the practice of transportation asset management at SCDOT, including the agency’s organizational structure and how it relates to the business structure that governs the asset management practices.

- **Chapter 3** reviews the principles of Whole Life Management of Assets at SCDOT and how this management technique is incorporated into the TAMP. The chapter describes the current state of the practice within the agency, potential enhancements, best practices, and the agency’s asset management systems.

- **Chapter 4** reviews the state of SCDOT’s highway transportation system. Specifically, the chapter discusses the demand for transportation, asset inventory, and asset condition trends.

- **Chapter 5** outlines the role of the financial plan as a key component of the agency’s asset management framework. This chapter documents the agency’s financial resources to manage the existing highway infrastructure.

- **Chapter 6** presents the investment approach to allocating asset management resources at SCDOT. The chapter defines system performance targets, establishes the hierarchy of investment decision making and outcomes, and highlights existing system performance gaps.

- **Chapter 7** documents potential opportunities the agency has identified to further enhance the transportation asset management process to support better utilization of resources.
2. SOUTH CAROLINA TRANSPORTATION ASSET MANAGEMENT

2.1. OVERVIEW

The overarching objective of asset management requires vital support from the executive level and all other strategic, technical, and operational units within an organization. How asset management is organized within SCDOT and general transportation asset management policies and principles are discussed in this chapter.

2.2. ORGANIZATIONAL STRUCTURE

The Transportation Commission has the responsibility of governing the South Carolina Department of Transportation. The Commission is a nine-member policy-making body. Seven members of the Commission individually represent each of the seven congressional districts of the State and are appointed by the Governor of the State. Two at-large members of the Commission are also appointed by the Governor. All Commission Member Appointees go through a legislative confirmation process. 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 2-1 illustrates the organizational structure for SCDOT. SCDOT is divided into the following organizational units: Intermodal Planning, Finance and Administration, Engineering (including maintenance), Human Resources, Minority and Small Business Affairs, Chief of Staff, and Legal Services. Figure 2-1 shows further divisional offices under each organizational unit that support the operation of the transportation system in South Carolina.
Figure 2-1. SCDOT Organizational Structure
2.3. 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. SCDOT 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 2-2 illustrates the transportation asset management governance structure and consists of the following functional tiers:

1. Transportation Commission,
2. Secretary of Transportation,
3. Senior Management Committee,
4. Transportation Asset Management Team Staff, and
5. Transportation Asset Management Advisory Groups.

Figure 2-2. SCDOT Transportation Asset Management Governance Structure
The specific functions of each tier are listed in the following subsections:

**SCDOT Transportation Commission**

The TAMP is approved by the SCDOT Transportation Commission as required by South Carolina Act 40 of 2017. The Commission also approves any policy related to transportation asset management by the request of the SCDOT Secretary of Transportation.

**Secretary of Transportation**

As required by 23 CFR §515.9, the Secretary of SCDOT approves the TAMP for submittal to FHWA. The Secretary directs all transportation asset management policy initiatives at SCDOT and recommends 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 is in harmony with statewide policy;
- Directs transparency, accountability, and communication efforts relating to the TAMP; and
- Provides an annual report regarding progress towards achieving the targets outlined in the TAMP.

**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 and 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 TAMP.

**Transportation Asset Management Team Staff**

The Transportation Asset Management Team Staff consists of the Chief Asset and Performance Management Engineer and his or her staff. The role of the Transportation Asset Management Team Staff 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 Management Engineer. The groups are made up of subject area experts to provide knowledgeable inputs as well as undertake technical analyses required for transportation asset management. These advisory groups are formed and dissolved as needed. Some of the tasks the advisory groups undertake include pavement and bridge data analysis and programming, financial analysis and planning, policy setting, and target setting.
2.4. GUIDING PRINCIPLES OF SCDOT ASSET MANAGEMENT PROGRAM

The primary purpose of SCDOT is to provide a safe and reliable transportation system for the movement of people and goods. This purpose requires SCDOT to ensure that transportation assets are effectively and efficiently operated, preserved, maintained, and expanded to meet future demands. Asset management at SCDOT is guided by the following principles:

- Providing quality transportation services to effectively meet the needs of South Carolina citizens;
- Maintaining public trust by being a transparent, effective, accountable, and cost-efficient organization in providing services to its citizens and other users of the system;
- Promoting economic efficiency and making use of performance data to optimize investments and reduce costs over assets’ lifecycles; and
- Collaborating as a team and partnering with other stakeholders, such as Metropolitan Planning Organizations and Council of Governments, to meet infrastructure needs.

2.4.1. Current Practice

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.
The MAP is capable of estimating the cost associated with moving from the current LOS to a desired LOS. Based upon this information, resources can be targeted at areas requiring improvements. The MAP system evaluates seven different elements to determine the LOS of a road segment: pavement, shoulders/ditches, drainage structures, roadside, signs, pavement markings, and guardrail. As a result, transportation investment decision-making at SCDOT has been in harmony with many aspects of the MAP-21 and FAST Act provisions.

2.4.2. 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.

2.5. 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.
3. **WHOLE LIFE MANAGEMENT OF ASSETS**

3.1. **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 Cost Analysis (LCCA), 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 3-1, the transportation asset management lifecycle spans four distinct stages: planning, design, construction, and maintenance. 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.

![Figure 3-1. The Asset Life Cycle](image)

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. 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. SCDOT therefore developed its pavement program to include funding dedicated to preservation activities targeted toward pavements in an existing good condition rather than follow a strict "worst-first" approach.
The outcome of this planning facilitates the development of investment options that address key strategic issues, including:

- Enhanced safety,
- Improved asset conditions,
- Enhanced reliable transportation system, and
- Reduced risks at the minimum practicable cost extending the life of the asset.

**Life-Cycle Cost Basics**

Figure 3-2 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 bridge 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.

**Figure 3-2. Representation of Whole Life Asset Management Approach**

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 3-3 (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 3-3. Deterioration Curve of a Pavement Asset

FHWA report FHWA-SA-98-079, 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.

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, 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 3-4.
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. Based on this analysis, an alternative with better cost-effectiveness 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.
3.2. CURRENT APPLICATION OF LCC 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. 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 condition 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 Division 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 3-1, 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 3-1. Expected Service Life of Selected Treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Pavement Service Life)</td>
</tr>
<tr>
<td>Crack Seal</td>
<td>2</td>
</tr>
<tr>
<td>Chip Seal</td>
<td>4</td>
</tr>
<tr>
<td>Microsurfacing</td>
<td>5</td>
</tr>
<tr>
<td>Open Graded Friction Course</td>
<td>6</td>
</tr>
<tr>
<td>General Rehab</td>
<td>7</td>
</tr>
<tr>
<td>Mill &amp; Replace 1&quot;-2&quot;</td>
<td>8</td>
</tr>
<tr>
<td>Overlay &lt; 200 PSY</td>
<td>9</td>
</tr>
<tr>
<td>Mill &amp; Replace 2&quot;-4&quot;</td>
<td>10</td>
</tr>
<tr>
<td>Overlay 400 PSY</td>
<td>10</td>
</tr>
<tr>
<td>Overlay &gt; 400 PSY</td>
<td>10</td>
</tr>
<tr>
<td>Overlay &gt; 400 PSY</td>
<td>10</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>10</td>
</tr>
<tr>
<td>Mill &amp; Replace 2&quot;-4&quot; + Overlay 200 PSY</td>
<td>11</td>
</tr>
<tr>
<td>Section Reclamation</td>
<td>12</td>
</tr>
<tr>
<td>Mill &amp; Replace 1&quot;-2&quot; + Overlay 400 PSY</td>
<td>17</td>
</tr>
<tr>
<td>Mill &amp; Replace 2&quot;-4&quot; + Overlay 400 PSY</td>
<td>17</td>
</tr>
<tr>
<td>IC 2&quot;-4&quot; + Overlay 150-200 PSY</td>
<td>17</td>
</tr>
<tr>
<td>IC 4&quot;-6&quot; + Overlay 150-200 PSY</td>
<td>17</td>
</tr>
</tbody>
</table>

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.

3.3. 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.

To illustrate, Table 3-2 shows the number of lane miles added to SCDOT’s system in 2016. In addition to the initial roadway construction costs, SCDOT calculates the cost of maintaining the pavements over 50 years, which includes multiple treatments to extend their typical 20-year design life. With the 34 lane miles of capacity added during 2016, SCDOT projects an additional $64 million needed to maintain those added miles in a good condition over a 50-year period.
Table 3-2. Maintenance Cost of Added Lane Miles in 2016 over 50 year period

<table>
<thead>
<tr>
<th>Year</th>
<th>System</th>
<th># of Lane Miles of Capacity Added</th>
<th>Cost of Maintenance per Lane Mile of System Over 50 Years</th>
<th>Added Cost of Maintenance Over 50 Years¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>Interstate</td>
<td>24</td>
<td>$2,200,900</td>
<td>$52,822,000</td>
</tr>
<tr>
<td>2016</td>
<td>Non-Interstate NHS</td>
<td>10</td>
<td>1,121,100</td>
<td>11,211,000</td>
</tr>
<tr>
<td>2016</td>
<td>Non-NHS Primary</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2016</td>
<td>Federal Aid Secondary</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2016</td>
<td>Non-Federal Aid Secondary</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2016</td>
<td>Total Lane Miles added</td>
<td>34</td>
<td>Total Cost Added</td>
<td>$64,033,000</td>
</tr>
</tbody>
</table>

¹ Assumes 2.0% annual inflation rate based on 2016 costs by treatment type.

It should be noted that factors such as mobility level of service and freight needs play a greater role in the agency's determination as to whether or not it will pursue a capacity project. However, increased maintenance cost does play an important role in developing long-term program budgets.

3.4. 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 Office of Intermodal Planning encompasses Pavement Management, GIS Collection, and Inventory sections. These sections are responsible for the collection, processing, analyzing, and reporting of pavement condition and traffic counts for approximately 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 is made up 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 3-5. 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 3-5. PQI Ranges Suitable for Treatment Types**

<table>
<thead>
<tr>
<th>Pavement Condition</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQI Range</td>
<td>0.0 – 2.6</td>
<td>2.7 – 3.3</td>
<td>3.4 – 5.0</td>
</tr>
</tbody>
</table>

The treatment types are defined as:

- **Reconstruction** – usually involves the complete replacement of the pavement structure.
- **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 transportation asset to sustain it at or improve it to a good condition.

The current pavement management system (PMS) has 15 to 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, 62, 63, 64, and 65 (attached as Appendices B and C), which outline the pavement improvement project prioritizations for interstates, non-interstate NHS, non-NHS 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. SCDOT periodically reviews the number of miles that fall into preservation, rehabilitation, and reconstruction activities and distributes funding based on the proportion of lane miles that fall within each category from the funding allocated to each system. 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.

### 3.5. BRIDGE MANAGEMENT

SCDOT currently uses the AASHTOWare Bridge Management System (BrM) to manage its bridge assets. The agency primarily uses BrM to catalog bridge condition inspection data and develop priority lists for replacement candidates.

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 using BrM based on objective data, including structural condition, traffic status, Average Daily Traffic, Average Daily Truck Traffic percentage, detour
length, 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 on the National Highway System is a strategic priority of SCDOT.

After a prioritized list is created, it is sent to the Office of Preconstruction, which determines project cost and looks at other factors, such as if the potential bridge replacement would conflict with other projects under design or development. Once this vetting process and determination of initial cost estimates is completed, a finalized bridge list is developed based on funding availability and provided to the Transportation Commission for approval. SCDOT follows this process approximately every two years.

The current practice of staff is to use BrM to create priority lists based on a set decision tree outlined above. However, the agency is currently reevaluating its process and incorporating additional life cycle planning processes in its bridge management practices. This includes plans to upgrade the software and train additional staff on the management system’s capabilities in FY 2019.

SCDOT has also embraced an innovative bridge monitoring system that uses advanced condition assessment technology to supplement certain bridge inspections as one way to reduce expenses and improve the practice of WLM. The bridge monitoring system uses sensors installed on specific bridges to track bridge performance. The sensors enable efficient tracking of bridge conditions for timely intervention, thereby extending the service life of bridges. SCDOT installs this system on important bridges for the movement of people and goods, such as the Arthur Ravenel Jr. Bridge over the Cooper River in the Charleston area.

3.6 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.

By showing the needs of its existing assets, SCDOT secured additional funding from a historic 12-cent increase in the state gas tax, of which approximately 50% is being allocated to preserving its existing assets. This process included developing “performance curves” (which are included in the Investment Strategies Chapter), that
project asset conditions in 10-years for SCDOT’s different pavement and bridge systems based on outputs from the agency’s pavement and bridge monitoring systems.

Using results of this life-cycle planning process, 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 TAMP that lead 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.

In addition, SCDOT is currently pursuing a request for proposals for enterprise-level asset management software that will allow it to perform more robust analyses and more thoroughly involve life cycle planning at the network and agency level. Further discussion about the future of transportation asset management at SCDOT is included in Chapter 7.
4. STATE OF THE SYSTEM

4.1. 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. 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 and asset inventory and condition.

4.2. DEMAND—PAST, PRESENT, FUTURE

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 2000 and 2010 according to the US Census Bureau and the State’s population increased by 15.3 percent over this period. South Carolina’s population is expected to grow an additional 31 percent by 2040, with a corresponding household growth of 32 percent by the year 2040.2 In addition, South Carolina experienced 1.9% job growth in 2016 according to the Bureau of Labor Statistics Quarterly Census of Employment and Wages.

Table 4-1 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.

2 Source: South Carolina Multimodal Transportation Plan, 2014
Table 4-1. South Carolina Demographic and Socioeconomic Projections

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Base Year (2010)</th>
<th>Forecast Year (2040)</th>
<th>Forecast Growth (%)</th>
<th>Annual Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>4,625,000</td>
<td>6,061,000</td>
<td>31.0</td>
<td>0.91</td>
</tr>
<tr>
<td>Household</td>
<td>1,801,000</td>
<td>2,379,000</td>
<td>32.1</td>
<td>0.93</td>
</tr>
<tr>
<td>Employment</td>
<td>2,037,000</td>
<td>2,758,000</td>
<td>35.4</td>
<td>1.02</td>
</tr>
</tbody>
</table>

The change in Daily Vehicle Miles Traveled (DVMT) over the years in South Carolina is similar to trends exhibited nationwide. DVMT in South Carolina declined from 134 million in 2007 to 130 million in 2014, which was largely attributable to the recession between 2007 and 2009. Figure 4-1 shows the DVMT trends in South Carolina between 2007 and 2016 and forecast out to 2026. The figure shows that DVMT has been picking up since 2014 and peaked in the year 2016 with over 141 million DVMT, which is the most daily miles traveled since SCDOT began tracking the measure. DVMT is projected to increase 0.9% annually through 2026.

Figure 4-1. DVMT Trend in South Carolina

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3 Road Data Services, Office of Planning, Traffic Engineering, SCDOT
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. Examples include: more frequently collecting pavement data beginning in 2017, incorporating new pavement data collection technologies scheduled to begin in 2019, implementing new traffic counters that have the ability to classify vehicle types, and employing sensors that monitor the structural health of key bridges and bridge components. SCDOT understands that undertaking these efforts in collecting and analyzing highway and bridge data to inform business decisions is not just good for business, but it is the right thing to do as a steward of public resources.

4.3. Asset Registry

SCDOT’s current transportation asset management efforts focus on its pavement and bridge infrastructure assets. South Carolina’s transportation system includes the NHS, which includes the interstate system, and other important roadways that are not necessarily a part of the NHS. It is also important to note that SCDOT does not manage certain sections of the non-interstate NHS, totaling approximately 0.2 percent of the non-interstate NHS mileage within the State, or 4.2 centerline miles. 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 MPOs and the COGs, who typically program capacity, access management, and similar projects on the non-interstate NHS system.

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: Interstate, Non-Interstate NHS, Non-NHS Primary (U.S. highways and SC designated routes), Federal Aid Secondary, and Non-Federal Aid Secondary highways. Additionally there is an Off-system category which SCDOT does not maintain. Table 4-2 shows a breakdown and description of each category maintained by the State. By centerline miles, the NHS accounts for 8.7 percent of the road network maintained by SCDOT.
4.4. PAVEMENT INVENTORY

SCDOT owns, operates, and maintains a mixture of asphalt, concrete, and composite pavement assets. Pavement assets form the core part of the highway transportation system. As such, SCDOT invests adequate time, human, and financial resources in tracking the quantity and conditions of these core assets.

4.4.1. Pavement Condition Metric

SCDOT understands the importance of maintaining a functional highway system. The agency measures the performance and tracks the condition of its highway infrastructure assets using metrics it has selected to align with its long-term goals. SCDOT tracks asset conditions by using these metrics, which it incorporates into its Pavement Quality Index (PQI) measure. With the move toward a unified national metric reporting standard, SCDOT has also begun measuring pavements by International Roughness Index (IRI), cracking percentage, rutting (for asphalt only), and faulting (for jointed concrete only).

SCDOT tracks and maintains pavement conditions using a pavement management system (PMS) and the Road Inventory Management System (RIMS). These systems support the agency in making informed, strategic investment decisions relating to pavement maintenance and programming. Figure 4-2 through Figure 4-6 show SCDOT’s pavement condition trend by functional class based on PQI. PQI scales are shown in

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4 Excludes NHS Secondary Routes.
Figure 3-5 in the preceding chapter. SCDOT generates these results using the Department’s PMS. Figure 4-2 shows that SCDOT is incrementally improving its interstate pavements. Beginning in 2011, SCDOT has kept the percentage of interstate pavements in poor condition around ten percent, while maintaining the percentage of interstate pavements in good condition consistently above 60 percent. 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 as good. 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 4.2 percent of the road network system, measured by lane miles, they carry approximately 30.6 percent of the DVMT as of 2016.

**Figure 4-2. Interstate Pavement System Condition Trend**

Figure 4-3 through Figure 4-6 show a different story for the other state-maintained systems. All of these systems experienced a double-digit percentage point increase of pavements considered poor using the PQI measure between 2008 and 2016. This is primarily from pavements quantified as fair deteriorating into poor condition. As will be discussed in the Financial and Investment Strategies chapters, these systems have deteriorated because SCDOT historically has had insufficient funds to maintain its system and has had to strategically focus its maintenance projects on certain areas. With increased state revenues, SCDOT intends to prevent further deterioration in its pavement system and begin improving overall pavement condition across all of the systems it maintains.
Figure 4-3. NHS Primary Pavement System Condition Trend

Figure 4-4. Non-NHS Primary Pavement System Condition Trend
4.4.2. Remaining Service Life

Because SCDOT maintains approximately 90,000 lane miles, it has limited resources to adequately maintain its entire system. For example, if all of its pavement assets were maintained once on a ten-year cycle, SCDOT would need to treat 9,000 lane miles annually, which with its historical funding levels has been prohibitive. Another useful metric to illustrate this principle is remaining service life. Each pavement asset has an initial service life based on its design. As each year passes, every pavement loses one year of service life unless the pavement has been treated, in which case additional service life is added. Figure 4-7 shows the aggregate service life for SCDOT maintained pavements from 2008 to 2016 for the interstate, primary, and secondary systems. In any given year, SCDOT’s pavements lose service life equal to the number of lane miles in
the system. However, service life is also gained by performing preventative maintenance, rehabilitation, or reconstruction treatments or adding capacity, such as interstate widenings. As the data shows, except for the interstate system in 2013, SCDOT’s pavements have overall been deteriorating each year based on this metric.

Figure 4-7. Net Change in Pavement Service Life

![Service Life Net Change](chart)

1 SCDOT began tracking this metric in 2008.

4.5. BRIDGE INVENTORY

As shown in Table 4-3, SCDOT owns, operates, and maintains 8,422 bridge structures with an average age of about 40 years. These structures include over 1,000 large culverts, defined as bridges with a span greater or equal to 20ft. 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 NBI and the National Bridge Elements (NBE).
Table 4-3. South Carolina State-maintained Bridge Inventory

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Count</th>
<th>Bridge Deck Area (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHS</td>
<td>1,745</td>
<td>39,110,289</td>
</tr>
<tr>
<td>Federal Aid</td>
<td>3,883</td>
<td>24,903,895</td>
</tr>
<tr>
<td>Off System</td>
<td>2,794</td>
<td>7,607,110</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,422</strong></td>
<td><strong>71,621,294</strong></td>
</tr>
</tbody>
</table>

4.5.1. Bridge Condition Metric

SCDOT monitors progress in maintaining and preserving bridges using the following set of metrics: percentage of state-owned bridges classified as substandard, structurally deficient, functionally obsolete, and load restricted. These metrics are compared to the agency’s goals and targets to evaluate the effectiveness and efficiency of resource allocation and utilization processes. These metrics align with the National Highway Performance Program (NHPP) recommended reporting metrics, which is the percentage of NHS bridge deck area classified as good or poor based on the NBI scale of 0 - 9. Under the NHPP standards, a bridge is considered in poor condition if its deck, substructure, or superstructure rates 4 or below. A bridge is considered in good condition if each of the three components: deck, substructure, and superstructure rate 7 or higher. The collective use of these measures and metrics enhances SCDOT's transportation asset management processes and influences decisions about program budgets and priority setting.

4.5.2. Bridge Condition Trends

SCDOT tracks and maintains bridge conditions using the BrM. In addition, the SCDOT Highway Maintenance Management System complements the BrM in tracking maintenance activities on bridges. The BrM facilitates the annual NBI reporting requirements and supports the agency in making informed decisions relating to bridge maintenance and programming. 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.

Figure 4-8 through Figure 4-11 show the historic trend of bridge performance by measuring the number of load restricted, number of structurally deficient, and percentage of structurally deficient bridges by deck area for its entire system and NHS, respectively. The data indicates that the agency has reduced the number of load
restricted bridges in addition to structurally deficient bridges as measured by count and percentage of total deck area over the past five years. Per NHPP requirements, SCDOT cannot allow the deck area of structurally deficient NHS bridges to exceed 10 percent of the total NHS bridge deck area without facing penalties. SCDOT is well below this target, with approximately 4.2 percent of NHS bridge deck area classified as poor in 2016.
4.6. Asset Valuation

SCDOT uses a modified Governmental Accounting Standards Board (GASB) Statement No. 34 approach to value its pavement and bridge assets, using a straight-line method, which assumes an asset life of 75 years for roads and 50 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, 2017, SCDOT’s road and bridge networks are valued at $10.4 billion net of depreciation according to the CAFR. The agency is revising its process of estimating the value of its assets by functional class and will include valuation estimates in future revisions to its TAMP, which will also detail the annual investment needed to maintain the value of these assets over a ten-year period.
5. **FINANCIAL PLAN OVERVIEW**

The financial plan chapter outlines SCDOT’s financial planning efforts in funding its pavement and bridge assets, safety, capacity, MPO/COG, and freight 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.

5.1. **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.

For pavement systems other than the interstate, funding is allocated for preservation, rehabilitation, or 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. Both the interstate and non-interstate NHS pavement programs are 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, such as reducing the number of structurally deficient bridges on the NHS to zero by FY 2027. 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 6.

5.2. **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 $84 million annually.

• **Infrastructure Maintenance Trust Fund (IMTF):** Act 40 of 2017 requires SCDOT to establish the IMTF, the purpose of which is to segregate funds directed for the State’s transportation infrastructure maintenance needs. 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 and diesel taxes. In FY 2017, the NFAHF provided approximately $49 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. SCDOT projects to receive $606.5 million from the Federal-Aid Highway Program for use to program on its assets in 2018.

• **General Fund:** in addition to the above funds, SCDOT also periodically receives one-time appropriations as stipulated by the South Carolina State Legislature for specific projects or activities.

• **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 match can be reduced.

In addition to the above funding sources, SCDOT 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, counties must spend at least 25 percent of their C-Fund allocations on the state highway system for construction, improvements, and maintenance; however, in practice, the counties spend closer to
60 percent of their C-Fund allocations on the state highway system. For FY 2017, the C-Fund received $133.8 million.

5.3. CURRENT FUNDING LEVELS

In 2017, SCDOT programmed $1 billion for its assets, of which 90% came from the State Highway Fund and the Federal-Aid Highway Program. Figure 5-1 outlines the funding sources and associated amounts SCDOT programmed for its assets for the fiscal year ending June 30, 2017.

For FY 2018, SCDOT expects to program $1.1 billion for its transportation assets. Figure 5-2 shows the funding sources for its FY 2018 transportation asset program and associated amounts. Projected revenues from state sources account for $148 million of the $155 million increase from FY 2017, or 92%.
5.4. 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, and SCDOT’s freight program. Figure 5-3 represents SCDOT’s $844 million program for the fiscal year ending June 30, 2017, related to SCDOT’s bridge and highway assets.
Figure 5-4 shows the agency’s forecasted program related to pavements and bridges on the state highway system for FY 2018 by program category. With the addition of new state revenue, SCDOT forecasts it will spend $349 million, or 41.3%, more on its bridge and highway assets in FY 2018 compared with the previous fiscal year. Approximately half of SCDOT’s funding goes to maintenance of its existing assets, indicating the agency’s commitment to maintaining the value of the highway transportation network.
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 percent, 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 is forecast to increase annual revenues for SCDOT’s assets by approximately $600 million once the increases are fully phased in beginning in FY 2023 compared to the FY 2017 funding level. Table 5-1 represents the Department’s asset management revenue forecast for FY 2018 to FY 2027. SCDOT projects $13.6 billion over the 10-year period will be available to program for its transportation assets.
Table 5-1. Forecasted Asset Management Program Funding Level Sources for FYs 2018-27
(in millions)

<table>
<thead>
<tr>
<th>Revenue Source</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>10-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal-Aid Highway Program</td>
<td>$606.5</td>
<td>$629.6</td>
<td>$644.6</td>
<td>$644.8</td>
<td>$652.6</td>
<td>$654.1</td>
<td>$652.5</td>
<td>$652.7</td>
<td>$652.5</td>
<td>$652.7</td>
<td>$644.2</td>
</tr>
<tr>
<td>State Highway Fund</td>
<td>142.9</td>
<td>144.9</td>
<td>142.9</td>
<td>144.9</td>
<td>142.9</td>
<td>144.9</td>
<td>142.9</td>
<td>144.9</td>
<td>142.9</td>
<td>144.9</td>
<td>144.3</td>
</tr>
<tr>
<td>Infrastructure Maintenance Fund¹</td>
<td>300.2</td>
<td>392.8</td>
<td>422.5</td>
<td>477.4</td>
<td>527.6</td>
<td>609.1</td>
<td>611.5</td>
<td>614.1</td>
<td>617.4</td>
<td>619.0</td>
<td>519.2</td>
</tr>
<tr>
<td>Non-Federal Aid Highway Fund</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
<td>48.0</td>
</tr>
<tr>
<td>General Fund One-time Transfers</td>
<td>50.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,147.5</strong></td>
<td><strong>$1,215.3</strong></td>
<td><strong>$1,257.9</strong></td>
<td><strong>$1,315.0</strong></td>
<td><strong>$1,371.0</strong></td>
<td><strong>$1,456.0</strong></td>
<td><strong>$1,457.1</strong></td>
<td><strong>$1,459.6</strong></td>
<td><strong>$1,462.7</strong></td>
<td><strong>$1,464.5</strong></td>
<td><strong>$1,360.7</strong></td>
</tr>
</tbody>
</table>

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. INVESTMENT STRATEGIES

6.1. 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 capacity programs. This chapter incorporates federally-required measures and targets where appropriate, but primarily focuses on state-specific transportation asset management targets.

6.2. GUIDING PRINCIPLES OF SCDOT INVESTMENT STRATEGIES

SCDOT’s 2018-2020 Strategic Plan has five stated goals with underlying objectives:

- Improving safety programs and outcomes in high-risk areas.
  - Reduce fatalities by 6% by end of calendar year 2020
  - Reduce fatalities on roads in rural areas

- Maintaining and preserving existing transportation infrastructure.
  - Increase responsiveness regarding customer service requests for routine maintenance items
  - Increase the % Good Pavements on the road network across the State
  - Decrease the number of structurally deficient bridges across the State
  - Improve the level of service of day-to-day maintenance of the State Highway System for key safety-related items
  - Decrease the number of mass transit vehicles in poor condition
  - Enhance the network of small businesses that are ready, willing and able to assist the Department in meeting its infrastructure goals

- Improving program delivery to increase the efficiency and reliability of the road and bridge network.
  - Improve the reliability of the movement of people and goods across the major portions of the road network
  - Ensure projects proceed on schedule and within budget in accordance with SCDOT’s 10-year Program Delivery Plan
  - Expedite the environmental permitting process for road and bridge projects

- Providing a safe and productive work environment for SCDOT employees.
  - Increase the public’s awareness of highway worker safety in work zones
  - Establish programs to provide unit and individual safety awards and incentives

- Earning public trust through transparency, improved communications, and audit compliance.
  - Launch an updated Customer Service Training
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.

6.3. 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. Risk is defined as the positive or negative effect of uncertainty on objectives. 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. This process is referred to as risk management.

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. The consideration of risk allows SCDOT to estimate the consequences and/or opportunities to agency or network operations for a given or an implemented investment strategy. SCDOT is developing an agency-wide enterprise risk management process, which will include a biennial survey of directors to identify and score the likelihood and impact of risks. This process includes the development of a heat map of negative risks the agency may face related to its strategic plan.

Figure 6-1 shows the identified risks with values determined by SCDOT leadership in 2017 showing their potential impact and likelihood. For example, agency leadership agreed that a potentially high impact and likelihood relates to the loss of key personnel and the inability to recruit or retain staff. All of the risks listed in the risk assessment may affect SCDOT’s effective use of whole life asset management principles to varying degrees. Under SCDOT’s current process, which is in development, the agency plans to treat high impact/likelihood risks and tolerate low impact/likelihood risks. Understanding the risks it may face enables SCDOT to proactively mitigate the outcomes of these risks.

Figure 6-1. SCDOT Risk Assessment Heat Map

2017 Risk Assessment by SCDOT Leadership
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 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.

Moving forward, SCDOT intends to monitor its investment strategies through the use of modeling software that analyzes cross asset allocations to ensure good stewardship and optimal investment of public funds into its pavement and bridge assets. Results from this modeling are aligned with SCDOT’s strategic vision and take into account its risk profile. Chapter 7 of the TAMP includes further discussion on the agency’s action plan. SCDOT is also developing a risk management plan specific to its pavement and bridge assets, which includes the NHS. This process will identify and outline mitigation strategies for risks that may affect the condition and performance of its assets and outline a plan to monitor assets with the highest combined likelihood and impact as determined by the agency’s directors. The analysis resulting from this risk assessment will be included in future versions of the agency’s TAMP.

**Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events**

As part of its risk management process, SCDOT is evaluating its pavement and bridge assets on the NHS that have required repair and reconstruction activities at least twice due to the effects of an event that resulted in an emergency or disaster declaration by the Governor of South Carolina or President of the United States.

SCDOT expects to complete its evaluation by November 2018 and include the results in updates to its Transportation Asset Management Plan. SCDOT’s process includes identification of assets that have required repair more than once during emergency events since 1997. This includes assets that required repair and reconstruction activities as a result of the historic 1,000 year flood that occurred in South Carolina in the fall of 2015 and damages resulting from Hurricane Matthew in the fall of 2016. As a result of the evaluation, SCDOT intends to consider project design variances to mitigate potential adverse effects from future emergency events. SCDOT is also currently working with in-state research universities to develop a resiliency plan for the State and a new tool to monitor water levels during storm events.

**6.3.1. Safety Investment Strategies**

While the majority of SCDOT’s TAMP 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 2014 and 2015, South Carolina was worst in the nation for the number of deaths per 100 million vehicle
miles traveled, with 1.65 and 1.89 deaths respectively. The rate in 2015 is 67 percent higher than the national rate and 40 percent higher than other states in the southeastern region. In total, approximately 1,000 people die on South Carolina public roads annually. Many of these fatalities occur on the State’s rural road system, which encompasses any 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 2027 into its rural road system, 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 accident data compiled by the Department’s Traffic Engineering Office. 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 will be discussed in Section 6.5.3.

6.3.2. 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 funding to the different pavement strategies based on the ratio of pavements eligible for that type of strategy.

- **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

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the pavements over their remaining service life while the pavements remain in good condition. Based on SCDOT 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.

- **Pavement rehabilitation:** SCDOT is committed to utilizing strategies that enhance pavements that have structural or functional defects. 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. Restoration, resurfacing, and recycling rehabilitation strategies are implemented to modernize and extend the pavements’ service life and return the pavements to a good condition.

- **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 widenings or safety improvements, which reduce overall cost by eliminating duplication of certain construction activities.

### 6.3.3. Bridge Investment Strategies

SCDOT adopts cost-effective bridge investment strategies, such as bridge preservation, which includes preventive and condition-driven maintenance and bridge replacement as integral components of the asset management resource allocation framework. With the agency’s needs-based approach, bridge investments will include a combination of preservation and replacement activities. Preservation strategies include painting, deck patching, and sealing expansion joints. This approach will enable SCDOT to address structurally deficient bridges while ensuring that bridges in good condition are effectively preserved to delay a higher cost of rehabilitation or replacement. Adopting these strategies helps the Department to address bridge needs. SCDOT implements these investment strategies with the objective of achieving the following:

- **Halt the decay of the State's bridge system condition:** SCDOT’s commitment to stop the deterioration of the overall bridge system condition is the highest priority when developing bridge investment strategies.
• **Reduce the number of structurally deficient bridges**: Structurally deficient bridges present uncertainty in the smooth operation of a transportation system. The Department’s 10-year fiscally-constrained target is to replace or upgrade all of its structurally deficient bridges on the interstate and NHS Primary systems. These networks carry about 56 percent of all the daily vehicle miles traveled in the State. In addition, including bridges already programmed, SCDOT projects to replace or upgrade 465 bridges statewide through FY 2027 that are classified as structurally deficient throughout its system, including 51 structurally deficient bridges in 2016 that were not yet programmed for replacement or repair on the NHS that could significantly hamper South Carolina’s ability to move freight across the major routes in the State.

• **Target load-restricted bridges**: This strategy will direct investments towards bridges designated as load restricted. Most of these bridges are currently located on the primary and secondary roadway system. System operation is negatively impacted by these load-restricted bridges. SCDOT understands that some of these bridges are located on strategic freight routes leading to adverse impacts on business operations in South Carolina. SCDOT intends to replace 348 load restricted bridges through FY 2027.

### 6.3.4. Interstate Capacity Investment Strategies

The interstate system within South Carolina carries 29% of the annual traffic in the State, but consists of just 4 percent 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. 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 2027.

### 6.4. 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

6.6 These lists are not mutually exclusive. Certain load-restricted bridges are also structurally deficient and vice versa.
the effectiveness of selected investment strategies. The use of targets in performance management allows for accountability to decision makers and the general 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. For bridge assets, SCDOT tracks conditions using the FHWA NBI rating criteria.

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 TAMP. As a result, the targets are dynamic and may evolve over the next ten years.

### 6.5. 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 enable 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 6-2 shows the average annual funding level required to maintain the system at its 2016 current percent good condition levels through 2027, which are 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).

The model assumes that if any system were to receive no 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.

**Figure 6-2. Ten-Year Projected Performance and Funding Levels for Pavement Systems**

Figure 6-3 likewise shows the average annual funding level required to maintain the three SCDOT-maintained bridge systems at their 2016 current percent poor levels through 2027, which are 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).
As noted in the Financial Chapter, SCDOT will have available for its assets approximately $1.36 billion on average annually through FY 2027. Deducting $610 million per year for its interstate capacity, MPO and COG, freight, and safety programs leaves approximately $750 million on average per year for pavement and bridge preservation, rehabilitation, and reconstruction. Table 6-1 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.

Table 6-1. Projected Program Category Allocations to Assets FYs 2018 - 2027 (in millions)

<table>
<thead>
<tr>
<th>Asset Budget Category</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>10-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavements</td>
<td>$401.8</td>
<td>$417.0</td>
<td>$487.0</td>
<td>$562.0</td>
<td>$642.0</td>
<td>$702.0</td>
<td>$702.0</td>
<td>$702.0</td>
<td>$702.0</td>
<td>$702.0</td>
<td>$750.0</td>
</tr>
<tr>
<td>Interstate</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>150.0</td>
<td>150.0</td>
<td>150.0</td>
<td>150.0</td>
<td>150.0</td>
<td>150.0</td>
<td>150.0</td>
<td>135.0</td>
</tr>
<tr>
<td>NHS</td>
<td>65.0</td>
<td>80.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>90.0</td>
<td>86.5</td>
</tr>
<tr>
<td>Non-NHS Primary</td>
<td>100.0</td>
<td>100.0</td>
<td>140.0</td>
<td>140.0</td>
<td>180.0</td>
<td>240.0</td>
<td>240.0</td>
<td>240.0</td>
<td>240.0</td>
<td>240.0</td>
<td>186.0</td>
</tr>
<tr>
<td>Federal Aid Secondary</td>
<td>55.0</td>
<td>55.0</td>
<td>75.0</td>
<td>100.0</td>
<td>140.0</td>
<td>140.0</td>
<td>140.0</td>
<td>140.0</td>
<td>140.0</td>
<td>140.0</td>
<td>112.5</td>
</tr>
<tr>
<td>Non-Federal Aid</td>
<td>81.8</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
<td>82.0</td>
</tr>
<tr>
<td>Bridges</td>
<td>$180.0</td>
<td>$170.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$145.0</td>
<td>$151.0</td>
</tr>
<tr>
<td>NHS</td>
<td>110.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>115.0</td>
<td>114.5</td>
</tr>
<tr>
<td>Federal Aid</td>
<td>50.5</td>
<td>25.5</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Off System</td>
<td>19.5</td>
<td>29.5</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>18.5</td>
</tr>
<tr>
<td>Assets Subtotal</td>
<td>$581.8</td>
<td>$587.0</td>
<td>$632.0</td>
<td>$707.0</td>
<td>$787.0</td>
<td>$847.0</td>
<td>$847.0</td>
<td>$847.0</td>
<td>$847.0</td>
<td>$847.0</td>
<td>$753.0</td>
</tr>
<tr>
<td>Interstate System Upgrade</td>
<td>$350.5</td>
<td>$352.6</td>
<td>$373.1</td>
<td>$323.3</td>
<td>$332.2</td>
<td>$340.3</td>
<td>$341.0</td>
<td>$343.5</td>
<td>$346.6</td>
<td>$348.4</td>
<td>$345.1</td>
</tr>
<tr>
<td>MPO/COG Programs</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
<td>138.0</td>
</tr>
<tr>
<td>Freight</td>
<td>24.6</td>
<td>27.3</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>29.2</td>
</tr>
<tr>
<td>Safety</td>
<td>97.7</td>
<td>98.7</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.6</td>
<td>99.3</td>
</tr>
<tr>
<td>Total</td>
<td>$1,192.6</td>
<td>$1,203.6</td>
<td>$1,272.8</td>
<td>$1,297.9</td>
<td>$1,386.9</td>
<td>$1,454.9</td>
<td>$1,455.6</td>
<td>$1,458.2</td>
<td>$1,461.2</td>
<td>$1,463.1</td>
<td>$1,364.6</td>
</tr>
</tbody>
</table>
As noted above, SCDOT programs and develops its 10-year investment strategies at the network level. Table 6-2 provides a snapshot of funding allocations for preservation and rehabilitation/reconstruction work types for FY 2019 based on SCDOT’s Pavement Improvement and Preservation Program. Due to the agency’s current funding allocation process, funding allocations cannot be broken out by preservation, rehabilitation, and reconstruction over the course of the TAMP. Instead, work type allocations are determined annually based on up-to-date asset condition data.

### Table 6-2. FY 2019 Pavement Budget Allocations by Work Type

<table>
<thead>
<tr>
<th>Pavement Asset Budget Category</th>
<th>Preservation Allocation</th>
<th>Rehabilitation/Reconstruction Allocation</th>
<th>Total Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>$10.0</td>
<td>$104.0</td>
<td>$114.0</td>
</tr>
<tr>
<td>Non-Interstate NHS</td>
<td>18.4</td>
<td>61.6</td>
<td>80.0</td>
</tr>
<tr>
<td>Non-NHS Primary</td>
<td>23.1</td>
<td>76.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Federal Aid Secondary</td>
<td>10.6</td>
<td>44.4</td>
<td>55.0</td>
</tr>
<tr>
<td>Non-Federal Aid Secondary</td>
<td>11.1</td>
<td>56.9</td>
<td>68.0</td>
</tr>
</tbody>
</table>

* Budget reduced by $14 million due to program overruns in FY 2018.

### 6.5.1. PQI and the Federal Pavement Performance Measure

Beginning in 2018, states are required to collect and report pavement data to FHWA based on the federal pavement performance measure, which uses rideability, cracking percentage, rutting, and faulting condition data. While SCDOT has historically collected these types of data, the collection method was not aligned with new federal standards. SCDOT anticipates it will have collected sufficient pavement condition data in 2019 to comply with the federal standards and will include federally-aligned targets in future updates to this TAMP. Table 6-2 lists the measurement thresholds that determine whether a pavement is good or poor under the federal pavement performance measure. For Jointed Plain Concrete Pavement and Asphalt, IRI, Cracking, and Rutting/Faulting must all be good to warrant a good rating. If at least two of the three categories qualify as poor, then the pavement is considered poor. For Continuously Reinforced Concrete Pavement, the pavement is considered good if both IRI and Cracking are good and the pavement is considered poor if both IRI and Cracking are poor.
Table 6-3. Federal Performance Measure Pavement Condition Thresholds

<table>
<thead>
<tr>
<th>Pavement Condition</th>
<th>Good</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRI (inches/mile)</td>
<td>&lt; 95</td>
<td>&gt; 170</td>
</tr>
<tr>
<td>Cracking Percent (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuously Reinforced Concrete Pavement (CRCP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jointed Plain Concrete Pavement (JPCP)</td>
<td>&lt; 5</td>
<td>&gt; 15</td>
</tr>
<tr>
<td>Asphalt</td>
<td></td>
<td>&gt; 20</td>
</tr>
<tr>
<td>Rutting (Asphalt only) (inches)</td>
<td>&lt; 0.20</td>
<td>&gt; 0.40</td>
</tr>
<tr>
<td>Faulting (JPCP only) (inches)</td>
<td>&lt; 0.10</td>
<td>&gt; 0.15</td>
</tr>
</tbody>
</table>

In the process of changing its pavement condition data collection, SCDOT staff approximated pavement condition data using the federal measures for 2016, which is outlined in Table 6-3 in comparison with PQI. Based on the data, the PQI measure shows a higher percentage of pavements in good and poor condition than the federal measure across all pavement systems; however, the percentage of interstate pavements in good condition are comparable using either the PQI or the federal measure.

Table 6-4. 2016 Pavement Condition Measure Comparison

<table>
<thead>
<tr>
<th>Pavement Asset Category</th>
<th>Current Condition (PQI)</th>
<th>Current Condition (Federal measure)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Good</td>
<td>% Poor</td>
</tr>
<tr>
<td>Interstate</td>
<td>65</td>
<td>11</td>
</tr>
<tr>
<td>Non-Interstate NHS</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>Non-NHS Primary</td>
<td>20</td>
<td>61</td>
</tr>
<tr>
<td>Federal Aid Secondary</td>
<td>19</td>
<td>52</td>
</tr>
<tr>
<td>Non-Federal Aid Secondary</td>
<td>13</td>
<td>55</td>
</tr>
</tbody>
</table>

* Estimated

Based on a number of factors, including decades of historical pavement condition data, which includes patching and raveling, SCDOT staff believe presenting 10 year pavement condition targets using PQI as the performance measure rather than the federal metric is the prudent choice for the agency currently. Once SCDOT has collected multiple years of pavement condition data using the newly-promulgated federal standards, the agency will reevaluate its methodology.
6.5.2. Fiscally-Constrained Targets

These are targets 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. 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 6-5. Table 6-6 lists 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 6-5. National Bridge Inventory Measurement Rating Scale

<table>
<thead>
<tr>
<th>NBI Rating Scale (from 0 – 9)</th>
<th>9 8 7</th>
<th>4 3 2 1 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck</td>
<td>≥ 7</td>
<td>≤ 4</td>
</tr>
<tr>
<td>Superstructure</td>
<td>≥ 7</td>
<td>≤ 4</td>
</tr>
<tr>
<td>Substructure</td>
<td>≥ 7</td>
<td>≤ 4</td>
</tr>
<tr>
<td>Culvert</td>
<td>≥ 7</td>
<td>≤ 4</td>
</tr>
</tbody>
</table>

Table 6-6. SCDOT Pavement and Bridge System Fiscally-Constrained Targets*

<table>
<thead>
<tr>
<th>Pavements</th>
<th>2016 (Actual)</th>
<th>2016 (Actual)</th>
<th>Ten-year Target</th>
<th>Ten-year Target</th>
<th>Average 10-Year Allocation (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavements</td>
<td>% Good</td>
<td>% Poor</td>
<td>% Good</td>
<td>% Poor</td>
<td></td>
</tr>
<tr>
<td>Interstate¹</td>
<td>65</td>
<td>11</td>
<td>92</td>
<td>3</td>
<td>$135.0</td>
</tr>
<tr>
<td>Non-Interstate NHS</td>
<td>28</td>
<td>45</td>
<td>72</td>
<td>16</td>
<td>86.5</td>
</tr>
<tr>
<td>Non-NHS Primaries</td>
<td>20</td>
<td>61</td>
<td>48</td>
<td>37</td>
<td>186.0</td>
</tr>
<tr>
<td>Federal Aid Secondary</td>
<td>19</td>
<td>52</td>
<td>40</td>
<td>35</td>
<td>112.5</td>
</tr>
<tr>
<td>Non-Federal Aid Secondary²</td>
<td>15</td>
<td>55</td>
<td>25</td>
<td>45</td>
<td>121.0</td>
</tr>
<tr>
<td>Bridges (by count)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHS</td>
<td>48</td>
<td>6</td>
<td>66</td>
<td>0</td>
<td>114.5</td>
</tr>
<tr>
<td>FA</td>
<td>46</td>
<td>11</td>
<td>41</td>
<td>11</td>
<td>18.0</td>
</tr>
<tr>
<td>Off System</td>
<td>40</td>
<td>9</td>
<td>36</td>
<td>10</td>
<td>18.5</td>
</tr>
<tr>
<td>Bridges (by deck area)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHS</td>
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<td>4</td>
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<td>114.5</td>
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<tr>
<td>FA</td>
<td>50</td>
<td>10</td>
<td>41</td>
<td>15</td>
<td>18.0</td>
</tr>
<tr>
<td>Off System</td>
<td>51</td>
<td>7</td>
<td>44</td>
<td>10</td>
<td>18.5</td>
</tr>
</tbody>
</table>

* Pavement condition based on PQI scale. Bridge condition is based on the federal NBI scale.
1 Includes approximately $20 million added value from planned interstate widening projects over the next ten years.
2 Includes approximately $39 million projected added value from projects County Transportation Committees program on the State’s Non-Federal Aid Secondary system annually.
With the $602 million SCDOT is budgeting toward its pavement systems on average over the next 10 years, it is forecasting significant improvement in the percent good of its pavements. Investments in the NHS bridge system are projected to increase the percent good by 18 percentage points measured by both count and deck area. However, the projected percent good of the Federal Aid and Off System bridge networks, measured by both count and deck area, is projected to trend downward.

The 10-year fiscally constrained targets shown in Table 6-6 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 10-year 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 if analysis shows the gap cannot be closed, consider amending its 10-year 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 maintenance budget by increasing the mileage that needs ongoing preservation. While it is likely that added capacity during this TAMP’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 maintenance budget to properly maintain its interstate system. However, the need for an increased future maintenance budget does not affect the agency’s decision whether it will pursue added interstate capacity in the present, other factors such as mobility level of service and freight needs do.

**Two and Four-Year Targets**

Federal law requires states to set two- and four-year targets for their pavement assets on the interstate and non-interstate NHS and bridge assets on the NHS by May 2018 and every four years thereafter using the federal measures. SCDOT is in the process of developing the methodology to set its two- and four-year targets for assets at the publication date of this TAMP. Included in the agency’s process is collecting historical data, reviewing projects expected to be completed during the two- and four-year timeframe, and analyzing deterioration of the existing asset systems. Federal two- and four-year targets will be included in future updates to this TAMP.

**Safety Targets**

As noted, the agency is also prioritizing improving safety in its investment strategies. Table 6-7 highlights SCDOT’s 10-year safety targets compared with baseline data from 2016 based on its ten-year investment strategies. These targets are developed from FHWA’s safety performance measures. SCDOT is forecasting a 23 percent decrease in fatality rate and a 38 percent 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.

### Table 6-7. SCDOT’s 10-year Safety Performance Targets

<table>
<thead>
<tr>
<th>Safety</th>
<th>2016 Baseline Condition</th>
<th>Ten-year Target</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatalities (Number)</td>
<td>890</td>
<td>886</td>
<td>(0.5)</td>
</tr>
<tr>
<td>Fatalities (Rate)</td>
<td>1.75</td>
<td>1.34</td>
<td>(23.4)</td>
</tr>
<tr>
<td>Serious Injuries (Number)</td>
<td>3,194</td>
<td>2,573</td>
<td>(19.4)</td>
</tr>
<tr>
<td>Serious Injuries (Rate)</td>
<td>6.30</td>
<td>3.89</td>
<td>(38.3)</td>
</tr>
<tr>
<td>Non-Motorized Fatalities and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious Injuries (Number)</td>
<td>376</td>
<td>368</td>
<td>(2.1)</td>
</tr>
</tbody>
</table>

* Based on a five year rolling average.

### 6.5.3. 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 in mobility on the State’s freight network, bridges, mobility projects on the NHS in partnership with metropolitan planning organizations and councils of governments, and safety-related routine maintenance. These investment strategies align with SCDOT’s 2018-2020 Strategic Plan and the agency intends to use asset management and whole life management principles to select projects if the additional funding were to become available.
6.5.4. State of Good Repair

With the passage of Act 40 in May of 2017, SCDOT projects it will receive an additional $600 million in state revenue when it is fully phased in, a near doubling of its state resources, which will also outpace the federal funds coming to the State by 2:1. This additional revenue will enable SCDOT to greatly improve the condition of its assets by 2027. 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 during the TAMP’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 TAMP, SCDOT defines its assets in a state of good repair when it can fully apply preservation and rehabilitation treatments based on asset management principles without the need to divert significant funding to reconstruct pavement and bridge assets in poor condition.
7. THE FUTURE OF TRANSPORTATION ASSET MANAGEMENT AT SCDOT

7.1. 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 7-1 shows the agency’s action plan matrix to 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 7-1. Opportunities for Improvements Action Plan Matrix

<table>
<thead>
<tr>
<th>Strategic Area</th>
<th>Strategic Direction</th>
<th>Timeframe</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture</td>
<td>Identify communication strategies to disseminate transportation asset management information to key stakeholders.</td>
<td>2-4 years</td>
<td>Secretary of Transportation and Deputy Secretaries for Intermodal Planning, Engineering, and Finance and Administration</td>
</tr>
<tr>
<td></td>
<td>Increase the use of Whole Life Management principles in the pavement, bridge, and maintenance management processes.</td>
<td>2-4 years</td>
<td>Secretary of Transportation and Deputy Secretaries for Intermodal Planning and Engineering</td>
</tr>
<tr>
<td></td>
<td>Conduct a risk assessment of key assets.</td>
<td>1-2 years</td>
<td>Secretary of Transportation and Deputy Secretaries for Intermodal Planning, Engineering, and Finance and Administration</td>
</tr>
<tr>
<td>Data</td>
<td>Create a comprehensive inventory of transportation infrastructure assets.</td>
<td>5-10 years</td>
<td>Directors of Planning and Asset Management, Maintenance, and Information Technology</td>
</tr>
<tr>
<td></td>
<td>Develop a data governance plan for assets.</td>
<td>5-10 years</td>
<td>Directors of Planning and Asset Management and Information Technology</td>
</tr>
<tr>
<td>Tools</td>
<td>Evaluate securing analytical tradeoff decision support tools to support transportation asset management decision making.</td>
<td>5-10 years</td>
<td>Directors of Planning and Asset Management and Maintenance</td>
</tr>
</tbody>
</table>
7.2. **ACTION ITEMS**

The focus of the action items is on improving 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 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:*

- Schedule a workshop to develop a risk profile related to the SCDOT’s assets including key stakeholders from different divisions within the agency.
- Formulate a risk mitigation plan to lessen the impact or likelihood of serious risks.
- 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 TAMP, 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.
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

Recommended by: Kenneth B. Eargle, Interim
Chief Engineer for Operations

Approved: Christy A. Hall
Deputy Secretary for Engineering

Lead: Director of Construction

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
Figure 1 – Flowchart of Pavement Type Selection Process

Does the project have significant existing pavement, and, if so, is this pavement significant?

Yes

Does the State Pavement Design Engineer recommend consideration of an alternative?

Yes

Select preferred method.

No

Is the required SN > 4.0?

Yes

State Pavement Design Engineer makes

No

Is the required SN > 5.0?

Yes

Convene Pavement Advisory Committee to make final

Final recommendations forwarded to Directors of Construction and

No

Does the life-cycle cost or any other factor favor a higher initial cost?

Yes

State Pavement Design Engineer makes

No

Select low initial

No
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, and Design

Submitted by: __________________________ J. C. Watson

Chief Engineer for Operations

Approved: __________________________ Tony L. Chapman

Deputy Secretary for Engineering

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-62
Effective: January 13, 2017

Subject: Non-Interstate NHS 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-interstate NHS pavement improvement needs using objective and quantifiable criteria. 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 9,197 lane miles of non-interstate NHS routes. Available funding will be used for pavement improvement and preservation. The portion of funding used for preservation is determined by the percentage of pavements on the primary system in good condition. Funding for pavement preservation will be distributed to each county based on the county’s percentage of primary lane miles in good condition compared to the statewide total of primary lane miles in good condition. Non-interstate NHS routes will be ranked on a statewide priority basis for pavement improvement.

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). Based on the result of this ranking score, non-interstate NHS routes will be prioritized on a statewide basis with the highest score receiving the highest priority.

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 non-interstate NHS routes will be presented to the SCDOT Commission for approval by county.

All raw data used by the Director of Maintenance to determine the prioritization of candidates for inclusion in the non-interstate NHS statewide program will be kept on file as required by Departmental Directive 51 and SCDOT's record retention schedules.

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 January 13, 2017

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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-NHS 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 14,834 lane miles of non-NHS primary routes. Available funding will be used for pavement improvement and preservation. The portion of funding used for preservation is determined by the percentage of pavements on the primary system in good condition. Funding for pavement improvement will be distributed to each county based on the county’s percentage of primary lane miles in fair and poor condition, compared to the statewide total of primary lane miles in fair and poor condition.

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). Non-NHS 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 non-NHS primary routes will be presented to the SCDOT Commission for approval by county.

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: 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 January 13, 2017
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. The portion of funding used for preservation is determined by the percentage of pavements on the FA secondary system in good condition. Funding for pavement improvement will be distributed to each county based on the county’s percentage of FA secondary lane miles in fair and poor condition, compared to the statewide total of FA secondary lane miles in fair and poor condition.

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 will be presented to the SCDOT Commission for approval by county.

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: **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 January 13, 2017
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. The portion of funding used for preservation is determined by the percentage of pavements on the NFA secondary system in good condition. Funding for pavement improvement will be distributed to each county based on the county’s percentage of NFA secondary lane miles in fair and poor condition, compared to the statewide total of NFA secondary lane miles in fair and poor condition.

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 will be presented to the SCDOT Commission for approval by county.

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:       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 January 13, 2017
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 schedules.
South Carolina Department of Transportation

Engineering Directive

Directive Number: ED-69 Effective: March 10, 2017

Subject: Non-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 non-NHS bridge replacement needs using objective and quantifiable criteria.

SCDOT has approximately 3,880 bridges on the non-NHS system. Only bridges that are structurally deficient will be considered for replacement. Non-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 schedules.

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
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.

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 schedules.

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