

Submitted to:



South Carolina Department of Transportation

Bridge Maintenance Best Practices Study

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Submitted by:

The Kercher Group, Inc.



supported by
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TABLE OF CONTENTS

- GLOSSARY..... 4**
- EXECUTIVE SUMMARY..... 6**
 - CONCLUSIONS..... 6
 - STUDY HIGHLIGHTS..... 6
 - ADDITIONAL COMMENTS 12
- BRIDGE MAINTENANCE BEST PRACTICE REPORT13**
 - PROJECT DESCRIPTION..... 13
 - APPROACH 14
 - Initiate Project..... 14
 - Review Available Documents 14
 - Develop Interview Questionnaire 14
 - Baseline SCDOT Practices..... 14
 - Select Peer States for Review..... 15
 - Interview Peer States 16
 - Identify Best Practices in all Review Areas..... 16
 - Enhancement Items for SCDOT to Consider..... 16
 - CONCLUSIONS..... 16
 - BRIDGE INSPECTION PROGRAM 17
 - Topic Introduction..... 17
 - Organization 18
 - Manuals and Guidance..... 22
 - Quality Control / Quality Assurance..... 23
 - Data Collection Methodology 23
 - BRIDGE LOAD RATING PROGRAM 25
 - Topic Introduction..... 25
 - Organization 26
 - Manuals and Guidance..... 27
 - Quality Control/Quality Assurance..... 27
 - Software 28
 - BRIDGE MANAGEMENT (PRESERVATION / REHABILITATION / REPLACEMENT)..... 29
 - Topic Introduction..... 29

Organization	31
Bridge Management Process & Procedures for Preservation/Rehabilitation/Replacement.....	32
Use of Bridge Management Systems	39
BRIDGE MAINTENANCE AND PRIORITY REPAIR PROCEDURES	41
Topic Introduction	41
Organization	42
Bridge Critical Findings and Priority Repairs	46
SCOUR ASSESSMENT & EMERGENCY RESPONSE.....	48
Topic Introduction	48
Organization	48
Process for Addressing Bridge Emergencies	50
Cost-Effective Methods for Scour Prevention.....	51
OVERSIZE AND OVERWEIGHT PERMITTING PROGRAM	53
Topic Introduction	53
Organization	54
Manuals and Guidance.....	55
Automation	56
Fee Schedule	57
COORDINATION ON LOCALLY OWNED BRIDGES.....	59
Topic Introduction	59
Organization	59
APPENDIXES	62
Appendix A: Summary of Commendable Practices and Enhancements	62
Appendix B: Interview Guide	68
Appendix C: Peer State Answers to Interview Guide.....	69
Appendix D: Peer State Comparative Statistics	70
Appendix E: Sample Local Road Authority Statutes	71

GLOSSARY

Name / Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials. See https://www.transportation.org/home/organization/
AASHTOWare	Software development unit of AASHTO. See https://www.aashtoware.org/about/organization/
BIGD	Bridge Inspection Guidance Document
BIRM	Bridge Inspection Reference Manual (BIRM). See https://www.fhwa.dot.gov/bridge/nbis/pubs/nhi12049.pdf
BMO	Bridge Maintenance Office
BMS	Bridge Management System
<i>Bridgewatch</i>	A commercial, Internet-based application for monitoring environmental events. See https://www.usengineeringsolutions.com/bridge-watch/
<i>BrM</i>	AASHTOWare <i>Bridge Management (BrM)</i> software. See http://aashtowarebridge.com/
<i>BrR</i>	AASHTOWare <i>Bridge Design and Rating (BrR)</i> software. See http://aashtowarebridge.com/
DeIDOT	Delaware Department of Transportation
DOT	Department of Transportation
FHWA	Federal Highway Administration. See https://www.fhwa.dot.gov/about/
GCR	General Condition Ratings
HMMS	Highway Maintenance Management System
KYTC	Kentucky Transportation Cabinet
LRGD	Load Rating Guidance Document
MDOT	Michigan Department of Transportation
<i>MiBridge</i>	Bridge software application developed by the Michigan DOT
MnDOT	Minnesota Department of Transportation
MR&R	Maintenance, repair and rehabilitation
NBI	National Bridge Inventory, a bridge database maintained by the FHWA. See https://www.fhwa.dot.gov/bridge/nbi.cfm
NBIS	National Bridge Inspection Standards. See https://www.fhwa.dot.gov/bridge/nbis.cfm
NCDOT	North Carolina Department of Transportation
NDE	Non-Destructive Evaluation

Name / Abbreviation	Description
OSOW	Oversize and Overweight
PAR	Prompt Action Request
POA	Plan of Action
PRI	Priority Replacement Index
QA	Quality Assurance
QC	Quality Control
RFA	Request for Action
SCDOT	South Carolina Department of Transportation
USGS	U.S. Geological Survey. See https://www.usgs.gov/
WIGINS	North Carolina DOT Bridge Inspection software

EXECUTIVE SUMMARY

At the request of the Governor of South Carolina, the Honorable Henry McMaster, South Carolina Department of Transportation (SCDOT) Secretary Christy A. Hall initiated an independent review of SCDOT's protocol and procedures for inspecting and maintaining its 8,431 state-owned bridges with the overarching goal of assuring the public that all South Carolina bridges are safe and properly maintained. To ensure an objective evaluation, Secretary Hall obtained the assistance of the State Inspector General, Mr. Brian Lamkin, to conduct this evaluation in full partnership with SCDOT.

SCDOT has engaged the services of The Kercher Group, Inc. (Kercher) supported by Greenman Pedersen, Inc. (GPI) because of their considerable nationwide bridge subject matter expertise to conduct an independent evaluation. This evaluation, Bridge Maintenance Best Practices Study for the South Carolina Department of Transportation, focuses on seven (7) areas critical to ensuring bridge safety as follows:

1. Bridge Inspection Program
2. Bridge Load Rating Program
3. Bridge Management (Preservation/Rehabilitation/Replacement)
4. Bridge Maintenance and Priority Procedures
5. Scour Critical Bridge Management & Emergency Response
6. Oversize/Overweight Permitting Program
7. Coordination on Locally Owned Bridges

The Kercher/GPI team benchmarked SCDOT's current practices in each of the above areas against eight (8) peer states and nationally identified best practices to determine areas for improvement in SCDOT's programs. This evaluation summarizes SCDOT's current practices, documents commendable or leading practices in SCDOT's current programs, and identifies bridge maintenance related process improvements and initiatives currently under way. In view of Secretary Hall's drive for continuous improvement, potential enhancements initiated in other states are also provided for SCDOT consideration. These commendable or leading practices along with potential enhancements are provided below.

Conclusions

All state and locally owned public bridges within South Carolina have been inspected within the past two years in accordance with the National Bridge Inspection Standards (NBIS) to ensure the safety of the motoring public. **As detailed in this document, the consulting team found that SCDOT has appropriate business processes, practices, guidance materials and management tools in place to ensure that public bridges located within the state of South Carolina are routinely inspected, maintained and safe for the motoring public.**

Study Highlights

Commendable/leading SCDOT practices and potential enhancement items for SCDOT to consider in each of the project review areas are summarized below:

BRIDGE INSPECTION PROGRAM

Organization

Commendable/leading SCDOT Practices include:

- Supplementing in-house bridge inspection teams with consultant bridge inspection teams to ensure inspection timeliness, while retaining in-house experience and capabilities to optimize program cost

- Revising Human Resource classifications to address retention and better define the roles and responsibilities of team leaders and inspectors
- Using mobile technology for bridge inspection to improve data quality and accuracy
- Improving equipment accessibility by establishing and utilizing rental contracts

Enhancement Items for SCDOT to Consider:

- No singular “best” practice exists for organization placement and structure of the NBIS bridge inspection function
- Each state DOT must decide on the organization location and reporting structure that best meets its needs

Manuals and Guidance

Commendable/leading SCDOT Practices include:

- Developing a comprehensive, industry-leading practice bridge inspection guidance document to promote high quality and more consistent inspections
- Training bridge inspection staff in the use of the draft BIGD

Enhancement Items for SCDOT to Consider:

- Continue efforts to finalize and adopt the draft BIGD
- Consider identifying and requiring a certification or exam program for bridge inspectors, similar to those used by some peer states

Quality Control / Quality Assurance

Commendable/leading SCDOT Practices include:

- Including a comprehensive QC/QA section in the draft BIGD to enhance inspection information quality and consistency
- Requiring bridge inspection consultants to have an approved QC/QA plan prior to contracting is a leading practice

Enhancement Items for SCDOT to Consider:

- Leave the QC aspects of bridge inspection reports at the bridge inspection team level but shift to a process of using district-based peer reviews
 - For example, District 1 performs QC on District 2’s bridge inspection reports and District 2 performs QC on District 3’s bridge inspection reports, etc.
- Retain QA responsibility at the BMO for bridge inspection reporting but consider adding a BMO-based QA team to assist district bridge inspection teams in reviewing a sample of consultant-performed inspections

Data Collection Methodology

Commendable/leading SCDOT Practices include:

- Providing bridge inspectors technology that allows first person, real-time data entry is broadly considered as a data entry best practice

- Supplying standard forms for collecting a variety of inspection and inspection-related QC/QA information in the draft BIGD
- Providing standard forms in the BIGD for reporting critical deficiencies that use consistent terminology with the SCDOT Highway Maintenance Management System (HMMS) improves tracking and reporting efficiency

Enhancement Items for SCDOT to Consider:

- Continue efforts to deploy enhanced technologies for easier and more reliable first person, real-time data entry and information collection

BRIDGE LOAD RATING PROGRAM

Organization

Commendable/leading SCDOT Practices include:

- Supplementing in-house staff through contracts with qualified engineering consultants
- Including load rating task as part of bridge inspection consultant contracts

Enhancement Items for SCDOT to Consider:

- Strengthen resources to increase load rating capability and retain expertise to meet future needs, thereby, reducing costs and increasing efficiency

Manuals and Guidance

Commendable/leading SCDOT Practices include:

- Developing and implementing a comprehensive LRGD

Enhancement Items for SCDOT to Consider:

- Establish a minimum schedule to update the LRGD to ensure the document maintains its accuracy and relevance over time

Quality Control / Quality Assurance

Commendable/leading SCDOT Practices include:

- Developing a comprehensive QC/QA section in the LRGD
- Requiring consultants that perform load ratings to have an approved QC/QA plan in their scope of work
- Providing QC/QA review checklists and tracking documents in the LRGD

Enhancement Items for SCDOT to Consider:

- Strengthen expertise in performing load ratings through NHI training and on the job training

Software

Commendable/leading SCDOT Practices include:

- Adopting nationally accepted load rating software available through AASHTO
- Providing a listing of preferred load rating software products along with standard approval forms in the Load Rating Guidance Document

Enhancement Items for SCDOT to Consider:

- Ensure the most current *AASHTOWare BrR* software available is being used to increase the number of bridge types the software can load rate, which will increase the efficiency and effectiveness of the Hexagon OSOW software

BRIDGE MANAGEMENT (PRESERVATION/REHABILITATION/REPLACEMENT)

Organization

Commendable/leading SCDOT Practices include:

- Optimizing internal resources with consultant expertise for BMS development and implementation

Enhancement Items for SCDOT to Consider:

- Develop policies and procedures for a bridge program that is based on using a balanced approach of preservation, rehabilitation, and replacement projects
- Provide sufficient expert technical resources to fully leverage SCDOT's investment in a BMS

Bridge Management Process & Procedures for Preservation/Rehabilitation/Replacement Bridge Projects

Commendable/leading SCDOT Practices include:

- Implementing a 10-year plan for replacing 465 restricted and deficient bridges

Enhancement Items for SCDOT to Consider:

- Modify the existing capital and maintenance bridge programs to include an appropriate mix of preservation, rehabilitation, and replacement strategies that keep good and fair bridges in their condition state while prioritizing replacement of bridges in poor condition

Use of Bridge Management System

Commendable/leading SCDOT Practices include:

- Developing an advanced BMS

Enhancement Items for SCDOT to Consider:

- Continue to advance the development and implementation of BMS software and consider adopting the identified BMS best practices

BRIDGE MAINTENANCE AND PRIORITY REPAIR PROCEDURES

Organization

Commendable/leading SCDOT Practices include:

- Providing a proven ability to handle emergencies such as extreme storm events, flooding, and vehicle or vessel collisions
- Having some district maintenance crews capable of performing major repairs and replacing small bridges and culverts on secondary routes using standard plans
- Outsourcing the maintenance and management of specialty bridges

Enhancement Items for SCDOT to Consider:

- Create a manual for identifying standard bridge maintenance actions statewide

- Provide the National Highway Institute's (NHI) two-week Bridge Maintenance course
- Expand asset maintenance contracting to include additional complex bridge structures that have specialized maintenance needs

Priority Repairs

Commendable/leading SCDOT Practices include:

- Currently implementing the enhanced critical deficiencies prioritization process as described in the draft BIGD
- Supplying detailed policies and processes in the Agency's BIGD document to address critical deficiency prioritization, response, and tracking
- Providing excellent agency coordination and response to emergency situations such as hurricanes, natural disasters, vehicle or vessel impact damage, and discovery of advanced deterioration

Enhancement Items for SCDOT to Consider:

- Complete implementation of the critical deficiencies prioritization process described in the draft BIGD

SCOUR CRITICAL BRIDGE MANAGEMENT & EMERGENCY RESPONSE

Organization

Commendable/leading SCDOT Practices include:

- Incorporating full scour inspection guidance into the draft BIGD
- Utilizing and coordinate with an in-house Hydraulic Design Support team to perform hydraulic analysis
- Augmenting in-house staff with scour specific consultant inspection contracts for use statewide
- Identifying triggering events for scour re-evaluation and inclusion of these events in the draft BIGD

Enhancement Items for SCDOT to Consider:

- Schedule the underwater scour critical bridge inspections on a 48-month basis to coincide with a routine biennial NBIS bridge inspections
- Review each bridge-specific POA as part of the scope of work assigned to the underwater inspection consultant team

Process for Addressing Bridge Emergencies

Commendable/leading SCDOT Practices include:

- Incorporating full damage inspection guidance into the draft BIGD
- Incorporating full hurricane and storm inspection guidance into the draft BIGD
- Developing rapid deployment process for placing USGS stream flow gauges on several streams in advance of a hurricane or extreme rainfall event, where USGS does not have a permanent stream flow gauge installation
- Piloting the use of *BridgeWatch*, a commercially available, web-based, real-time, monitoring software solution, on 1600 bridges
- Developing a process for bridge closings in the draft BIGD that includes communication procedures and flowcharts

Enhancement Items for SCDOT to Consider:

- Include an emergency on-call/response section in the consultant bridge inspection contracts issued by the BMO
- Expand the use of USGS Water Alert service and *BridgeWatch*
- Include a pre-event assessment of the waterway for debris at the bridge piers or abutments, to be removed by district maintenance crews in advance of the storm
- Formalize policies and procedures for performing post-event evaluations to identify opportunities to improve responsiveness and effectiveness

Cost-Effective Methods for Scour Prevention

Commendable/leading SCDOT Practices include:

- Developing South Carolina bridge scour envelope curves in conjunction with the USGS

Enhancement Items for SCDOT to Consider:

- Develop a program for designing/developing scour countermeasures, including stream armoring and channel protection, for scour critical bridges that are not currently scheduled for bridge replacement and likely, will not be for the foreseeable future

Oversize and Overweight Permitting Program

Organization

Commendable/leading SCDOT Practices include:

- Issuing permits the same day as requested, which is industry best practice

Enhancement Items for SCDOT to Consider:

- Develop a succession plan to address long-term OSOW staffing needs

Manual & Guidance

Commendable/leading SCDOT Practices include:

- Providing an easily understood and navigated OSOW website

Enhancement Items for SCDOT to Consider:

- Develop permit application forms that can be completed electronically (e.g., in a writable “.pdf” format) to support direct submission to the SCDOT permit office

Automation

Commendable/leading SCDOT Practices include:

- Configuring the *Hexagon* commercial off-the-shelf permitting system to provide increased efficiencies and allow for easier updates across one software platform

Enhancement Items for SCDOT to Consider:

- Reach out to the states identified as *Hexagon* users (Louisiana, Oklahoma and Tennessee) for lessons learned on implementing and using this system
- Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to develop updated truck route maps

Fee Structure

Commendable/leading SCDOT Practices include:

- Returning permit fees to SCDOT to support the state funded bridge program

Enhancement Items for SCDOT to Consider:

- Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to identify opportunities to consolidate/simplify permit categories and to determine the fairness and equity of the fee structure

Coordination on Locally Owned Bridges

Organization

Commendable/leading SCDOT Practices include:

- Performing all bridge inspections and load ratings for all locally owned bridges consistent with those on the state network
- Supplementing in-house bridge inspection teams and load rating capabilities with use of consultants to ensure safety of locally owned bridges
- Performing all above services at no cost to the local agencies

Enhancement Items for SCDOT to Consider:

- Draft legislation, if appropriate, that clarifies and supports SCDOT's responsibility and authority for inspection, load rating, posting restrictions or closing locally owned bridges

Additional Comments

Unless otherwise noted, all photographs included herein were provided courtesy of SCDOT.

The consulting team thanks all SCDOT, Federal Highway Administration (FHWA) and other state DOT personnel that participated in this project. SCDOT leadership and staff were extremely cooperative and responsive to all requests for information and documents. The consultants appreciate this opportunity to serve the SCDOT and the State of South Carolina.

BRIDGE MAINTENANCE BEST PRACTICE REPORT

Project Description

This is the project report of the Bridge Maintenance Best Practices Study for the SCDOT. This is an SCDOT-sponsored project, performed at the request of Governor Henry McMaster, and in cooperation with the South Carolina Office of Inspector General.

This report is the primary project deliverable and contains the results of a consultant-performed, independent review and analysis of SCDOT's bridge inspection, maintenance and replacement programs. The intent of this report is to provide recommendations for improving or enhancing the existing programs based upon generally accepted industry best practice and to provide the proper assurances to the public regarding the integrity, structure and operation of the overall bridge program. SCDOT's compliance with the federal NBIS ensures that public bridges located within the state of South Carolina are routinely inspected and safe.

The scope of work for this project identified the following five (5) primary tasks, each of which has several focus areas:

1. Establish a baseline of the current practices of SCDOT's bridge inspection, maintenance and replacement programs.
2. Identify best-practices in bridge inspection, maintenance and replacement programs of other states with similar bridge inventories, in addition to best practices identified by the Federal Highway Administration (FHWA) that may improve the efficiency and effectiveness of the SCDOT programs. Specifically, the consultant team considered the following items:
 - Inspection Procedures
 - Load Rating Procedures
 - Oversize and Overweight Permitting
 - Maintenance (Clearing Flags & Load Posting)
 - Preservation
 - Rehabilitation
 - Replacement
 - Coordination on Locally Owned Bridges
3. Identify comparative statistics of SCDOT's bridge inventory to national and regional data.
4. Recommend opportunities for improvements within the SCDOT Bridge Management and Replacement Program with regard to the roles, responsibilities and synchronization of efforts relating to bridge inspection, load rating and issuing of Oversize and Overweight permits including those designated as super-loads.
5. Identify the best practices and effective tools utilized by other state departments of transportation in support of bridge asset management. Specifically, management dashboards, quality control of data within the inventory, techniques for forecasting bridge investment needs, condition trend lines and conducting risk analysis.

Approach

Initiate Project

The consulting team initiated this project with an onsite meeting of the SCDOT Director of Maintenance and the SCDOT BMO team.

Review Available Documents

SCDOT promptly provided the consulting team with requested, relevant SCDOT materials. The consulting team reviewed this material, which helped inform the interview questionnaire, the selection of peer states and the other best practice research efforts.

Develop Interview Questionnaire

The consulting team developed a questionnaire for use in interviewing both SCDOT personnel and peer states. This document underwent multiple revisions, attempting to balance the desire for greater detail against a desire to encourage more peer state participation by minimizing their time commitment. These drafts were reviewed with the SCDOT project manager and the SCDOT project team for feedback and suggestions. A copy of the final version of this interview guide is found in [Appendix B](#).

In most cases, interviews took between 1-2 hours. Most SCDOT interviews were conducted in-person while peer state interviews were conducted through a variety of approaches (in-person, telephone, *Skype*, etc.).

Because of the range of areas covered by the questionnaire, many of the people interviewed did not answer all questions and, in some cases, forwarded the interview guide to additional people within their respective agencies to provide specific details/information. In many cases, interviewees also supplemented their oral responses provided with supplemental material forwarded by email (or otherwise).

Baseline SCDOT Practices

Effectively, this entire project is organized around a benchmarking project effort, aimed at identifying where SCDOT could adopt practical enhancements to improve the efficiency or effectiveness of its bridge program. Accordingly, the first step in this project was to gain a full understanding of SCDOT current practices in each of the areas reviewed.

Gather information

The information gathering stage of the SCDOT baseline effort involved requesting and receiving the materials previously identified. Supplementing these initial requests were materials identified and provided by SCDOT personnel through the course of the interviews and other communications.

The consulting team reviewed the materials provided. Along with the interview information gathered, this information provided the basis of much of the analysis described in this report.

Interview SCDOT Personnel

As indicated, a significant number of SCDOT personnel were interviewed in support of this project. These included central office and district-based SCDOT personnel involved in bridge inspections and maintenance. Several field locations were visited as part of this project to help the consulting team understand the operating environment variables and challenges facing SCDOT personnel involved in performing their work. In all cases, SCDOT personnel were knowledgeable, cooperative and forthcoming with their responses, providing significant detail on the business processes and technologies used as well as the challenges faced in performing their duties.

Select Peer States for Review

The second step in a benchmarking effort is to determine the standards to be used for comparison. In this case, other state DOTs represent the obvious pool from which to draw. However, it is important to note that the consulting team’s benchmarking efforts were not limited to just state DOTs that were part of the peer state review effort. The consulting team also reached out to other state DOT contacts and reviewed relevant resource materials including a significant volume of state DOT bridge program information gathered by FHWA in support of various conference events and other initiatives.

Target DOTs for this benchmarking effort ideally would share as many similarities with SCDOT as possible yet ideally, also would be able to demonstrate “best” or “leading” practices in many of the areas covered by this project. As in any benchmarking effort that requires a significant effort to participate, the ability to secure subject cooperation tends to be a significant consideration.

Finalize Peer State List

Appendix C contains the results of this analysis for all 50 U.S. states, the District of Columbia and Puerto Rico. The consulting team suggested and SCDOT approved approaching eight (8) states to participate in the benchmarking effort, all of which agreed. These states and the major reasons for selection are described [Table 1](#) below:

Table 1: Benchmarking Peer States

State	Reason Included
Delaware	<ul style="list-style-type: none"> • High percentage of DOT owned bridges • Coastal state • Relatively mild climate
Florida	<ul style="list-style-type: none"> • Southern state • Similar climate and large coastline • Extensive experience with outsourcing inspection and maintenance to consultants
Georgia	<ul style="list-style-type: none"> • Direct neighbor • Southern state • Similar climate • Comparable fuel tax rates
Michigan	<ul style="list-style-type: none"> • Record of success in improving bridge conditions over time • Known for successful local agency coordination practices • Considered by peers to be a bridge management system best practice state
New Jersey	<ul style="list-style-type: none"> • Large bridge program • Coastal state • Considered by peers as a bridge management system best practice state
North Carolina	<ul style="list-style-type: none"> • Direct neighbor • Large program • Large state-owned network • Southern state • Similar climate • Considered by peers as a bridge management system best practice state

State	Reason Included
Virginia	<ul style="list-style-type: none"> • Coastal state • Southern State • Similar climate • Large bridge program • Large state-owned network • Considered by peers as a bridge management system best practice state
West Virginia	<ul style="list-style-type: none"> • Large state-owned network • High percentage of DOT-owned bridges • Good reputation for bridge inspection program

Interview Peer States

The interview guide was emailed to each participating DOT in advance to assist in identifying and gathering the information being sought. Most interviews took 1-2 hours and were conducted through a variety of approaches.

Gather Information

Most DOTs interviewed provided some amount of support material to supplement the information provided during the interviews. The consultants collected this information and shared it among the team using a project file-sharing site. This material was used to support project best practice benchmarking efforts, supplementing information gathered by the team from other resources.

Perform Interviews

As previously described, peer state interviews typically were not limited to a single conversation. As a result, compiling the information from the peer state outreach required aggregating multiple sources into the respective state DOT interview response form. In turn, these responses were compiled into tables that are organized by report review area, interview question and the responses by state. [Appendix D](#) contains this information.

Identify Best Practices in all Review Areas

The consulting team used the information gathered through the steps described above for the purpose of identifying practices for possible SCDOT adoption. This involved evaluating the efficiency and effectiveness of the current SCDOT approach to the alternative approaches identified through research and outreach.

Enhancement Items for SCDOT to Consider

The Enhancements provided in this document are intended to be viewed as options and alternatives for SCDOT to consider.

Conclusions

All state and locally owned public bridges within South Carolina have been inspected within the past two years in accordance with the National Bridge Inspection Standards (NBIS) to ensure the safety of the motoring public. **As detailed in this document, the consulting team found that SCDOT has appropriate business processes, practices, guidance materials and management tools in place to ensure that public bridges located within the state of South Carolina are routinely inspected, maintained and safe for the motoring public.**

Bridge Inspection Program

Topic Introduction

The NBIS are federal regulations that establish requirements for bridge inspection procedures, frequency of inspections, qualifications of personnel, reporting, and maintenance of the publicly owned bridge inventory. NBIS regulations apply to bridges or culverts that carry vehicular traffic and have an opening longer than 20 feet measured along the center of the roadway. The NBIS provides “minimum” standards for bridge inspection but most state DOTs provide additional or more detailed instruction in manuals, guidance documents and procedures, informational memorandums and periodic training.

A bridge inspection is an accurate and thorough assessment of each bridge’s condition to assure the structure remains safe, functional, and reliable. There are seven (7) basic types of bridge inspections:

1. Initial (inventory)
2. Routine (periodic)
3. In-depth
4. Damage
5. Fracture critical
6. Underwater
7. Special (interim)

These inspections are described in the American Association of Transportation Officials (AASHTO) Manual for Bridge Evaluation¹ and the Federal Highway Administration’s (FHWA) Bridge Inspection Reference Manual² (BIRM).

The NBIS requires that each state DOT have a bridge Inspection “Program Manager”, who is responsible for the NBIS bridge inspection program. The person must be a registered Professional Engineer or have at least ten (10) years of bridge inspection experience and have successfully completed an FHWA approved comprehensive bridge inspection training course. The bridge inspection program manager must have adequate authority over the NBIS program to successfully carry out his or her responsibilities.

Bridge inspections are led by a team leader, who is responsible for planning, preparing and performing the inspections of individual bridges as well as the day-to-day aspects of the inspection. The NBIS requires a team leader to be present during each initial, routine, in-depth, fracture critical and underwater inspection.

The team leader can be an engineer or non-engineer that meets the qualification requirements provided by the NBIS. These qualifications include education, professional registration or certification, experience and training.

Training to be a bridge inspector starts with the NHI’s *Safety Inspection of In-Service Bridges* or equivalent FHWA approved bridge inspection training course, and includes on-the-job training led by the team leader. Refresher training is required at intervals set by the DOT. The bridge inspection program manager is responsible for setting policies and procedures including scheduling and tracking the required training for the bridge inspection staff.

Bridge inspection team members are responsible for assisting the team leader in day-to-day aspects of the inspection. While there are no specific federal training guidelines for members of the inspection team, these

¹ <https://store.transportation.org/Item/CollectionDetail?ID=179>

² <https://www.fhwa.dot.gov/bridge/nbis/pubs/nhi12049.pdf>

personnel should have sufficient technical expertise (obtained through education and/or hands-on experience) to support the inspector in successfully completing the tasks at hand. The goal is for the team member to learn the correct inspection methods and to evaluate bridge components and elements consistently.

Bridge inspectors record findings of the inspection in a bridge inspection report, which should meet the following requirements:

- Be in a standard format
- Use nationally accepted condition ratings such as the NBI General Condition Ratings (GCR) or AASHTO Element Condition States
- Include photographs and descriptions of specific defects that are detailed, quantitative (where possible) and complete

A bridge inspection may take several hours to complete for a small bridge or culvert, or it may take several days (or weeks) for a large complex bridge. Equipment needed for bridge inspections may include ladders, boats, and access vehicles such as aerial lift “bucket” trucks, “platform” trucks, and under-bridge inspection “snooper” vehicles.

Bridge inspectors use a combination of simple and complex tools to support inspection analysis. Simple, Non-Destructive Evaluation (NDE) tools include the use of hammers or steel chain to “sound” for delamination in the concrete, evaluate certain materials, check structural details, and identify defects. Complex tools may be used as needed, and include ultrasonic testing equipment, which is used to find cracks in steel, or ground penetrating radar, that can evaluate the condition of bridge decks. NDE tools can help bridge inspectors find hidden defects that cannot be observed by visual inspection alone. NDE tools also can be used to identify material conditions that could lead to future defects and the need for expensive repairs.

The NBIS requires QC/QA procedures to maintain a high degree of accuracy and consistency in the highway bridge inspection program. Accuracy and consistency are important because the bridge inspection data is reported to FHWA and is the foundation for funding decisions and other infrastructure legislation at the national level.

QC is the establishment and enforcement of procedures that are intended to maintain the quality of the inspection at or above a specific level. QA involves the use of sampling and other measures to assure the adequacy of quality control procedures. This information is used to verify or measure the quality level of the entire bridge inspection program. QA is a standardized process that is a check and verification of the QC process. An additional way QA can be accomplished is by the re-inspection of a sample bridges by an independent inspection team.

For example, in agencies where bridge inspections are performed by district or region-based bridge inspection teams, the QA program typically is performed by the central staff or its consultants. If the inspections are centralized at the headquarters level within the state, a consultant or a separate state bridge inspection team typically performs the QA program separately and independently from the unit performing the original inspection.

Organization

Identify National and Peer Practices

Organizational theory suggests that organizations centralize for efficiency and control and decentralize for flexibility and responsiveness. The tradeoffs between these approaches must consider the extent to which the functions in question are highly specialized in nature and need some degree of pooling of resources to avoid creating hard-to-maintain islands of expertise within an organization.

Nationally, most States use either centralized or decentralized organizational structures for NBIS bridge inspections based on what works best in each state. Several states use a hybrid organization by having one or more NBIS teams report directly to the central office in an otherwise, decentralized organization. State

organizational decisions are often based on geographic size of each state, number of bridges state and locally owned, delegation of authority and reporting structure, and other factors.

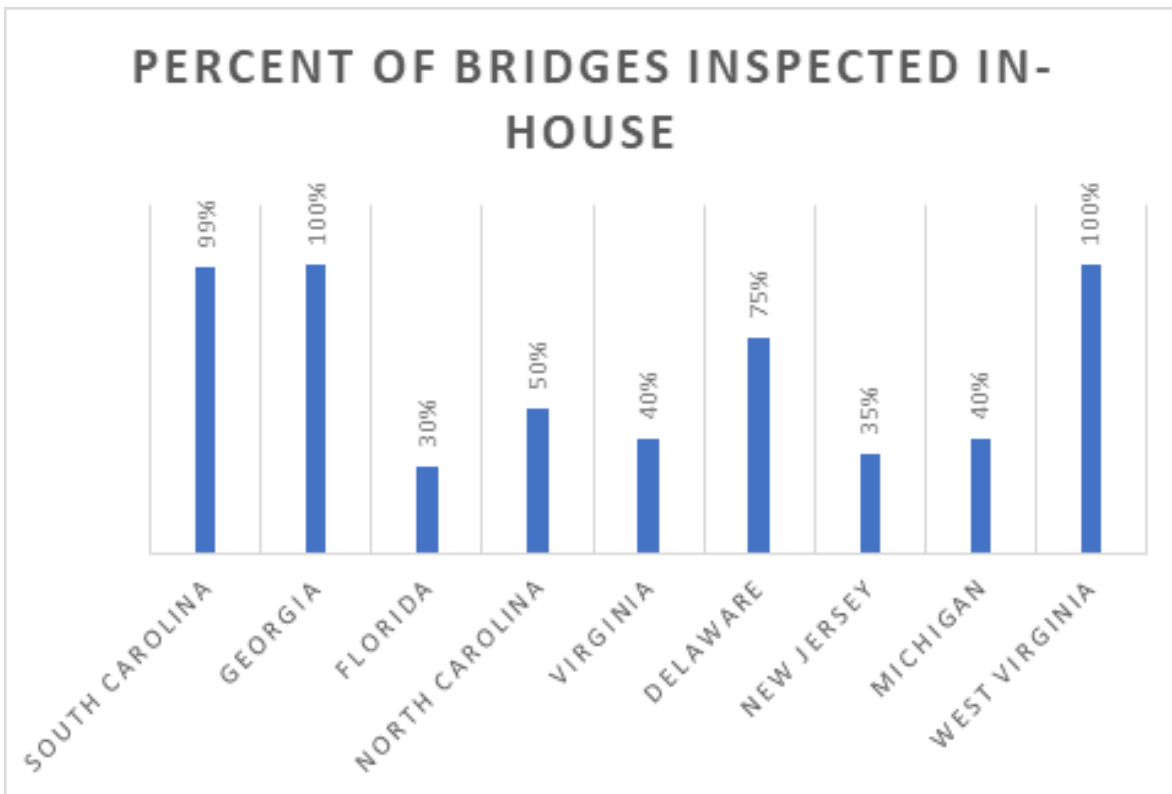
As described, peer states have experienced success using a variety of organization placement options for the bridge inspection function. Accordingly, no one approach can be considered singularly as “best practice”; rather, any of the described options can produce the target outcome if provided sufficient guidance and support. Bridge inspection teams in most of the peer states included in this study are field-based (decentralized, i.e., physically located within geographic districts, divisions or regions). Exceptions tend to be geographically smaller states (e.g., DE and NJ), which have their bridge inspection teams located at their respective DOT headquarters (centralized).

Michigan, Virginia and West Virginia have their bridge inspection teams reporting locally within the district or region’s maintenance chain of command. The remainder of the peer states have their inspection teams geographically dispersed but reporting to a central/headquarters-based group which may be within the Maintenance command structure or within another organizational unit. Similarly, the selection and oversight of consultants performing bridge inspection varies from state to state, some headquarters-based and some region-based.

From a national perspective, both Alabama and Louisiana have their bridge inspection teams located in their districts and reporting through their district chain of command, but they do have one or two inspection teams reporting to, and based out of, their central Bridge office. These inspection teams supplement district inspection teams during times of temporary staff shortages or when workload issues arise; they also assist the districts with priority findings and provide advice with maintenance repair methods and techniques. In Louisiana, its two teams also perform the QC.

Peer states tend to use a mix of consultants and in-house bridge inspection teams to perform the bridge inspection function as shown in [Figure 1](#). Peer states also typically rely on the specialty engineering firms to perform underwater inspections. Georgia and West Virginia are the exceptions to both practices and self-perform both routine and underwater inspections.

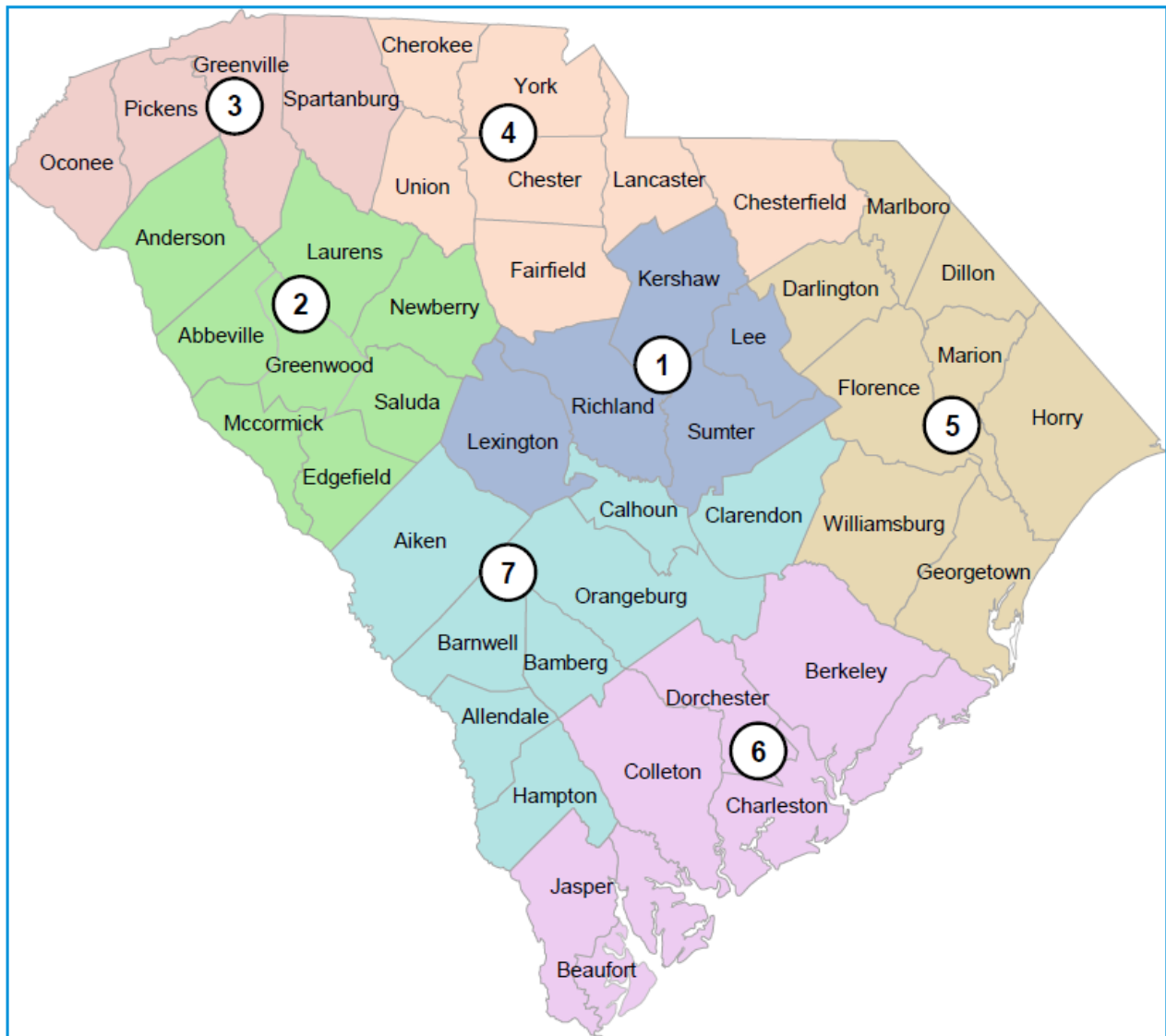
Figure 1: Self-Performed Routine Bridge Inspection Rates



SCDOT Current Practices

The state is divided into seven (7) engineering districts (see [Figure 2](#)). Bridge inspection teams are district-based and report to the District Maintenance Engineer through the District Bridge Inspection Supervisor. When fully staffed, most districts have two or three inspection teams. Each two-member team includes a bridge inspection team leader and a bridge inspector. Historically, SCDOT inspection teams have been responsible for routine inspections of all bridges in the State, including bridges on the local system. The exception are the bridges that are being inspected as part of the management contract for movable and complex bridges (15 bridge systems in total).

Figure 2: SCDOT Engineering Districts



The BMO is headquarters-based and falls within the organizational structure of the Director of Maintenance as a major program area. The BMO supports the bridge inspection staff and performs the QA function for the bridge inspection program. The BMO is in the process of contracting with consultant engineering firms to supplement SCDOT in-house bridge inspection staff. In addition, the BMO maintains contracts with specialty engineering firms for required underwater inspections.

Commendable/leading SCDOT Practices include:

- Supplementing in-house bridge inspection teams with consultant bridge inspection teams to ensure inspection timeliness, while retaining in-house experience and capabilities to optimize program cost
- Revising Human Resource classifications to address retention and better define the roles and responsibilities of team leaders and inspectors
- Using mobile technology for bridge inspection to improve data quality and accuracy
- Improving equipment accessibility by establishing and utilizing rental contracts

SCDOT's strategic approach of using a blend of in-house bridge inspectors and consultant inspectors is aligned with most other peer states and is considered a best practice for optimizing resources.

Enhancement Items for SCDOT to Consider:

- No singular “best” practice exists for organization placement and structure of the NBIS bridge inspection function
- Each state DOT must decide on the organization location and reporting structure that best meets its needs

Manuals and Guidance

Identify National and Peer Practices

All peer states have a bridge inspection manual, either as a stand-alone document or included within their bridge design manual. The central bridge unit of each state typically has responsibility for updating and maintaining this document.

Training practices identified as particularly noteworthy include the following:

West Virginia

- Holds an annual Bridge Inspection Conference for all state bridge safety inspectors
- Conducts a state certification exam that all bridge safety inspectors must successfully pass before acting as a team leader
- Requires personnel to earn technical development hours towards an Associate of Applied Science (A.A.S.) in Highway Engineering Technology – Bridge degree program before being eligible for the higher Bridge Safety Inspector classifications
 - Funds tuition for up to two (2) classes per semester in the program

Michigan

- Requires a Field Proficiency Exam that all bridge inspection team leaders must successfully complete to be qualified as a bridge inspection team leader

Indiana

- Partnered with Purdue University to develop required bridge inspection [short] courses

SCDOT Current Practices

The BMO is completing the BIGD. The draft BIGD is comprehensive and reflects a compendium of leading policies, practices and procedures currently in industry use. SCDOT already is conducting inspections using the draft BIGD and is aggressively training its personnel to follow the revised processes and guidance statewide.

Commendable/leading SCDOT Practices include:

- Developing a comprehensive, industry-leading practice bridge inspection guidance document to promote high quality and more consistent inspections
- Training bridge inspection staff in the use of the draft BIGD

Enhancement Items for SCDOT to Consider:

- Continue efforts to finalize and adopt the draft BIGD
- Consider identifying and requiring a certification or exam program for bridge inspectors, similar to those used by some peer states

Quality Control / Quality Assurance

Identify National and Peer Practices

All peer states have QC/QA policies and practices included in their respective bridge inspection manuals, within their bridge design manuals or as a stand-alone document. Similarly, the central bridge office within each peer state also has responsibility for the updating and maintenance of the QC/QA elements in their respective manuals.

As noted previously, Louisiana has central office bridge inspection teams, which support QC/QA efforts and assist in maintaining overall bridge inspection report consistency.

SCDOT Current Practices

District-based bridge inspectors currently perform QC on their inspection reports. The current review process primarily is a check for completeness and a consistency on the NBI and element coding. QA is performed centrally from the BMO.

The draft BIGD provides enhanced QC/QA guidance and requirements for bridge inspection. It also defines QC/QA, outlines roles, and identifies responsibilities and review procedures. There are separate sections for in-house performed bridge inspections and for consultant-performed bridge inspections.

The draft BIGD defines the requirements for the inspection team's qualifications and includes a QC/QA flow chart while also providing guidance on participation in and performing FHWA audits and reviews. The attachments section of the draft BIGD provides QC/QA forms for field reviews, independent inspections and district meetings. There are also tracking spreadsheets for QC/QA and inspection team qualifications.

Commendable/leading SCDOT Practices include:

- Including a comprehensive QC/QA section in the draft BIGD to enhance inspection information quality and consistency
- Requiring bridge inspection consultants to have an approved QC/QA plan prior to contracting is a leading practice

Enhancement Items for SCDOT to Consider:

- Leave the QC aspects of bridge inspection reports at the bridge inspection team level but shift to a process of using district-based peer reviews
 - For example, District 1 performs QC on District 2's bridge inspection reports and District 2 performs QC on District 3's bridge inspection reports, etc.
- Retain QA responsibility at the BMO for bridge inspection reporting but consider adding a BMO-based QA team to assist district bridge inspection teams in reviewing a sample of consultant-performed inspections

Data Collection Methodology

Identify National and Peer Practices

Many of the peer states use devices and technologies that support direct capture of field notes and pictures directly into bridge inspection forms, pre-populated from the previous inspection. This information typically is held on the mobile device until the device is synced with the agency network, and the records subsequently uploaded.

Once QC has been performed, these files are ready to be reviewed through the QA process. Ultimately, this information is uploaded as NBIS records.

SCDOT Current Practices

SCDOT provides electronic tablets to support the direct collection of bridge inspection data via its *Bridge Inspection Online* (BIO) application. However, most bridge inspectors currently collect information on paper forms during their field visits because of tablet durability concerns and network connectivity limitations. As a result, most bridge inspection data entry must be transcribed into the BIO application. This includes bridge element condition ratings with estimates (or measurements, if taken) and any specific element deterioration noted. Photos taken during the field visit also must be imported separately into the bridge inspection report. The field paper documents then are attached to the bridge inspection report as a PDF file.

SCDOT is aware of the current limitations of the existing BIO application, technology and multi-step nature of this process and is taking proactive measures to replace the application, the supporting technology and streamline the process. SCDOT has executed a procurement contract with *AASHTOWare* to develop a mobile application and bridge management system to address this need.

Commendable/leading SCDOT Practices include:

- Providing bridge inspectors technology that allows first person, real-time data entry is broadly considered as a data entry best practice
- Supplying standard forms for collecting a variety of inspection and inspection-related QC/QA information in the draft BIGD
- Providing standard forms in the BIGD for reporting critical deficiencies that use consistent terminology with the SCDOT Highway Maintenance Management System (HMMS) improves tracking and reporting efficiency

Enhancement Items for SCDOT to Consider:

- Continue efforts to deploy enhanced technologies for easier and more reliable first person, real-time data entry and information collection

Bridge Load Rating Program

Topic Introduction

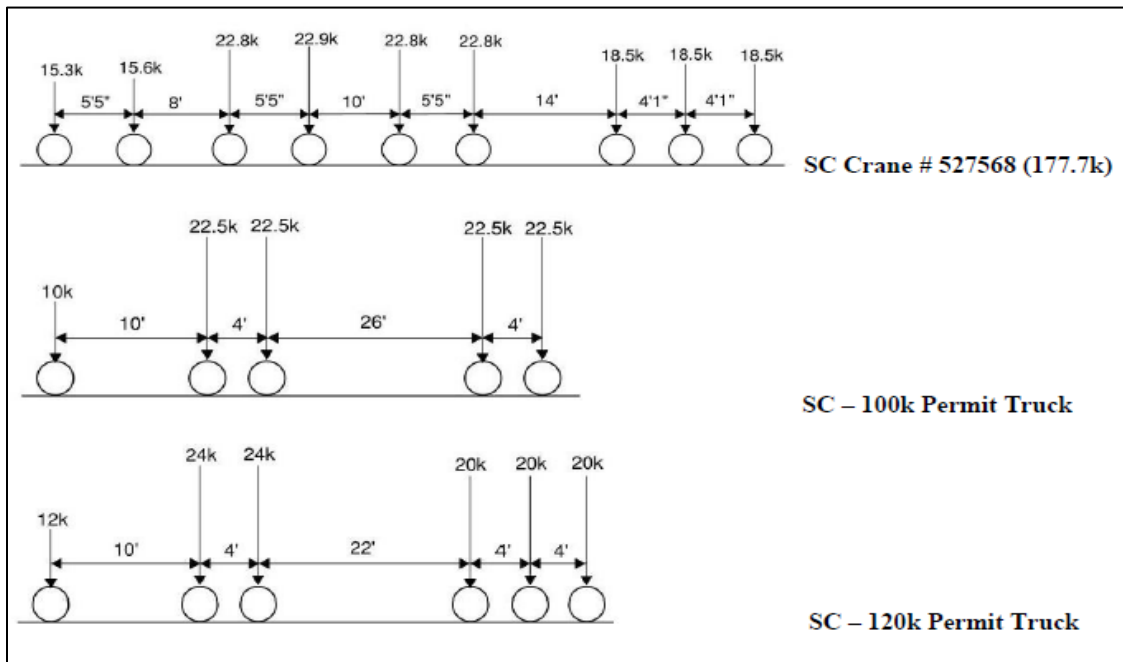
The term “load rating” is used to define a series of actions that ensure a bridge is safe to carry the loads traveling on it. Determining how strong a bridge is to carry vehicular traffic, such as cars and trucks, is an extremely important aspect of any bridge program. Failure to properly determine load carrying capacity can have catastrophic results.

When bridges are closed or load restricted, significant public impacts can result such as long detours, which slow the efficient movement of goods and services. Therefore, identifying bridges that have reduced capacity and addressing them is a crucial component of an overall agency bridge program.

Bridges must be able to carry their own weight plus any additional loads. The bridge’s own weight is typically referred to as “dead load” whereas other loads such as cars and trucks are referred to as “live loads.” Live loads are those loads that are not continuously applied to the bridge. Besides cars and trucks, this can also be wind, snow and even the braking of trucks and cars.

Truck loading is divided into loads the bridge sees everyday like the typical eighteen-wheeler and special trucks that carry very heavy loads and only occasionally cross the bridge (see [Figure 3](#)). Often these special trucks have many axles (to distribute the load) and sometimes a police escort as they might be oversized or over height and might purposely move slowly to impart less load on a bridge.

Figure 3: SCDOT Load Rating Diagram



Load rating engineers use existing documentation such as the initial design and “as-built” construction plans to determine the capacity of the bridge. However, an important aspect of load rating a bridge is to see if any changes have occurred over the life of the bridge that might have reduced its ability to carry loads. These changes are documented through ongoing NBIS bridge inspections.

A common example of deterioration observed during routine NBIS inspections that would be considered during load rating might be a steel girder that has rusted over time. When a steel girder rusts, the resulting “section loss”

diminishes its ability to carry the loads for which it was originally designed. It is therefore imperative that the bridge inspection team document these types of changes through measurements and photography during their bridge inspection and include important details in the bridge inspection report. If necessary, field load testing utilizing strain gauges and other electronic “non-destructive” evaluation methods may be required to assess the load carrying capabilities of a bridge with deteriorated elements.

A load rating engineer typically performs analysis calculations to determine the capacity of the bridge. Sometimes this can be very minimal such as evaluating one bridge girder and the loads on it, then assessing how those loads affect the entire bridge. These load rating calculations may be performed by hand, utilizing a standard template or spreadsheet. The results of this type of analysis typically is very conservative.

Sometimes a “refined analysis” is used, which is a more sophisticated analysis that requires using highly complex computer software. A refined analysis takes longer and is more costly to perform. However, it provides a more accurate result. Occasionally, a refined analysis may indicate the strength of the bridge is adequate. In such cases, a structural rehabilitation/strengthening project and its accompanying costs are not required.

As previously noted, bridges also may be load-tested to help with the load rating. This typically involves driving trucks of known weight over the bridge and using gauges to measure the reactions in the load carrying members and at the supports.

Load rating is viewed by the FHWA as an extremely critical task with the requirement that all load rating engineers responsible for determining how much load a bridge can carry must be licensed professional engineers. Many states DOTs have an in-house load rating engineer who oversees DOT staff or consultants performing the load rating analysis. Load ratings are input into agency bridge management computer programs so that routes can be determined for movement of overweight trucks when requested via the oversize-overweight permitting process.

Organization

Identify National and Peer Practices

In most peer states, if the bridge inspection function resides in the district/region, then the load rating function also resides in the district/region. Georgia and Michigan are exceptions to this practice.

In peer states that perform load rating of bridges in the district/region, the central bridge offices typically have the capability to perform load ratings but usually are engaged in the quality assurance of load ratings, maintaining the load rating policies and procedures, and in evaluating software which can be used for load rating (or updates for software in use).

All peer states use consultants to assist them with load rating large, complex and truss bridges, though Georgia, North Carolina and West Virginia perform the majority (>80%) of the bridge load ratings with in-house staff. The remainder of the peer states use consultants to assist them to a varying degree (50%-75%).

SCDOT Current Practice

Currently, load ratings are performed by consultants, who are contracted by, and report to, the BMO. Load ratings are performed in accordance with the SCDOT LRGD and are typically performed under the following circumstances including:

- When a bridge is originally designed and then immediately updated upon completion of construction or reconstruction (if construction changes warrant)
- When bridge inspection teams note a suspected loss in load carrying capacity of a bridge component due to deterioration
- When damaged through vehicle impact or other extreme event

- When a trucking company submits a permit request to move a large, overweight vehicle over a bridge (or bridges)

In addition, FHWA recently issued guidance requiring that all bridges be load rated for a Special Hauling Vehicle and Emergency Vehicle. In order to meet this significant increase in bridge load rating needs, the BMO has engaged consultant engineering firms to perform the required load ratings.

Commendable/leading SCDOT Practices include:

- Supplementing in-house staff through contracts with qualified engineering consultants
- Including load rating task as part of bridge inspection consultant contracts

Enhancement Items for SCDOT to Consider:

- Strengthen resources to increase load rating capability and retain expertise to meet future needs, thereby, reducing costs and increasing efficiency

Manuals and Guidance

Identify National and Peer Practices

Most peer states have a load rating manual, either as a stand-alone document or included within their bridge design or bridge inspection manuals. The peer states who do not have a manual perform load ratings with in-house staff utilizing in-house guidance documents. Maintenance and updating of electronic load rating manuals and guidance documents are a function assigned to the central bridge offices of the peer states interviewed.

SCDOT Current Practices

The LRGD recently developed by SCDOT is comprehensive and reflects a compendium of best practice policies and procedures currently in use by industry. The LRGD provides all load raters with a common source document to utilize when developing bridge load ratings. It also provides documentation and standard load rating summary forms with a workbook guide explaining these summary forms and provides the logic and rationale utilized by SCDOT. The LRGD is invaluable to load raters as they develop bridge specific load ratings with respect to deterioration or overweight loads.

Commendable/leading SCDOT Practices include:

- Developing and implementing a comprehensive LRGD

Enhancement Items for SCDOT to Consider:

- Establish a minimum schedule to update the LRGD to ensure the document maintains its accuracy and relevance over time

Quality Control/Quality Assurance

Identify National and Peer Practices

All peer states have QC/QA guidance for bridge load rating included in either stand-alone load rating manuals or the load rating guidance sections of their bridge inspection or bridge design manuals. The maintenance and updating of bridge load rating guidance documents is typically a function assigned to agency central bridge offices.

SCDOT Current Practices

Bridge load rating QC/QA is currently performed by the consultant firms performing the load ratings, or if the new bridge is being designed by SCDOT, then the load rating and the QC/QA is being performed by the Preconstruction (design) unit.

Chapter 3 of the LRGD provides the guidance and requirements for QC/QA for bridge load ratings. It also outlines roles and responsibilities, and the associated review procedures. The LRGD defines the qualifications for load rating personnel including the Engineer of Record, who is required to be a licensed professional engineer in the

State of South Carolina. It specifically states the QC engineer and the QA engineer shall be independent from the individual performing the load rating. In the Chapter 3 Appendix, there is a QC review checklist and tracking sheet, and a QA review checklist and tracking sheet.

Commendable/leading SCDOT Practices include:

- Developing a comprehensive QC/QA section in the LRGD
- Requiring consultants that perform load ratings to have an approved QC/QA plan in their scope of work
- Providing QC/QA review checklists and tracking documents in the LRGD

Enhancement Items for SCDOT to Consider:

- Strengthen expertise in performing load ratings through NHI training and on the job training

Software

Identify National and Peer Practices

All of the peer states use a combination of available load rating software products. A majority of the states are using *AASHTOWare Bridge Rating* (BrR). All peer states also have an approved list of commercially available load rating software, including Microsoft EXCEL spreadsheets and PTC Mathcad.

SCDOT Current Practices

SCDOT requires its consultants performing load rating to use *BrR* version 6.8.3 load rating software for all structure types supported by this software. For those structure types which cannot be load rated using *BrR*, a list of preferred alternative software products is provided. Prior to using one of these software alternatives, the consultant must request approval from the BMO. Standard approval forms are provided in the LRGD. The LRGD approves Microsoft EXCEL spreadsheets or PTC Mathcad for use to load rate bridges; thus, they do not require separate approval by SCDOT prior to use.

Commendable/leading SCDOT Practices include:

- Adopting nationally accepted load rating software available through AASHTO
- Providing a listing of preferred load rating software products along with standard approval forms in the Load Rating Guidance Document

Enhancement Items for SCDOT to Consider:

- Ensure the most current *AASHTOWare BrR* software available is being used to increase the number of bridge types the software can load rate, which will increase the efficiency and effectiveness of the Hexagon OSOW software

Bridge Management (Preservation / Rehabilitation / Replacement)

Topic Introduction

This section of the report focuses on the SCDOT’s approach to managing the State’s system of bridges, which broadly is categorized as its BMS. A BMS is the combination of tools, processes, and procedures used to develop an optimal agency bridge program. However, “BMS” also refers the software/applications used by agencies to support this function. In either usage, an effective BMS enables an agency to make informed, data-driven, short- and long-term investment decisions across a range of work types.

Bridges are rated using the NBI GCR for the major components, which consist of deck, superstructure, or substructure. If the asset is a culvert with a span length of 20 feet or over, then it is also counted as a bridge and a GCR is assigned to the structure major components.

The GCR rating is an overall asset condition rating, which uses a 0 (failed) to 9 (excellent) scale as shown in [Table 2](#).

Table 2: NBI General Condition Ratings³ and National Performance Measures⁴

Rating Number	NBI Descriptor	Performance Measure Classification (23 CFR 490)
9	EXCELLENT CONDITION	GOOD
8	VERY GOOD CONDITION	
7	GOOD CONDITION	
6	SATISFACTORY CONDITION	FAIR
5	FAIR CONDITION	
4	POOR CONDITION	POOR
3	SERIOUS CONDITION	
2	CRITICAL CONDITION	
1	"IMMINENT" FAILURE CONDITION	
0	FAILED CONDITION	

³ FHWA, Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges, Report Number FHWA-PD-96-001, December 1995, Page 38.

⁴ United States Code of Federal Regulations, Title 23, Part 490, National Performance Management Measures.

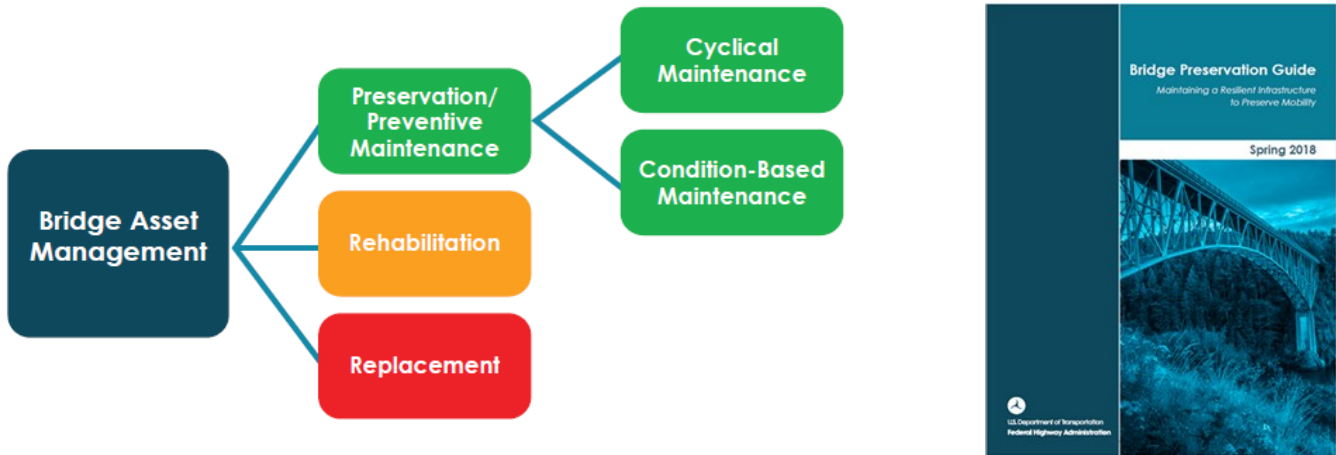
The FHWA categorizes overall bridge condition as “good” when all the major components are rated 7 or above, “fair” when the lowest major component is rated 5 or 6, and “poor” when one or more of the major components are rated 4 or below.

The Federal Highway Administration broadly describes asset management 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. The objective of asset management is 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 a singular asset or network of assets at its minimum, practical cost.⁵

The Federal Highway Bridge Preservation Guide⁶ categorizes bridge asset management into the following three (3) categories as shown in [Figure 4](#):

1. Replacement (also called reconstruction)
2. Rehabilitation
3. Preservation (also called preventive maintenance)

Figure 4: Bridge Action Categories and the Cover of the FHWA Bridge Preservation Guide



Preservation can be further categorized into cyclic maintenance and condition-based maintenance.

The FHWA preservation guide uses the following definitions for the corresponding actions:

- “Replacement” (reconstruction) refers to the total replacement of an existing bridge with a new facility constructed in the same general traffic corridor. Replacement projects are often done to bridges in “poor” condition where rehabilitation actions are no longer cost effective.
- “Rehabilitation” is major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects. Examples of bridge rehabilitation include partial or complete deck replacement, superstructure replacement, and substructure/culvert strengthening or partial/full replacement. Rehabilitation projects are often done to bridges when one or more of the major components are in poor condition.

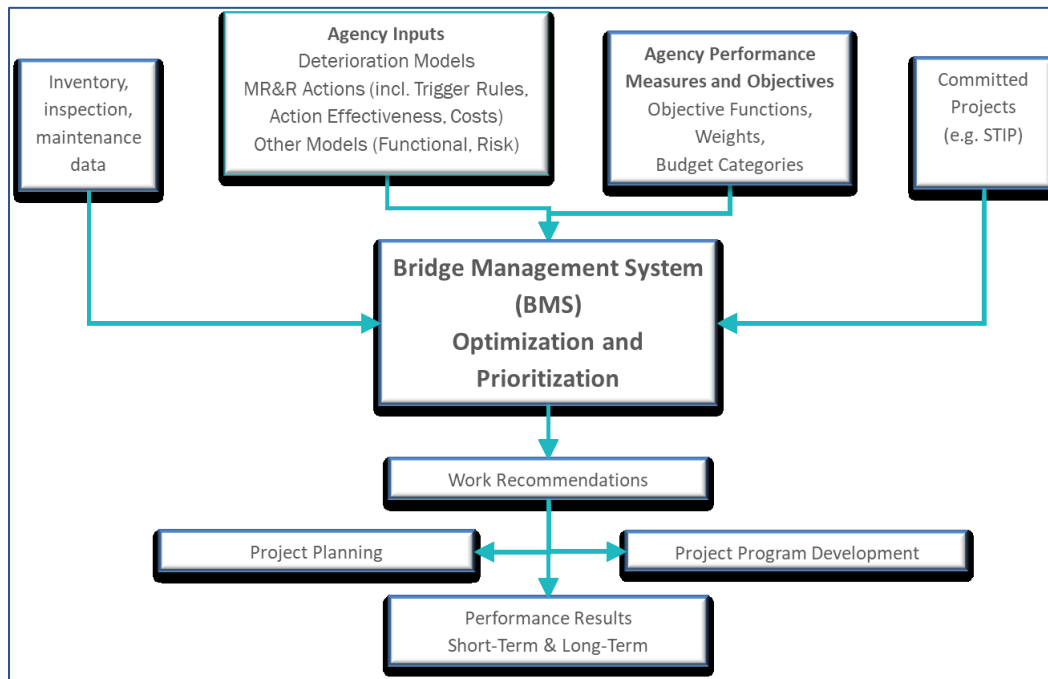
⁵ 23 CFR 515.5 – Asset Management Definition

⁶ FHWA, Bridge Preservation Guide Maintaining a Resilient Infrastructure to Preserve Mobility, Spring 2018.

- “Preservation” (preventive maintenance) is a category of activities or strategies that extend the service life of highway bridges by applying cost effective treatments to bridge elements while they are in “good” or “fair” condition. Preservation activities prevent, reduce or delay future deterioration and defer large expenses in bridge rehabilitation or replacement.

BMS software is a tool for managing bridge programs using advanced concepts to prioritize and optimize program development and project selection. These systems require calibration with many user inputs as shown in the top boxes in [Figure 5](#) that feed into the BMS application. The resulting outputs are used for program development, project planning, work recommendations, and short and long-term performance monitoring.

Figure 5: Bridge Management System Flow Chart



Note: “MR&R” stands for maintenance, repair and rehabilitation

Organization

Identify National and Peer Practices

Peer states organize the bridge management programs in a variety of ways. Selected examples include the following:

- Delaware has a bridge management engineer that manages the bridge program and a bridge management resource engineer that leads the development and implementation of the modeling side of their BMS Software. They have quarterly meetings between Bridge Management and Bridge Design staff to discuss project development. At these meetings, bridge management staff discuss concerns from recent inspections, and bridge design staff provide updates on projects. Projects that hit delays can sometimes have interim maintenance to extend life, and every bridge in critical condition is discussed.
- Michigan has a strong central office bridge management section that develops strategy to meet Department bridge goals, set annual objectives, and write the annual Call for Projects memo. The bridge management section has a section manager (the Bridge Management Engineer), a Bridge Management Systems engineer responsible for running their BMS, and multiple engineers to do bridge program management. Each of Michigan’s Regions (Districts) has a bridge engineer who is responsible for project

selection.

- New Jersey has several positions in the central office dedicated to bridge management and running their BMS software. Their program is managed centrally.
- Virginia has a bridge management section with multiple positions that develop bridge management policy, set project selection guidelines, and run their BMS. They work with their districts that select bridge projects given central office guidelines.

SCDOT Current Practices

SCDOT’s organizational structure for bridge management functions as a combination of central office and district responsibility. Central office staff maintain the bridge database, identify eligible bridges that meet the requirements of the replacement program, do preliminary engineering, and support the preparation of the Transportation Asset Management Plan (TAMP). The districts select projects and coordinate program delivery.

Commendable/leading SCDOT Practices include:

- Optimizing internal resources with consultant expertise for BMS development and implementation

Enhancement Items for SCDOT to Consider:

- Develop policies and procedures for a bridge program that is based on using a balanced approach of preservation, rehabilitation, and replacement projects
- Provide sufficient expert technical resources to fully leverage SCDOT's investment in a BMS

Bridge Management Process & Procedures for Preservation/Rehabilitation/Replacement

Identify National and Peer Practices

Table 3 summarizes the projected 10-year percent spending by work type on National Highway System (NHS) bridges based upon data included in the 2019 TAMPs of SCDOT and the other DOTs interviewed as part of the peer benchmarking effort. The consulting team performed these calculations, based on the published TAMP projected spending data and the team’s interpretation of this information.

Table 3: TAMP Percentage of Bridge Program Budget

State	Maintenance and Preservation	Rehabilitation	Replacement
Delaware	*87%		13%
Florida		18%	82%
Georgia	3%	8%	89%
Michigan	23%	28%	49%
New Jersey	39%	20%	41%
North Carolina	29%		71%
South Carolina	10%	19%	71%
Virginia (not available)			
West Virginia	17%	28%	56%

* Mix of maintenance, preservation and rehabilitation

As this table suggests, SCDOT’s projected bridge management spending by work type generally is consistent with the patterns of the other peer states. Specific observations include the following:

- Of the states providing maintenance and preservation spending projections, only Georgia is spending a smaller portion of its bridge program budget on preservation and rehabilitation versus full replacement than SCDOT.
- Though SCDOT’s rehabilitation spending share is third lowest of this peer group, the relative range of funding percentages is relatively smaller in this group.
- SCDOT’s projected 71% share of funding dedicated to bridge replacement is high, but similar to nearby states.

Common or Notable Practices

- All the peer states use NBI GCR condition as their primary performance indicators, using some form of “good”, “fair” and “poor” measures.
- Peer states differ in how they go about selecting bridge program projects, but all have a systematic process of categorizing preservation, rehabilitation, and replacement needs. This typically involves using NBI GCR ratings for the major components along with using expert judgement, spreadsheet tools and some use of a BMS software to make the initial prioritization and treatment selections.
- South Carolina, North Carolina, Virginia, and Delaware have a points-based ranking system to prioritize projects.
- Project selection often is an iterative process between the districts/divisions/regions and central office.
- North Carolina, Michigan, and Kentucky use field verification or detailed scopes to make final decision on the treatment used for a given bridge.
- North Carolina, Virginia, Michigan, and Kentucky have a separate budget and management process for large deck area and/or complex bridges. These structures are considered too important or costly to allow them to drop into poor condition.

Additional highlights of the peer state bridge programs and project research follow:

North Carolina

- NCDOT’s bridge preservation program was initiated by dedicating \$10 Million budget for steel beam painting and deck overlays for interstate bridges
- BMS software (*AgileAssets*) is used to produce the initial project recommendations for preservation, rehabilitation and replacement
- Projects are prioritized using a Priority Replacement Index (PRI), which is a points-based system based on the following factors:
 - Consideration of deficiency points
 - Sufficiency rating
 - Deck superstructure and substructure ratings
 - Use of temporary shoring
- Preservation typically is done via selecting multiple projects along a corridor

Virginia

- Central office develops an initial project list using *AASHTOWare BrM*

- Prioritization is done using the agency’s State of Good Repair ranking system, based on the following factors:
 - Importance
 - Condition
 - Structural redundancy
 - Structural capacity
 - Cost effectiveness

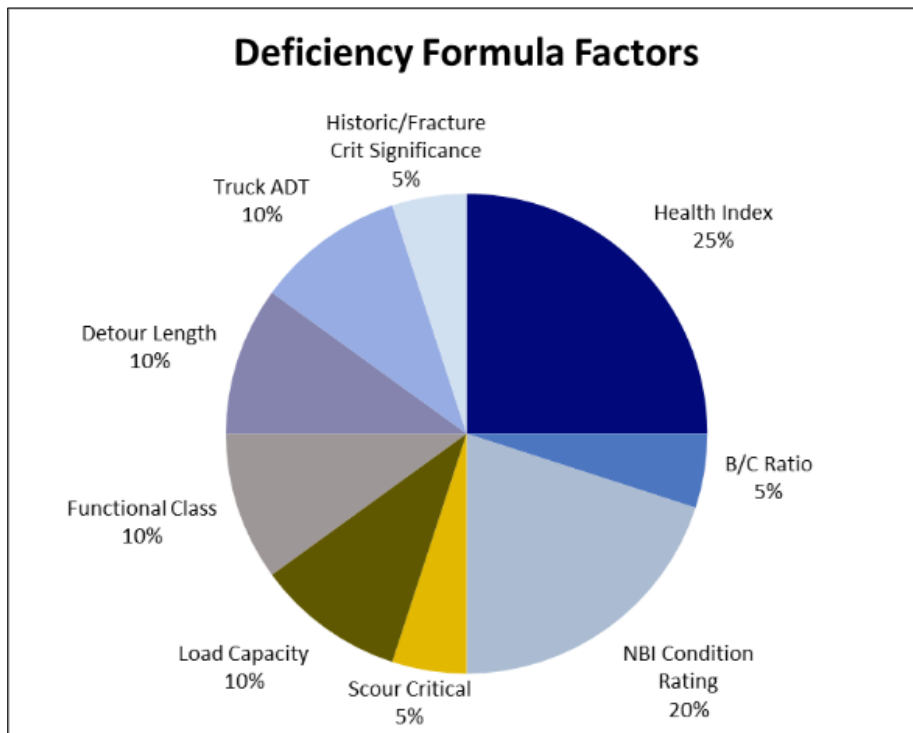
New Jersey

- Central office directs the bridge program using spreadsheets, inspection data, and some *AASHTOWare BrM* information
- Projects are identified by NBI GCR of the deck, superstructure, substructure, or culvert
- Bridges rated in poor condition are reviewed to determine if strengthening or deck replacement or superstructure replacement could provide a desired service life extension (a target of roughly 40 years); otherwise, replace the bridge

Delaware

- DelDOT is currently modifying *AASHTOWare BrM* software to use a deficiency formula using the ratings identified in Figure 6. Note, B/C Ratio in the figure is Benefit-Cost Ratio.

Figure 6: Delaware Deficiency Formula Weighted Factors*

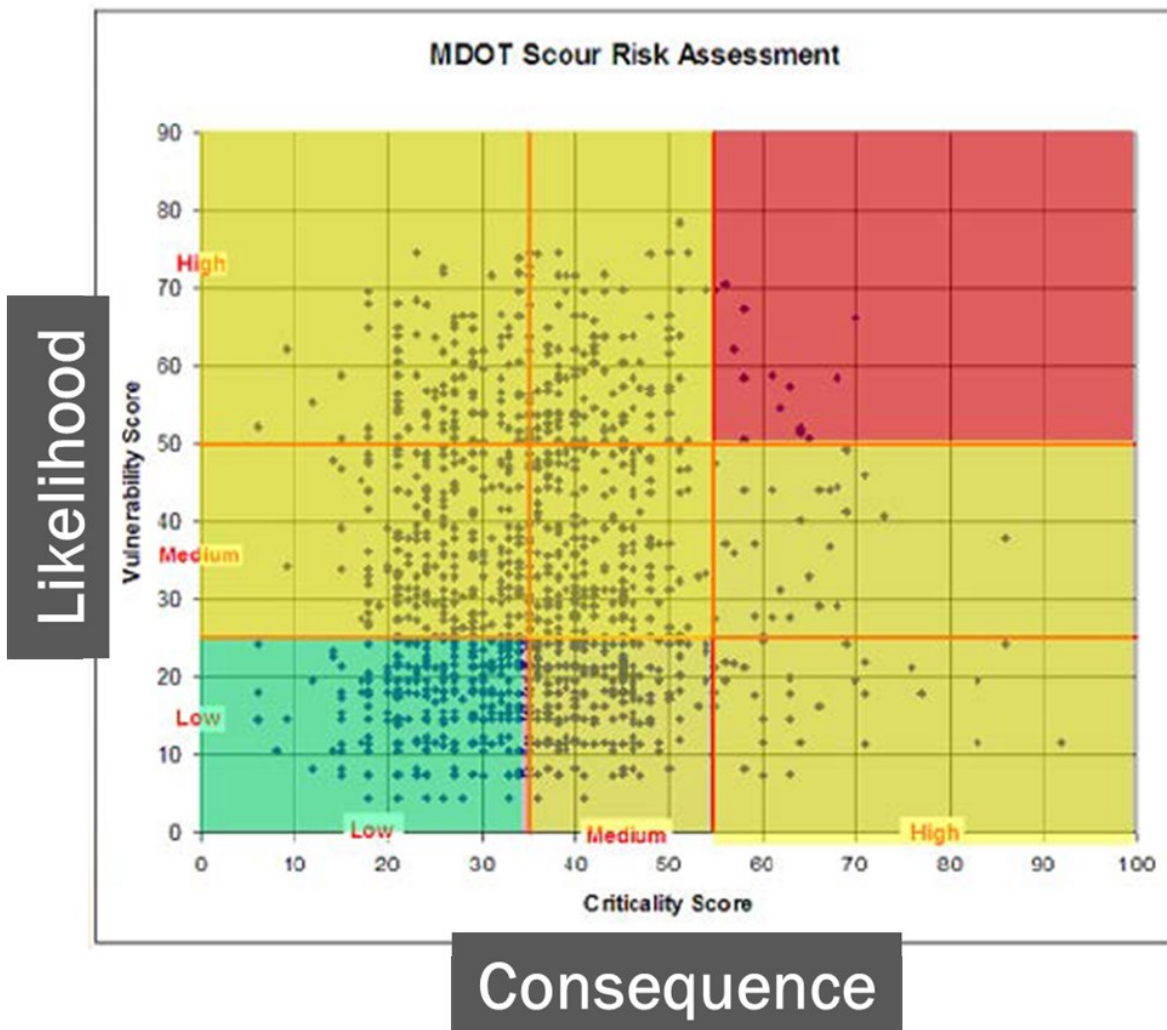


*“B/C Ratio” stands for benefit/cost ratio

Michigan

- Central office uses a MDOT-developed spreadsheet called *Bridge Condition Forecast System* to provide initial network level forecasts of bridge condition based on a given mix of fixes (preservation, rehabilitation, and replacement)
- Preservation project volume tends to be constrained by the number of bridges that can be closed in a year
- MDOT districts make and manage actual budget allocation decisions
 - Use preservation matrices to guide project selection
 - Detailed scope review determines approach used
 - Use of rehabilitation and replacement options are limited to bridge in “poor” condition unless specifically approved by the central office.
- Perform risk assessments to prioritize bridge rehabilitation or replacement projects over river crossings (see Figure 7).

Figure 7: Michigan DOT Scour Risk Assessment Chart for Prioritizing Bridge Projects



Case Study – Bridging Kentucky

Project research suggested that the experience of the State of Kentucky with its “Bridging Kentucky”⁷ program warranted its inclusion as a case study. “Bridging Kentucky” is an initiative by the Kentucky Transportation Cabinet (KYTC) to improve safety and soundness of Kentucky highway bridges, with a focus on protecting current structures. The objective of the program was to rehabilitate, repair, or replace more than 1,000 critical structures in six (6) years (2019 – 2024).

Among the more notable elements of this program is that it does not simply identify reconstruction (replacement) projects; instead, it uses a screening process that is based on agency rules to identify the appropriate treatment for each bridge. The information below describes the Bridging Kentucky decision process:

1. Bridges are reviewed for exclusion from the program. Disqualifying factors include the following:
 - Complex bridges
 - Major river bridges
 - Interstate bridges
 - Bridge projects with non-structural goals
 - Bridges that should be removed from the inventory, such as closed bridges that are no longer relevant to the community
2. “Level 1 screening” is the next step in the process. This involves a review of bridge NBI GCR information, inspector notes, load rating information, and inspection photos.
3. “Level 2 screening” is the following step, which involves the use of life-cycle cost analysis, deterioration modeling, posting information, element condition state data, rehabilitation activities and cost, and user costs.
4. Field verification is the final step, which determines if the right action for the bridge is rehabilitation or replacement.

Using the described screening process, the KYTC increased their bridge rehabilitation program by 40% with a corresponding, significant reduction in overall program costs

Bridge Management Best Practices

Using the information gathered through the project outreach, research and industry knowledge, the consulting team identified the following bridge management best practices as being particularly worthy of consideration and emulation:

- Developing a specific and comprehensive set of bridge management business processes to be followed by department staff
 - Establishing agency bridge preservation policy guidance.
 - Providing training and guidance for comparing repair and preservation options and preparing design plans and specifications for bridge preservation projects.
 - Providing outreach to the contractor community to increase their understanding and buy in of a greater emphasis on preservation and rehabilitation.

⁷ <https://bridgingkentucky.com/>

- Coordinating bridge program projects with the pavement and safety programs to minimize impacts to traffic while optimizing mobilization and traffic control expenditures on projects.
- Bundling preservation and rehabilitation projects along highway corridors for maximum efficiency.
- Using a data-driven screening process that incorporates the use of deterioration models, treatment strategies and decision trees to identify candidate bridge projects.
- Establishing decision trees or agency rules for preservation and rehabilitation treatments.

SCDOT Current Practices

At present, the SCDOT bridge management program includes a 10-year plan developed in 2017. This plan takes a bookend approach to address load restricted bridges across the state and in poor condition on the NHS. Replacement of load-restricted bridges is prioritized on objective and quantifiable criteria to rank bridge projects as per their cost benefit ratio in relation to the top ranked project. The criteria use the following factors:

- Structural condition
- Traffic status
- Average Daily Traffic (ADT)
- Percentage of Average Daily Truck Traffic (ADTT)
- Detour length

Once the pool of prospective bridge candidates has been ranked, the bridges are sorted by engineering district and sent to the district engineering administrators for the completion of a field review criteria. The districts score each bridge using the criteria listed below and return the results to the State Bridge Maintenance Engineer.

- Route continuity and river basin upgrades
- District repair feasibility
- Improved emergency services and emergency evacuation routes
- State Freight Network
- Strategic Corridor Network
- New schools and/or changes in bus routes
- Known commercial routes
- Future economic development (residential/commercial)

The points from the field review are added to the points received from the initial prioritization, and bridges are ranked from highest total score to the lowest total score. At this point, the Deputy Secretary of Engineering goes through an objective and quantifiable ranking process, which is reviewed and recommended by the Secretary of Transportation. The South Carolina Transportation Commission then reviews and approves bridge prioritization/rankings.

Upon commission approval, the bridge prioritization list is sent to the SCDOT Office of Preconstruction, which estimates project costs and looks at other considerations (such as the potential for a given bridge replacement to conflict with other projects under design or development). The proposed project delivery plan is submitted to the planning office to determine financial availability and then inserted into the Statewide Transportation Improvement Program.

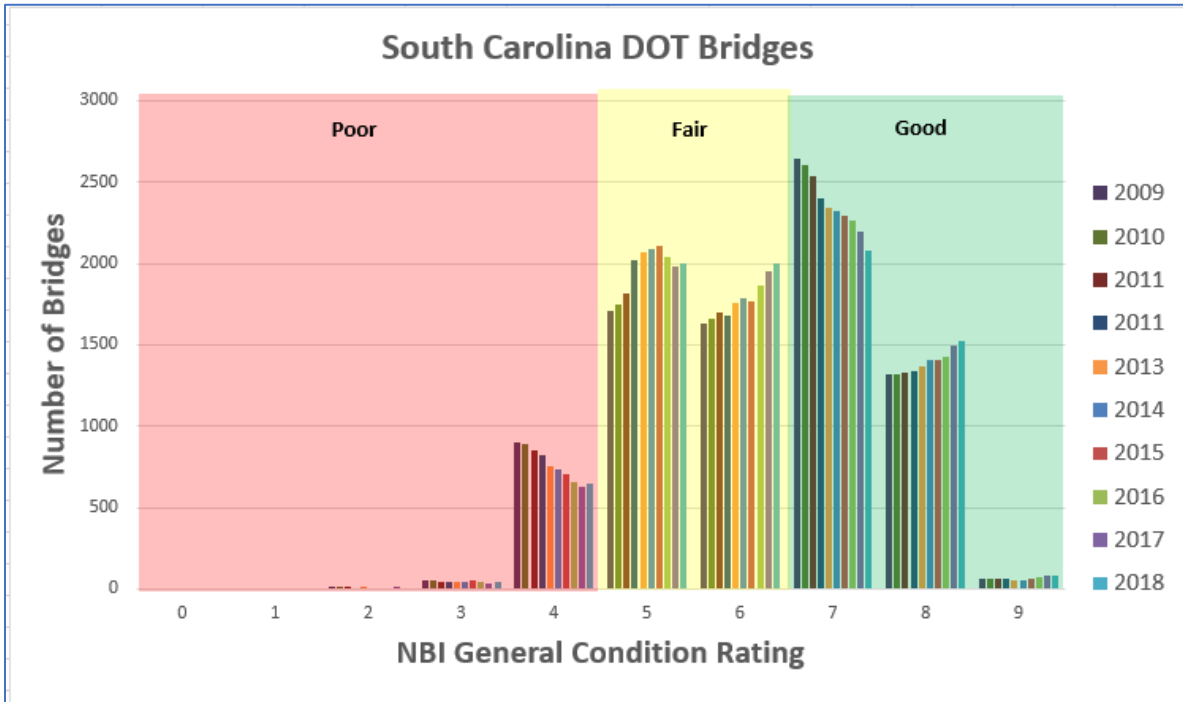
Figure 8 shows South Carolina NBI GCR condition trends over the past ten (10) years. Key points include the following:

- Bridges in condition 4 (poor) are decreasing over time while bridges in the condition level 8 (good) are increasing. This is reflective of SCDOT bridge replacement efforts.

Note: Bridges rated 2 or below are usually closed to the public. Repairs are made or the structure is replaced before reopening the bridge.

- Bridges in condition level 7 (good) are decreasing and condition 6 (fair) are increasing. In combination, this represents a trend of bridges moving between these categories, which suggests a need to increase the use preventive maintenance practices to slow that pattern.
- Bridges in condition level 5 (fair) were increasing for several years but now are mostly declining.

Figure 8: SCDOT Bridge Condition Rating by NBI General Condition Rating



As described previously, bridges rated 4 or below are considered in poor condition and are considered candidates for rehabilitation or replacement. These bridges are reviewed in greater detail to determine if a reduced load posting is appropriate. Bridges rated 5 or 6 are considered in fair condition and candidates for preventive maintenance. Bridges 7 or above are in good condition and may only have cyclic maintenance needs.

Commendable/leading SCDOT Practices include:

- Implementing a 10-year plan for replacing 465 restricted and deficient bridges

Enhancement Items for SCDOT to Consider:

- Modify the existing capital and maintenance bridge programs to include an appropriate mix of preservation, rehabilitation, and replacement strategies that keep good and fair bridges in their condition state while prioritizing replacement of bridges in poor condition

Use of Bridge Management Systems

Identify National and Peer Practices

To help agencies develop their BMS, the Transportation System Preservation Technical Services Program of the AASHTO created a Bridge Preservation BMS Working Group⁸ with the following objectives:

- Promote the development and/or adoption of best practices for BMS to extend the service life of bridges and demonstrate the value of preservation
- Develop general guidance and examples to help practitioners nationwide identify best practices for BMS that meets the needs of the agency and establish a process that makes implementation less intimidating
- Monitor and share the national development of management systems as they evolve

As part of its work, the BMS working group categorizes DOT bridge asset management maturity into three (3) stages: 1) Basic, 2) Intermediate and 3) Advanced, which is described as follows:

Basic

- Have accurate inventory and condition data that meets the needs of the agency
- Have goals and performance measures
- Monitor condition and performance trends
- Report on network bridge conditions with respect to agency goals and performance measures.

Intermediate

- Have deterioration models for bridge, major components, or elements
- Identify network-level preservation actions, quantities and costs
- Have a strategic plan that include short-and long-term budgets for the agencies' major categories of work such as preservation, rehabilitation, and replacement
- Forecast future network bridge conditions and performance measures
- Perform gap analysis of target conditions versus desired goals
- Use data to support and validate agency rules for network level bridge preservation policies
- Effectively communicate recommendations and expected outcomes based on network level analysis

Advanced

- Find the most appropriate investment actions for individual bridges, based on element level inspection data, with an estimated cost for the work
- Indicate when the work should be done, utilizing benefit-cost analysis that can also include life-cycle cost and user cost analysis
- Prioritize and optimize projects and programs to achieve optimal network budget efficiencies, progress towards agency goals, reduction of risk, and coordination with other infrastructure work
- Perform scenario comparisons
- Produce reports that effectively communicate recommendations and expected outcomes based on bridge and/or element level analysis

All the peer states are working towards having an advanced BMS. Delaware, Florida, Georgia, Michigan, New Jersey, and Virginia all use the *AASHTOWare BrM* software. New Jersey is the only state in this group to have

⁸ AASHTO Transportation System Preservation Technical Services Program Bridge Preservation Web Page: [https://tsp2bridge.pavementpreservation.org/national-working-groups/#Bridge Preservation BMS Working Group](https://tsp2bridge.pavementpreservation.org/national-working-groups/#Bridge%20Preservation%20BMS%20Working%20Group)

reached an advanced level of use with the AASHTOWare software to include running optimization scenarios. The other states are at various levels of intermediate development.

West Virginia uses Deighton dTIMS BMS software while North Carolina uses AgileAssets Structure Analyst BMS software. Both states utilize their BMS software to run optimization scenarios and use the results for their respective TAMPs.

SCDOT Current Practices

SCDOT does not currently use BMS software to manage their program; however, SCDOT recently initiated a project to begin using the *AASHTOWare BrM* software.

Commendable/leading SCDOT Practices include:

- Developing an advanced BMS

Enhancement Items for SCDOT to Consider:

- Continue to advance the development and implementation of BMS software and consider adopting the identified BMS best practices

Bridge Maintenance and Priority Repair Procedures

Topic Introduction

Bridge maintenance activities are actions or treatments done to a bridge to meet operational needs and/or to extend the service life of a bridge. These actions can be classified as preventive maintenance or routine maintenance.

Preventive maintenance (also called preservation) are actions that extend bridge service life through the application of cost-effective treatments to bridge elements while bridges are in good or fair condition⁹. Preventive maintenance activities attempt to slow future deterioration and defer (or potentially avoid) the much larger costs associated with bridge rehabilitation or replacement that could result without such actions.

Routine maintenance is defined as activities performed in reaction to an event, season, or activities that are done for short-term operational needs that do not have preservation value.¹⁰ Examples of routine maintenance include cleaning drains, removing debris, repairing storm damage, or patching a concrete deck with asphalt.

Many preventive maintenance actions are eligible for federal funds, based on each agency's agreement with their respective FHWA Division office. However, routine maintenance activities are not eligible for federal funds.

State and local bridge maintenance crews often complete a combination of routine and preventive maintenance. In some cases, bridge maintenance crews also have the capability to perform rehabilitation or replacement actions on small bridges and culverts.

A bridge inspection may identify a need for routine or preventive maintenance, which can be a high priority repair/action. Well-qualified bridge inspectors, sometimes supplemented with expert structural engineers, make the determination of the urgency of such actions.

The FHWA requires that certain needed repairs/actions, called "critical findings", be reported to the FHWA and tracked to ensure that they are taken care of promptly. The FHWA defines a critical finding as "a structural or safety related deficiency that requires immediate follow-up inspection or action."¹¹ Similarly, the National Bridge Inspection Standards require that owners "assure that critical findings are addressed in a timely manner," and must "notify the FHWA of the actions taken to resolve or monitor critical findings."¹²

For example, when a bridge load rating analysis concludes that load posting signs need to be installed (see [Figure 9](#) for an SCDOT example), the agency should have a

Figure 9: SCDOT Bridge Load Posting Sign



⁹ See "Bridge Management" report section for details on FHWA bridge condition rating designations.

¹⁰ "FHWA Bridge Preservation Guide", Spring 2018, <https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf>

¹¹ Federal-aid Program Overview, Bridge Program National Bridge Inspection Standards, August 2012, www.fhwa.dot.gov/federal-aidessentials/companionresources/87nbis.pdf

¹² Federal 23 CFR Part 650 - National Bridge Inspection Standards

process and procedure to ensure the sign is placed promptly. Currently, the FHWA requires posting signs be placed on the bridge as soon as possible but no later than 30 days after a load rating determines a need for such posting.¹³

Organization

Identify National and Peer Practices

Maintenance and repair activities performed on bridges by peer states include a wide variety of activities. Variables tend to be internal capacity, training, and the preservation and repair needs of the respective agency's bridges.

Typical bridge maintenance activities include concrete spall repairs, expansion joint repair or replacement, steel localized cleaning and painting, deck sealing, and cleaning and washing portions of bridges. More advanced self-performed maintenance practices identified through project outreach efforts included the following:

- Bearing alignment or replacement, placement of flexible overlays, concrete crack injection, correction of erosion issues, structural steel repairs, and shotcrete concrete repairs (Michigan, West Virginia and Virginia)
- Selective replacement of culverts and small bridges (South Carolina, North Carolina, Virginia and West Virginia)
- Dedicated maintenance crews for long-span signature bridges and movable bridges (South Carolina, Michigan and West Virginia)
- Centralized statewide bridge repair crew that can perform advanced repairs including straightening and repair of structural steel, repair of concrete structures, and placement of temporary supports (Michigan)

Additionally, many of the peer states utilize annual bridge maintenance contracts to perform the needed repairs or to supplement their in-house maintenance crews. For example, New Jersey is separated into three (3) regions, and each region annually issues two bridge maintenance contracts. One contract is for preventive (preservation) bridge repairs. This contract included candidate bridges and the required repairs are selected based on bridge inspection records using their BMS.

Like SCDOT, peer states, as well as other states contacted, usually contract out their steel bridge painting (coating) needs. The extensive preparations required (i.e., enclosures needed to capture blast medium, residue and provide climate-controlled environment for the new coating), training and the extensive personal protective equipment required for workers generally make repainting of bridges too expensive and impractical to perform in-house.

Funding

Bridge maintenance funding typically is included in most allocations to districts for the overall highway maintenance program. However, several noteworthy funding practices were identified during peer state interviews include the following:

- Dedicated budget for high priority bridge repairs (Delaware, Michigan, New Jersey and Virginia)
- Dedicated structure maintenance and structural painting fund (Delaware and New Jersey)

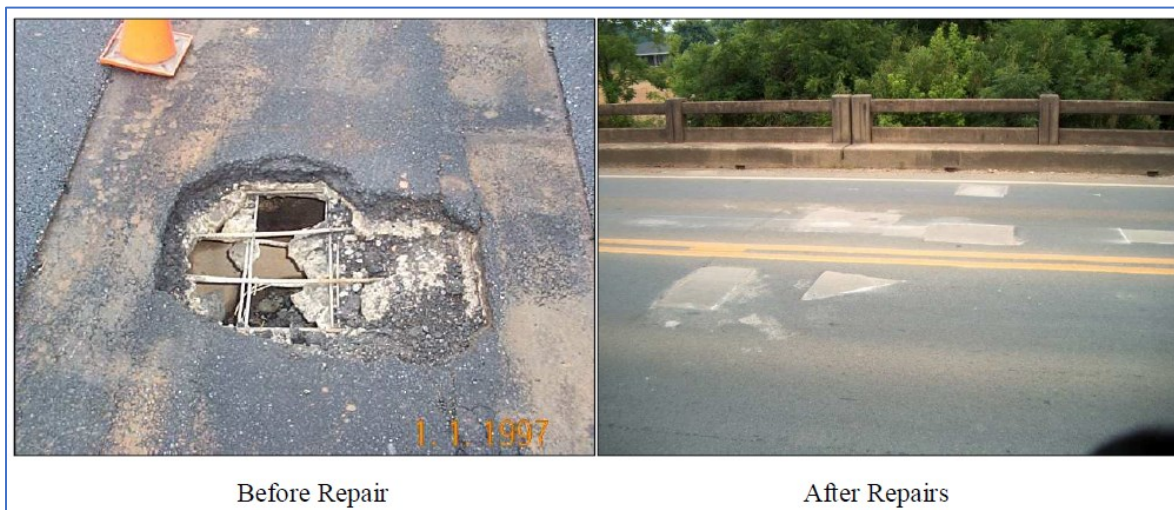
¹³ FHWA Memorandum, Timeframe for Installing Load Posting Signs at Bridges, April 17, 2019, <https://www.fhwa.dot.gov/bridge/nbis/190417.pdf>

- Asset maintenance contracts, similar to the one used by SCDOT for movable and some complex bridges, are extensively used in Florida and also selectively used in Virginia and Georgia
- Virginia has two (2) district-allocated funding practices of note:
 - Funding for complex and time-consuming maintenance activities which can be expended by either state personnel or by contract forces
 - Funding for bridge cleaning and painting, performed either by state personnel or contract forces

Manuals and Policies

Georgia, Michigan, and Virginia have bridge maintenance manuals of varying detail. West Virginia issues maintenance directives to provide direction and guidance. Georgia’s “Bridge Structure Maintenance and Rehabilitation Repair Manual¹⁴” provides guidance on over 50 preventative and corrective maintenance activities. This manual was designed to address the most common types of bridge structure distress by outlining practical procedures for corrective and preventive maintenance, such as the full depth deck repair shown in Figure 10.

Figure 10: Pictures from Minnesota Department of Transportation – Bridge Maintenance¹⁵



Training

For the peer states, bridge maintenance training is most often accomplished by on-the-job training. Other practices of note included the following:

- Michigan’s central bridge maintenance office provides training for new materials and procedures and schedules NHI Bridge Maintenance classes
- Virginia conducts a three (3) day workshop on a biennial basis in addition to *ad hoc* training

¹⁴ Georgia Department of Transportation, “Bridge Structure Maintenance and Rehabilitation Repair Manual,” June 29, 2012. Version 06.01.12

¹⁵ Pictures courtesy of the Minnesota Department of Transportation, “Bridge Maintenance Manual,” <https://www.dot.state.mn.us/bridge/maintenance-manual.html>

- West Virginia provides bridge maintenance training in the form of fall protection, first aid/safety, traffic control certification, product specific classes, commercial drivers' licenses, crane certification, and welding certification in addition to hosting NHI Bridge Maintenance training

The Minnesota Department of Transportation (MnDOT) generally is recognized as a national leader for its bridge maintenance program. MnDOT's "Bridge Maintenance Manual"¹⁶ and their Bridge Maintenance Academy Training Series includes the following elements:

- **Bridge Maintenance Academy I** is web-based training that provides bridge maintenance workers with an introduction to bridge components, bridge elements, design concepts, plan reading, concrete, safety, traffic control combined with an overview of bridge maintenance activities and practices.
- **Bridge Maintenance Academy II** is hands-on training that exposes bridge maintenance workers to forming, tying rebar, and pouring concrete for slabs and abutments; detecting, removing and patching delaminated area, installing stiffeners and/or diaphragms on structural steel members. This training also includes classroom presentations on concrete formwork, repairing structural steel, and placement of shotcrete.
- **Bridge Maintenance Academy III** (see [Figure 11](#)) includes hands-on training that exposes bridge maintenance workers to setting elastomeric bearings and steel beams; installing and bolting steel diaphragms; forming, tying rebar and pouring concrete for a reinforced concrete deck; installing strip seal expansion joint extrusions and glands; performing a full depth deck patch; performing strip seal gland repairs; placing cribbing and executing bridge jacking; as well as classroom presentations on strip seal expansion joint maintenance, bearing maintenance and bridge jacking considerations.

Figure 11: Pictures from Minnesota Department of Transportation – Bridge Maintenance Academy¹⁷



Placement of Load Posting signs

Like SCDOT, most of the peer states track placement of bridge load posting signs. In Delaware, all posting signs are clearly recorded (with locations and pictures) in the inspection reports.

¹⁶ Minnesota Department of Transportation, "Bridge Maintenance Manual," <https://www.dot.state.mn.us/bridge/maintenance-manual.html>

¹⁷ Pictures from "MnDOT Bridge Maintenance Academy," a MnDOT presentation, <http://www.apwa-mn.org/userfiles/ckfiles/files/MnDOTSondagCooper.pdf>

In Michigan and Virginia, a photo showing the installed load posting sign must be uploaded into their BMS. As part of the inspection procedure, the inspector verifies that the sign is present and matches the recommended posting.

SCDOT Current Practices

SCDOT performs bridge maintenance activities in each of their seven (7) districts. While the maintenance activities performed vary between districts and crews, each district has maintenance crews and at least one (1) maintenance crew typically is identified as a bridge maintenance crew. SCDOT outsources maintenance and management of specialty bridges.

Bridge maintenance needs discovered during bridge inspections are entered into the agency HMMS, which is used to develop the district specific bridge maintenance priorities and track work performed.

Manuals and Practices

SCDOT's maintenance crews and bridge inspectors are the agency's "eyes and ears" for determining bridge maintenance and priority needs. Common bridge maintenance activities completed by SCDOT crews include the following:

- Deck patching and repair
- Crack sealing
- Deck expansion joint replacement
- Bridge railing and approach guardrail I repairs
- Clearing of debris in streams in advance of or following storms
- Load posting sign installation and replacement

Of note, most bridge maintenance crews are capable of replacing small bridges and culverts using standard plans. SCDOT contracts out steel bridge painting (coating) needs.

In addition to the "normal" bridge maintenance activities performed, the BMO in collaboration with the Districts has developed an excellent process for handling bridge emergencies. The resources of the bridge inspection teams, bridge maintenance staff, and use of emergency contracting procedures are leveraged to first assess conditions, and then effect repairs to ensure the safety of the motoring public, returning the bridge to full capacity as soon as possible.

Training

The training of the bridge maintenance staff is typically carried out through "on-the- job training."

Placement of Load Posting Signs

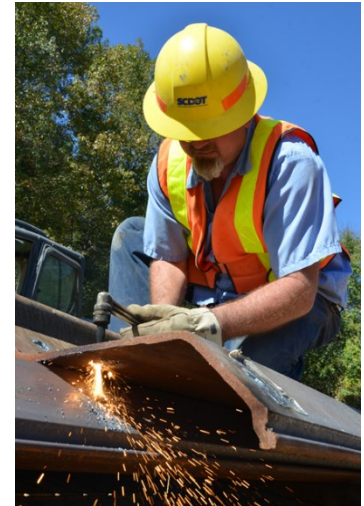
District maintenance crews handle the placement of bridge posting signs when directed by the BMO. FHWA requires that once a posting sign is placed, a photograph is taken to provide documentation and placed in the bridge file

Commendable/leading SCDOT Practices include:

Commendable practices for the SCDOT bridge maintenance program include the following:

- Providing a proven ability to handle emergencies such as extreme storm events, flooding, and vehicle or vessel collisions
- Having some district maintenance crews capable of performing major repairs and replacing small bridges and culverts on secondary routes using standard plans

Figure 12: SCDOT Cutting Sheet Pile for a Bridge Repair



- Outsourcing the maintenance and management of specialty bridges

Enhancement Items for SCDOT to Consider:

- Create a manual for identifying standard bridge maintenance actions statewide
- Provide the National Highway Institute’s (NHI) two-week Bridge Maintenance course
- Expand asset maintenance contracting to include additional complex bridge structures that have specialized maintenance needs

Bridge Critical Findings and Priority Repairs

Identify National and Peer Practices

In a 2011 report, “Critical Findings Review for the National Bridge Inspection Program”¹⁸, the FHWA found that “Areas of good practice include:

- Developing and communicating policy, definitions, and descriptions of critical findings and categorizing the deficiencies;
- Monthly schedule/audit reporting of critical findings;
- Automated critical findings notification systems; tracking critical findings; and
- Follow-up inspections/posting guidelines to close the loop on critical findings.”

Like SCDOT, several peer states have business processes and management systems that track and prioritize high priority bridge repair needs. As described below, North Carolina and Michigan rank high priority inspector findings with respect to urgency to do the repair, with the highest level being a critical finding that is reported to FHWA.

Michigan has a Request for Action (RFA) team that meets monthly to categorize and prioritize inspector findings, track progress of repairs or other needed action such as load rating, hands-on inspection, material testing, and status of design for the repairs. Priority repairs are categorized as follows:

- **Priority Level 1** – Emergency. Repairs are to be completed as soon as possible, either by the Statewide Bridge Repair Crew or emergency contract. A critical finding needs to be reported to the FHWA.
- **Priority Level 2** – Critical. Repairs are to be scheduled within 90 days, either by the statewide bridge crew or contract.
- **Priority Level 3** – Primary. Repairs are to be completed within 12 to 18 months.
- **Priority level 4** – Non-Critical. The distress is non-critical, and repairs should be programmed through the normal call for projects process, or repairs made by routine maintenance.

A guidance document describes each of the priority levels and shows the make-up of the committee. The committee meets monthly to prioritize RFAs and track action items. Michigan DOT’s inspection management application, *MiBridge*, is used to track and manage RFAs, and provide performance reports on the RFA program.

North Carolina has a Prompt Action Request (PAR) process that prioritizes bridge repair needs as follows:

- **Critical Finding.** This requires a plan be developed within 10 days and repair done in 45 days.

¹⁸ “Summary Report of Critical Findings Reviews for the National Bridge Inspection Program”, December 2011, <http://www.fhwa.dot.gov/bridge/nbip/critical.pdf>

- **Priority Maintenance.** The general expectation is the repair should be completed within a year.
- **Routine.** The repairs and timing of repair is determined by the District.

The PAR process is managed in NCDOT’s bridge inspection management system called *WIGINS*, where bridge managers can review all tiers anytime.

SCDOT Current Practice

SCDOT has a well-defined process for identifying, prioritizing, responding to and tracking bridge deficiencies as described in the draft BIGD¹⁹. Critical findings, as defined by the FHWA, are classified based on the following levels of severity:

- Urgent (color code red) require immediate bridge closure
- Restrictive (color code orange) require immediate bridge restriction such as lane and/or shoulder closure, or load restriction
- Serious (color code yellow) require immediate maintenance action

The draft BIGD provides procedures for identification, notification, follow-up, bridge closure, load rating and repair recommendation identification.

While the discovery, tracking and closure of Critical Findings are important to protect the traveling public, the occurrence rate of Critical Findings is generally low. Much more common are repair recommendations on the state’s bridge inventory to maintain bridges for years to come. SCDOT logs repair and maintenance recommendations in the HMMS. Repair recommendations are made based on the time frame in which the bridge owner should complete the recommended repair. SCDOT “flags” these maintenance and repair needs as follows:

- Priority A - Timeline for Work Completion once logged in HMMS is 30 calendar days
- Priority B - Timeline for Work Completion once logged in HMMS is 90 calendar days
- Priority C - Timeline for Work Completion once logged in HMMS is 365 calendar days

The draft BIGD provides examples of each type of priority flag to provide consistent process and procedure for common repair and maintenance needs.

Commendable/leading SCDOT Practices include:

- Currently implementing the enhanced critical deficiencies prioritization process as described in the draft BIGD
- Supplying detailed policies and processes in the Agency’s BIGD document to address critical deficiency prioritization, response, and tracking
- Providing excellent agency coordination and response to emergency situations such as hurricanes, natural disasters, vehicle or vessel impact damage, and discovery of advanced deterioration

Enhancement Items for SCDOT to Consider:

- Complete implementation of the critical deficiencies prioritization process described in the draft BIGD

¹⁹ “Bridge Inspection Guidance Document” – Chapter 8, Deficiency Reporting

Scour Assessment & Emergency Response

Topic Introduction

Bridge scour is the erosion of sediment, such as sand and gravel in a streambed, riverbed or ocean inlet from around a bridge's foundation, either at the abutment(s) or the pier(s). Scour holes, caused by swiftly moving water, can expose and undermine piles, footings, and other critical foundation elements, compromising the integrity of a structure.

In the United States, bridge scour is one of the three (3) main causes of bridge failure (the others being collision and overloading). It has been estimated that 60% of all bridge failures result from scour and other hydraulic-related causes. The USGS "Water-Resources Investigations Report 95-4009²⁰" identifies scour as the most common cause of highway bridge failure in the United States, where during the period of 1961-1976, 46 of 86 major documented bridge failures resulted from scour near piers,

The collapse of a bridge in upstate New York in the late 1980s led to the establishment of federal regulations requiring all bridges over water be inspected underwater so their foundations could be assessed. In the case of the New York bridge over the Schoharie Creek, the bridge's foundation was such that as water scoured out material under the foundation it became unstable and failed, bringing down an entire portion of the bridge.

A bridge's vulnerability to scour depends on many factors including its design, the type of channel bottom (bed) material, water velocity and how prone the waterway is to flood. To properly assess this vulnerability, engineers conduct a hydraulic analysis to determine how susceptible the bridge is to any of these opportunities for scour.

In addition to an analysis, bridge inspectors will perform an onsite assessment of field conditions, utilizing specialized underwater dive teams if required. For example, as part of this assessment, inspectors will typically observe and document how a river and/or stream channel tends to move and migrate naturally over time. These channel changes could result in more water being directed towards bridge foundations resulting in an increased susceptibility to the effects of scour.

One commonly observed example where the risk of scour is low is when a bridge foundation is constructed on bedrock. No matter how much water flows against it or around it, a bridge with this foundation design would not be susceptible to scour.

The FHWA has established guidelines for determining which bridges are susceptible to scour. These include a combination of field and analytical assessments. A hydraulic analysis is typical and requires a computer model assessment of how the water flows in and around the bridge foundations. If a bridge is susceptible to scour where it might cause a full or partial collapse, the bridge is defined as "Scour Critical."

As noted above, scour around a bridge foundation can result in an emergent structural condition. Other prominent structural conditions can be the result of advanced structural deterioration, vehicle or vessel impact, vehicle overloading and fire to name a few of the natural and man-made events that can severely impact a bridge. Agency planning and response protocols for scour and other structural emergencies are generally similar in nature and will be discussed in this section.

Organization

Identify National and Peer Practices

All national and peer states have bridge scour assessment procedures. While Georgia and West Virginia self-perform underwater inspections, the remainder of peer states rely on a mixture of in-house and consultant staff

²⁰ <https://pubs.er.usgs.gov/publication/wri954009>

to perform the top side and underwater scour assessment of their bridges. The peer states also use a combination of consultants and in-house hydraulic design staff to perform the necessary hydraulic analyses for determining scour criticality and potential mitigation measures. Most peer states schedule underwater inspections to coincide with a routine biennial NBIS bridge inspections but on a four-year frequency (48 months).

As required by FHWA, all states have developed a Plan of Action (POA) for all scour critical bridges. These POAs are reviewed as part of the normal NBIS bridge inspection process (24 months), or during each underwater bridge inspection (every 48 months), depending on the state specific agreement with their local FHWA office.

The peer states typically do not have broad categories of triggering events for re-evaluation of their scour critical bridges; however, most perform scour re-evaluation after significant storm events. Indicators used include either USGS stream gauges or *BridgeWatch* (a commercially available web-based, real-time, monitoring software solution), which is used by several of the peer states. Additionally, some states include specific triggering events within their bridge specific POA for their respective scour critical bridges for determining when to initiate a scour re-evaluation.

SCDOT Current Practices

Currently, scour assessments are conducted through a combination of in-house bridge inspection staff and consultants. The bridge inspectors perform the field assessment in conjunction with a consultant underwater inspection team.

This team performs an assessment of both the above water conditions and below water conditions of the bridge's abutments, piers, and any scour mitigation features present such as rip-rap or concrete-based alternative material. The purpose is to determine if there have been any changes since the prior inspection. In addition, SCDOT's in-house hydraulic design support team performs a hydraulic analysis of the waterway to determine such factors as the potential depth of scour, the scour critical velocity and stream bed mobility potential.

This "full scour" inspection or assessment, also known as an underwater inspection, is performed at intervals not to exceed 60 months but may be more frequent as determined by the district bridge inspection supervisor, the bridge inspection team leader, or the BMO. These procedures are outlined in the Scour POA developed for all scour critical bridges. The scour POA includes requirements (triggering events) as outlined in the draft BIGD.

Triggering events for bridge scour re-evaluation are normally identified during the biennial NBIS Inspection but may also be recommended by the district maintenance office or the BMO. Specifically, if any of the following observations are made a re-evaluation is performed:

- Channel changing course
- Evidence of erosion or scour around footings and embankments
- Large amounts of drift (debris) around substructure
- Evidence of riprap, bank protection removed or altered
- Stream work performed by others that might change the hydraulic characteristic at the bridge (such as dam removal upstream)
- Storm events

These conditions are included in Attachment 06 in the draft BIGD, "Bridge Scour – Item 113 Re-evaluation Form".

Commendable/leading SCDOT Practices include:

- Incorporating full scour inspection guidance into the draft BIGD
- Utilizing and coordinate with an in-house Hydraulic Design Support team to perform hydraulic analysis

- Augmenting in-house staff with scour specific consultant inspection contracts for use statewide
- Identifying triggering events for scour re-evaluation and inclusion of these events in the draft BIGD

Enhancement Items for SCDOT to Consider:

- Schedule the underwater scour critical bridge inspections on a 48-month basis to coincide with a routine biennial NBIS bridge inspections
- Review each bridge-specific POA as part of the scope of work assigned to the underwater inspection consultant team

Process for Addressing Bridge Emergencies

Identify National and Peer Practices

All peer states have an emergency bridge assessment procedure whether for natural emergencies (hurricanes, flooding or other) or man-made emergencies (vehicle impact, vessel impact, fire or other). The peer states rely on a mixture of in-house and consultant staff to perform these emergency assessments. Generally, the “first call” is to in-house bridge inspection teams; however, some states have consultant inspection teams “on-call” as well for emergency bridge inspections, when the in-house resources cannot provide all of the services needed either due to lack of availability or technical expertise. All peer states have a communication procedure in place that utilizes cell phones, with a documentation process for those phone calls. Phone calls are typically documented through follow-up emails in a manner similar to SCDOT’s process.

SCDOT Current Practices

The recently developed draft BIGD is an excellent document and quite comprehensive. The document reflects a compendium of best practice policies and procedures currently in use by industry. In addition to scour assessment as described above, other “non-routine” bridge inspections are required due to vehicle (or vessel) impact, flooding (due to rainfall or hurricane) or as warranted by other structural conditions (e.g., pin & hangar connections, fatigue cracks, accelerated corrosion, etc.) as outlined in the draft BIGD.

The process for a damage inspection (outlined in Chapter 4.7.2 in the draft BIGD) includes an immediate assessment of the bridge to ensure the safety of the motoring public. If a bridge closure is warranted, the formal bridge closing procedure as outlined in Chapter 8.6 is followed. This procedure requires SCDOT staff to marshal the necessary resources (in-house and consultant) to fully inspect, evaluate and analyze the bridge and the damaged component(s). A specific repair/rehabilitation plan is then developed for the damaged structure. If the required repairs cannot be completed with in-house bridge maintenance crews, staff can engage selected contractors utilizing SCDOT’s emergency contractor selection process. This process allows repairs to be completed as expeditiously as possible and practical, to reopen the facility to an unrestricted condition. Due to the critical nature of these actions, all communications are performed via phone call with the parties identified in Chapter 8.6 of the draft BIGD, with follow-up e-mail documentation of the telephone conversations

The process for an impending hurricane or extreme rainfall event (outlined in Chapter 4.10 in the draft BIGD), includes the deployment of stream flow gauges to the affected watershed(s). The BMO establishes the staging and deployment plan in conjunction with the District Bridge Inspection Supervisor and the bridge inspection teams. After the event, final deployment directives are issued to both topside and underwater inspection teams, focusing on the safety of the public with SCDOT maintenance crews barricading bridges for temporary closures until more extensive evaluations and/or repairs can be made. Specific attention is be paid to scour critical bridges during these post event assessments as required by the bridge POAs. Due to the critical nature of these actions, all communications are performed via phone call, with the parties identified in Chapter 8.6 of the draft BIGD, with follow-up e-mail documentation of the telephone conversations.

Commendable/leading SCDOT Practices include:

- Incorporating full damage inspection guidance into the draft BIGD
- Incorporating full hurricane and storm inspection guidance into the draft BIGD (Section 4.10)
- Developing a rapid deployment process for placing USGS stream flow gauges on several streams in advance of a hurricane or extreme rainfall event, where USGS does not have a permanent stream flow gauge installation
- Piloting the use of *BridgeWatch*, a commercially available, web-based, real-time, monitoring software solution, on 1600 bridges
- Developing a process for bridge closings in the draft BIGD that includes communication procedures and flowcharts

Enhancement Items for SCDOT to Consider:

- Include an emergency on-call/response section in the consultant bridge inspection contracts issued by the BMO
- Expand the use of USGS Water Alert service, based on flow rates at USGS gauges, and BridgeWatch, which is triggered by either flow rates or rainfall
- Include a pre-event assessment of the waterway for debris at the bridge piers or abutments, to be removed by district maintenance crews in advance of the storm
- Formalize policies and procedures for performing post-event evaluations to identify opportunities to improve responsiveness and effectiveness

Cost-Effective Methods for Scour Prevention**Identify National and Peer Practices**

All of the peer states interviewed use a combination of state design, FHWA and U.S Army Corp of Engineers guidance, and USGS stream statistical data to develop new bridge designs that mitigate or eliminate the risk of scour. Based on the experience and observations of the consulting team, this is a common national practice as well. Most of the peer states develop scour countermeasure plans within their bridge maintenance, preservation, and/or rehabilitation programs. These scour countermeasures are developed for bridges that are in otherwise fair condition (need no major reconstruction) and will not be replaced in the foreseeable future. One peer state, New Jersey, developed several bridge specific countermeasure designs and bundled them together into one contract for construction.

SCDOT Current Practices

SCDOT's Hydraulic Design Unit performs or oversees the hydraulic design for new bridges being constructed or reconstructed over waterways. If a consultant is developing the new bridge design over a waterway, the consultant will perform the hydraulic design, then the Hydraulic Design Unit will perform a quality review of that design. The Hydraulic Design Unit has developed excellent South Carolina specific design guidance in collaboration with USGS and uses FHWA, FEMA and U.S. Army Corp of Engineers guidance. This guidance includes bridge scour envelope curves specifically for South Carolina bridges. As scour critical bridges are programmed for replacement, the structural design is developed to eliminate the scour critical features, thereby reducing future risk.

Commendable/leading SCDOT Practices include:

- Developing South Carolina bridge scour envelope curves in conjunction with the USGS

Enhancement Items for SCDOT to Consider:

- Develop a program for designing/developing scour countermeasures, including stream armoring and channel protection, for scour critical bridges that are not currently scheduled for bridge replacement and likely, will not be for the foreseeable future

Oversize and Overweight Permitting Program

Topic Introduction

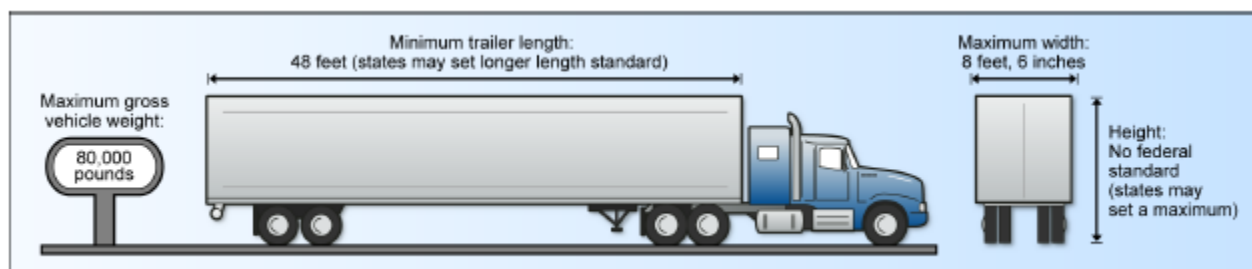
Commercial vehicles and loads are generally of a size and weight that allows them to freely travel on our nation's highways. However, some are too large and/or too heavy to operate on a highway without posing a safety risk or potentially damaging the transportation infrastructure.

A vehicle and load are considered oversized when the vehicle and the cargo it carries exceed the legal dimensions of length, width or height. This is defined by the applicable federal and/or state requirements in which the vehicle will be traveling. Of note, only states establish height requirements.

Weight limits may be based on a per axle basis, two or more closely spaced axles, tandem axle, Federal Bridge Formula²¹ or gross vehicle weight. The following definitions are used in conjunction with the Federal Bridge Formula:

- Gross Weight
The weight of a vehicle combination and its load. The federal gross weight limit on the Interstate System is 80,000 pounds.
- Single Axle Weight
The federal single axle weight limit on the Interstate System is 20,000 pounds.
- Tandem Axle Weight
Tandem axle means two axles spaced not less than 40 inches nor more than 96 inches apart and having at least one common point of weight suspension. The federal tandem axle weight limit on the Interstate System is 34,000 pounds.
- Consecutive Axle Weight
Federal law states that any consecutive two or more axles may not exceed the weight as computed by the formula even though the single axles, tandem axles, and gross weights are within the legal requirements.

Figure 13: Federal Vehicle Height and Width Maximums



Source: GAO. | GAO-15-236

Width and weight standards are set at maximums. The width standards generally require states to allow vehicles to be up to, but not exceed, 8-feet 6-inches wide. Similarly, the weight standards generally require states to allow vehicles to be up to, but not exceed, 80,000 pounds in total vehicle weight.

²¹ The Bridge Formula establishes the maximum weight any set of axles on a motor vehicle may carry on the Interstate highway system, see https://ops.fhwa.dot.gov/freight/publications/brdg_frm_wghts/

States cannot set lower width or weight maximums when these federal standards apply. Vehicles exceeding these width and weight standards may be considered oversized or overweight and require a state-issued permit before traveling through the respective areas. Some states such as North Carolina allow axle weight tolerances, e.g. 10% above the federal standards on non-Interstate routes for certain types of loads such as agricultural products without the requirement of a permit.

Organization

Identify National and Peer Practices

Nationally, the permitting maximum is 18 feet in width, 18 feet in height, 200 feet in length and 299,000 in weight. All peer states base their permits on the national clearance envelopes and the Federal Bridge Formula like SCDOT. However, the range of allowable values varies significantly by state as indicated below:

- Width clearances are from 14 feet to 16 feet
- Vertical clearances are from 14 feet to 18 feet
- Overall length limits range from 100 feet to 150 feet
- Loads vary from 115,000 lbs. to 250,000 lbs.

Peer states generally report proportional levels of increased permitting review intensity as loads approach the maximum allowed values.

SCDOT Current Practices

SCDOT's OSOW permitting section reports to the Director of Maintenance and is physically located at SCDOT headquarters. In 2018, the OSOW Office processed over 85,000 permits. These permits generated approximately \$3M in revenue, which is utilized to support the state funded bridge program.

South Carolina standards for size and weight mirror the FHWA requirements and match [Figure 13](#). South Carolina Code of Law sets a maximum height of 13-feet 6-inches, with an exception of 14 feet for trucks carrying trucks²².

South Carolina web publication, "Guidelines for Movement over South Carolina Highways of Oversize and Overweight (OSOW) Vehicles and Loads"²³ provides detailed guidance on OSOW Office operations including fees, hours of operation and expectations of all parties. Among the more significant details in that document is a stated performance expectation that the OSOW Office will issue a permit the same day if the permit is submitted correctly before 2:00 PM. Exceptions include superloads defined as greater than 130,000 pounds, and loads over 16 feet wide and/or 16 feet high, which may take up to a maximum of five (5) business days for review and issuance.

Commendable/leading SCDOT Practices include:

- Issuing permits the same day as requested, which is industry best practice

Enhancement Items for SCDOT to Consider:

- Develop a succession plan to address long-term OSOW staffing needs

²² South Carolina Code of Laws, SECTION 56-5-4060, see <https://www.scstatehouse.gov/code/t56c005.php>

²³ https://www.scdot.org/business/pdf/osow/OSOW_Guidelinesfor_movement.pdf

Manuals and Guidance

Identify National and Peer Practices

All peer states have a link to their respective OSOW permits on their web page; however, not all links are as easily found as SCDOT's. Some OSOW permits are issued by the Motor Vehicle Commission/Department. For most states with an automated OSOW permit process, the hauler is directed to a specific website for the permit.


SCDOT Current Practices

The SCDOT website for OSOW permits is well designed and understandable (see <https://www.scdot.org/business/permits-osow.aspx> and Figure 14). It is business friendly, allowing haulers to set up an escrow account and/or pay directly for permits with a credit card.

Figure 14: Image of SCDOT Oversize and Overweight Website


****IMPORTANT WEIGHT RESTRICTION AND LANE REDUCTION ON I-526 EAST AND WEST BOUND OVER THE WANDO RIVER BRIDGES****

EFFECTIVE IMMEDIATELY: NO OVERWEIGHT TRUCKS AND/OR LOADS OVER 100,000 LBS GROSS WEIGHT WILL BE PERMITTED TO TRAVEL ON I-526 EAST OR WEST BOUND BETWEEN VIRGINIA AVE AND LONG POINT RD. ALL OVERWEIGHT TRUCKS AND/OR LOADS WITH A GROSS WEIGHT OF 100,000 LBS. AND LESS WILL BE RESTRICTED TO TRAVEL IN THE RIGHT LANE ONLY WHEN TRAVELING EAST OR WEST BOUND.



Inclement Weather

In the event of inclement weather during the winter months, the permit office will be closed per the Governors instructions for state offices in the Richland and Lexington County area. Please visit the [road conditions page](#) to find out the condition of the roads in each county you may be traveling in or to.



Special Oversize/Overweight Restriction Waiver Request

If a special Oversize/Overweight restriction waiver is needed in the event of a national, statewide, regional or county emergency, the requesting governmental entity or utility should contact and work with the South Carolina Emergency Management Division at [\(803\) 737-8500](tel:803-737-8500) to request the waiver.

An Oversize/Overweight restriction waiver is currently in place. [View the Waiver](#)

If you are seeking clearance to bypass the weigh station/scale facility because an emergency condition exists, please contact the State Transport Police direct at [\(803\) 896-5500](tel:803-896-5500).

Related Links

- [SC Current Road Conditions](#)
- [SC's Code of Laws, Uniform Act Regulating Traffic on Highways](#)
- [SCDOT Bridge Load Restrictions](#)
- [Truck Size and Weight](#)

Related Documents

- [100,000 lbs Permit Application](#)
- [2019 Holiday Travel Restrictions and Office Closures Account Set-Up Form Amendment Form](#)
- [Bulk Agriculture Application](#)
- [House Moving License Application](#)
- [House Moving Permit Application](#)
- [Multi-trip \(Annual\) Permit Application](#)
- [SC Oversize/Overweight Truck Rt. Map Application Form](#)
- [SC Oversize/Overweight Truck Route Map](#)
- [SC Size and Weight Guidelines](#)
- [SC Truck Route Map 11 X 17](#)
- [Single Trip Permit Application](#)
- [STAA Truck Network Map for SC](#)
- [Straight Truck Application](#)
- [Update Request Form](#)
- [Wide Load Permit Application - Over 16 ft](#)

Specific permit applications are provided on the website. These applications can be submitted by e-mail, fax or mail. Single trip, multiple trip, and self-issue multiple trip, with or without OSOW truck route maps, are all clearly described. An interactive map is provided for haulers using local roads showing the local and SCDOT bridges that are posted with bridge load restrictions. Also, there are maps showing truck routes for trucks greater than 100,000 lbs. and including a truck network map for tandem tractor trailers.

Commendable/leading SCDOT Practices include:

- Providing an easily understood and navigated OSOW website

Enhancement Items for SCDOT to Consider:

- Develop permit application forms that can be completed electronically (e.g., in a writable “.pdf” format) to support direct submission to the SCDOT permit office

Automation

Identify National and Peer Practices

FHWA Report

A 2018 report prepared by FHWA titled, “Best Practices in Permitting Oversize and Overweight Vehicles”²⁴ included the following statistics:

- 30 states used automated OSOW permit systems
- Seven (7) states were in the process of adopting an automated OSOW permit system
- 13 states indicated that they were not considering automating their OSOW permitting process

Of the 37 states identified as using (or actively pursuing) an automated OSOW permitting systems, the common systems were as follows:

- 17 states use *Bentley SuperLoad*
- 11 states use *ProMiles*
- Three (3) states use *Hexagon*
- Six (6) states use a “home-grown” system.

Peer States

Peer state outreach for this project include the following updates to the information in the referenced 2018 FHWA report:

- Delaware, Michigan and North Carolina are the only peer states that reported reviewing and issuing OSOW permits manually
 - Delaware is working with a consultant to install the Hexagon automated permit system
 - Michigan is using *Bentley SuperLoad* in the background of their manual permitting system
- Florida has developed their own automated permit system
- All other peer states are using either the Bentley SuperLoad permit system or the ProMiles permit system

In both the automated permit systems and the manual permit systems, thresholds exist on size and weight that when exceeded, require a manual review before the OSOW permit is issued. In all the peer states, these types of OSOW vehicles are considered superloads.

SCDOT Current Practices

The SCDOT permit office currently reviews and issues all permits manually. The BMO is working with a consultant to develop and install an automated permitting system. This customizable-off-the-shelf software (COTS) system is compatible with SCDOT’s load rating software.

Commendable/leading SCDOT Practices include:

- Configuring the *Hexagon* commercial off-the-shelf permitting system to provide increased efficiencies and allow for easier updates across one software platform

²⁴ <https://ops.fhwa.dot.gov/publications/fhwahop17061/index.htm>

Enhancement Items for SCDOT to Consider:

- Reach out to the states identified as *Hexagon* users (Louisiana, Oklahoma and Tennessee) for lessons learned on implementing and using this system
- Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to develop updated truck route maps

Fee Schedule

Identify National and Peer Practices

In general, OSOW permit fees fall into the following categories:

- Single Trip
- Multiple Trip (Annual Basis)
- Special (homes, ocean borne, tow truck etc.)
- Superloads

Table 4 identifies the base fees for SCDOT and the peer states reviewed:

Table 4: Peer State Oversize / Overweight Fee comparison

STATE	SINGLE TRIP	MUTIPLE TRIP/YEAR	SPECIAL	SUPERLOAD
South Carolina	\$30-\$50	\$100	\$100 (House)	\$100-\$350
North Carolina	\$12-\$48	\$100-\$200	\$100 (House)	\$112
Virginia	\$20-\$30	\$100-\$500		\$30-\$100
Georgia	\$30	\$150-\$500	\$500 (Tow Truck)	\$125-\$500
Florida	\$5-\$25	\$20-\$540		\$70-\$500
West Virginia	\$20		\$150 (Ocean Borne)	\$200-\$500
New Jersey	\$10-\$20		\$100 (Ocean Borne)	\$210
Delaware	\$30			\$60
Michigan	\$15-\$65	\$30-\$100		\$264

In addition to the base permit charged, SCDOT and the peer states also vary in terms of additional charges and fees that may apply. Examples include the following:

- South Carolina and New Jersey add a transaction fee for each permit (\$10 in SC and \$12 in NJ) but NJ also adds a 5% administration fee
- Florida adds a mileage fee (\$0.25-\$0.50/mile) on their Single Trip Permit
- West Virginia adds a bridge evaluation fee ranging from \$150 - \$750 depending on the number of bridges evaluated

In some of the peer states, OSOW permit fees are retained by the DOT; in others, permit fees go into the State’s general treasury. This diversity of practice also is true from a national perspective.

SCDOT Current Practices

As noted previously, the OSOW Office processed over 85,000 permits in 2018. These permits generated approximately \$3M in annual revenue, which is returned to the SCDOT and utilized to support the state funded bridge program.

Commendable/leading SCDOT Practices include:

- Returning permit fees to SCDOT to support the state funded bridge program

Enhancement Items for SCDOT to Consider:

- Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to identify opportunities to consolidate/simplify permit categories and to determine the fairness and equity of the fee structure

Coordination on Locally Owned Bridges

Topic Introduction

Federal NBIS regulations apply to all structures defined as highway bridges located on public roads on or within each state's borders. These regulations hold each state responsible for the bridge inspection and load ratings of all bridges regardless of ownership. Thus, each state DOT must inspect, or require the inspection of, all highway bridges located on its public roads. Further, each state DOT also must load rate, or requiring the load rating of, each bridge as to its safe load carrying capacity and must post restrictions (or close) the bridge when the maximum legal loads exceed that allowed under the operating legal load rating. Exceptions to the state DOTs responsibility within its respective state boundaries are any federally owned bridges, which are the responsibility of the respective federal agencies.

Bridge inspections, load ratings, and posting or closure of these structures usually require coordination and the cooperation of the local owners. This arrangement generally works well and NBIS compliance is obtained. Yet, there are occasions when issues arise between the state and local entity that are difficult to resolve particularly when it comes to posting load restrictions and closures. To better ensure full NBIS compliance and public safety, several state governments have promulgated laws or regulations supporting their respective DOT's authority over inspection, load rating, posting restrictions and closing of locally owned bridges.

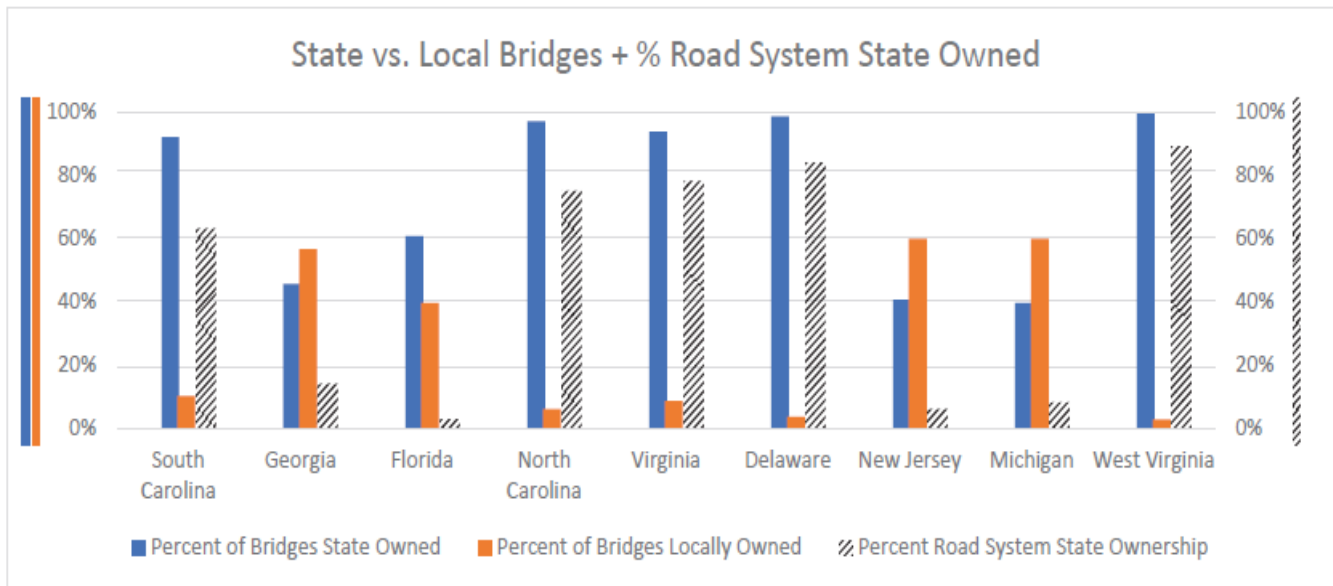
South Carolina is different from most states in that the majority of public roads and bridges located within the state are the jurisdictional responsibility of the SCDOT. However, approximately 9% of publicly owned bridges are located on city and county road networks. These bridges are the focus of this report topic.

Organization

Identify National and Peer Practices

While coordination on locally owned bridges varies from state to state, among the peer review states, Delaware, Georgia, North Carolina and West Virginia are most aligned with the SCDOT in that they perform all or most of the inspections of their locally owned bridges. As shown in [Figure 15](#) below, the percentage of locally owned bridges compared with state owned bridges varies significantly, which can essentially skew the overall work effort expended by the state's respective bridge inspection staff on their local bridges.

Figure 15: Percentage of State versus Locally-owned Bridges and Road System Ownership



With respect to the load rating of locally owned bridges, Delaware, North Carolina and West Virginia use their in-house DOT staff to load rate these bridges while all the other states utilize consultant load rating teams. It is worth noting that Delaware and West Virginia have relatively few local bridges (less than 2% of their total bridge inventory), thus the additional in-house DOT staff effort required is proportionally small.

All peer states require that local bridge inspections, load ratings and QC/QA programs follow their respective established manuals and procedures. Similarly, if any of these functions are performed by consultants, the consultants are required to have a QC/QA program in place that meets the requirements outlined in the state’s manuals and procedures. When using consultant QC/QA, the state DOT will also have a QA program in place for the consultant produced inspection reports or load ratings.

In much the same way as states choose to exercise “home rule” as it relates to federal programs, local jurisdictions often will choose home rule when it comes to state programs. Similar to SCDOT, in some instances the peer states noted a reluctance from local bridge owners with respect to load posting or closing local bridges. Like SCDOT, the peer states interviewed indicated that once the DOT clearly explained the critical nature of the condition of the local bridge, using common sense language, the local bridge owner typically agrees with the state.

Florida and Illinois are two examples of states with statutory authority over locally owned bridges to support their respective State DOTs. Florida may assess costs for posting and closing bridges when the local entity does not take action within a specific time frame. After a specified time, Illinois may apply more stringent requirements as noted below:

“Failure of a LPA [Local Public Agency] to comply may result in the withholding of Motor Fuel Tax (MFT) allotments and the district not approving current MFT expenditures, or other actions determined by the Department.”

The Florida statute and Illinois “Bureau of Local Roads and Streets Manual (Chapter 6)” are included in Appendix E.

SCDOT Current Practice

SCDOT is responsible for bridge inspection, load rating and posting (or closing) for 865 locally owned bridges as well as the 8,431 state owned bridges in South Carolina. According to the National Bridge Inventory (NBI), local bridges represent over 9% of the total number of bridges in South Carolina. These locally owned bridges are

predominantly located on low traffic volume county roads but may carry school bus and emergency vehicle traffic. A portion of state transportation funds are allocated annually to each county in the state through a legislatively designed formula. These funds are administered by a County Transportation Committee charged with the responsibility of developing a program of work that may include maintenance, rehabilitation or replacement of bridges in addition to roadway improvements on the local road network.

SCDOT bridge inspection teams inspect locally owned bridges every two (2) years, or more often if required depending on age and condition, in compliance with the NBIS requirements. If special inspections are needed due to deterioration, vehicle impact or flooding, SCDOT bridge inspectors perform these as well. Although most of these bridges do not require a formal underwater inspection, any underwater inspections that are required are performed by SCDOT's consultants. SCDOT performs these services at no cost to the local entity.

As required by federal law, SCDOT also has responsibility for load rating locally owned bridges and requires the local owner to sign those local bridges for weight restrictions when required. According to SCDOT staff, cooperation and coordination with local agencies generally goes well. However, there have been occasions where the local agency does not accept or support the recommended load posting (or closing) due to impact on local travel patterns or other traffic, e.g. school buses. SCDOT has been responsive to these concerns, persuasive and ultimately successful but there are times when temporary load restrictions or even bridge closures must be implemented in order to comply with the NBIS. Importantly, the safety of the travelling public is always the first consideration in such situations. Because of federal requirements, when local owners are not responsive on these bridges that are not owned or maintained by SCDOT, this can lead to unfavorable reporting by FHWA on SCDOT's bridge program – even if only temporarily. A definitive state law, or regulation, clarifying and supporting SCDOT's responsibility and authority to post or close locally owned bridges could help ensure timely compliance in these situations while also streamlining the process.

From a bridge management perspective, SCDOT's approach to locally owned bridges is consistent with its practices for state owned bridges. This is in keeping with SCDOT's commitment to improving safety and mobility, maintaining and preserving existing transportation infrastructure, and increasing the efficiency and reliability of the road and bridge network for all users.

SCDOT Progress/Commendable Practice

- Performing all bridge inspections and load ratings for all locally owned bridges consistent with those on the state network
- Supplementing in-house bridge inspection teams and load rating capabilities with use of consultants to ensure safety of locally owned bridges
- Performing all above services at no cost to the local agencies

Enhancement Items for SCDOT to Consider:

- Draft legislation, if appropriate, that clarifies and supports SCDOT's responsibility and authority for inspection, load rating, posting restrictions or closing locally owned bridges

APPENDIXES

Appendix A: Summary of Commendable Practices and Enhancements

Commendable SCDOT Practices include:	Enhancement Items to Consider:
<p>BRIDGE INSPECTION</p> <p>Organization</p> <ul style="list-style-type: none"> • Supplementing in-house bridge inspection teams with consultant bridge inspection teams to ensure inspection timeliness, while retaining in-house experience and capabilities to optimize program cost • Revising Human Resource classifications to address retention and better define the roles and responsibilities of team leaders and inspectors • Using mobile technology for bridge inspection to improve data quality and accuracy • Improving equipment accessibility by establishing and utilizing rental contracts <p>Manuals and Guidance</p> <ul style="list-style-type: none"> • Developing a comprehensive, industry-leading practice bridge inspection guidance document to promote high quality and more consistent inspections • Training bridge inspection staff in the use of the draft BIGD <p>Quality Control / Quality Assurance</p> <ul style="list-style-type: none"> • Including a comprehensive QC/QA section in the draft BIGD to enhance inspection information quality and consistency • Requiring bridge inspection consultants to have an approved QC/QA plan prior to contracting is a leading practice 	<ul style="list-style-type: none"> • No singular “best” practice exists for organization placement and structure of the NBIS bridge inspection function • Each state DOT must decide on the organization location and reporting structure that best meets its needs <ul style="list-style-type: none"> • Continue efforts to finalize and adopt the draft BIGD • Consider identifying and requiring a certification or exam program for bridge inspectors, similar to those used by some peer states <ul style="list-style-type: none"> • Leave the QC aspects of bridge inspection reports at the bridge inspection team level but shift to a process of using district-based peer reviews <ul style="list-style-type: none"> ▪ For example, District 1 performs QC on District 2’s bridge inspection reports and District 2 performs QC on District 3’s bridge inspection reports, etc. • Retain QA responsibility at the BMO for bridge inspection reporting but consider adding a BMO-based QA team to assist district bridge inspection teams in reviewing a sample of consultant-performed inspections

Commendable SCDOT Practices include:	Enhancement Items to Consider:
<p>Data Collection Methodology</p> <ul style="list-style-type: none"> • Providing bridge inspectors technology that allows first person, real-time data entry is broadly considered as a data entry best practice • Supplying standard forms for collecting a variety of inspection and inspection-related QC/QA information in the draft BIGD • Providing standard forms in the BIGD for reporting critical deficiencies that use consistent terminology with the SCDOT Highway Maintenance Management System (HMMS) improves tracking and reporting efficiency <p>BRIDGE LOAD RATING</p> <p>Organization</p> <ul style="list-style-type: none"> • Supplementing in-house staff through contracts with qualified engineering consultants • Including load rating task as part of bridge inspection consultant contracts <p>Manuals and Guidance</p> <ul style="list-style-type: none"> • Developing and implementing a comprehensive LRGD <p>Quality Control / Quality Assurance</p> <ul style="list-style-type: none"> • Developing a comprehensive QC/QA section in the LRGD • Requiring consultants that perform load ratings to have an approved QC/QA plan in their scope of work • Providing QC/QA review checklists and tracking documents in the LRGD 	<ul style="list-style-type: none"> • Continue efforts to deploy enhanced technologies for easier and more reliable first person, real-time data entry and information collection <ul style="list-style-type: none"> • Strengthen resources to increase load rating capability and retain expertise to meet future needs, thereby, reducing costs and increasing efficiency <ul style="list-style-type: none"> • Establish a minimum schedule to update the LRGD to ensure the document maintains its accuracy and relevance over time <ul style="list-style-type: none"> • Strengthen expertise in performing load ratings through NHI training and on the job training

Commendable SCDOT Practices include:	Enhancement Items to Consider:
<p>Software</p> <ul style="list-style-type: none"> Adopting nationally accepted load rating software available through AASHTO Providing a listing of preferred load rating software products along with standard approval forms in the Load Rating Guidance Document <p>BRIDGE MANAGEMENT</p> <p>Organization</p> <ul style="list-style-type: none"> Optimizing internal resources with consultant expertise for BMS development and implementation <p>Bridge Management Process & Procedures for Preservation/Rehabilitation/Replacement Bridge Projects</p> <ul style="list-style-type: none"> Implementing a 10-year plan for replacing 465 restricted and deficient bridges <p>Use of Bridge Management System</p> <ul style="list-style-type: none"> Developing an advanced BMS <p>BRIDGE MAINTENANCE AND PRIORITY REPAIR PROCEDURES</p> <p>Organization</p> <ul style="list-style-type: none"> Providing a proven ability to handle emergencies such as extreme storm events, flooding, and vehicle or vessel collisions Having some district maintenance crews capable of performing major repairs and replacing small bridges and culverts on secondary routes using standard plans Outsourcing the maintenance and management of specialty bridges 	<ul style="list-style-type: none"> Ensure the most current <i>AASHTOWare BrR</i> software available is being used to increase the number of bridge types the software can load rate, which will increase the efficiency and effectiveness of the Hexagon OSOW software Develop policies and procedures for a bridge program that is based on using a balanced approach of preservation, rehabilitation, and replacement projects Provide sufficient expert technical resources to fully leverage SCDOT's investment in a BMS Modify the existing capital and maintenance bridge programs to include an appropriate mix of preservation, rehabilitation, and replacement strategies that keep good and fair bridges in their condition state while prioritizing replacement of bridges in poor condition Continue to advance the development and implementation of BMS software and consider adopting the identified BMS best practices Create a manual for identifying standard bridge maintenance actions statewide Provide the National Highway Institute's (NHI) two-week Bridge Maintenance course Expand asset maintenance contracting to include additional complex bridge structures that have specialized maintenance needs

Commendable SCDOT Practices include:	Enhancement Items to Consider:
<p>Cost-Effective Methods for Scour Prevention</p> <ul style="list-style-type: none"> Developing South Carolina bridge scour envelope curves in conjunction with the USGS <p>Oversize Overweight Permitting Program</p> <p>Organization</p> <ul style="list-style-type: none"> Issuing permits the same day as requested is industry best practice <p>Manual & Guidance</p> <ul style="list-style-type: none"> Providing an easily understood and navigated OSOW website <p>Automation</p> <ul style="list-style-type: none"> Configuring the <i>Hexagon</i> commercial off-the-shelf permitting system to provide increased efficiencies and allow for easier updates across one software platform <p>Fee Structure</p> <ul style="list-style-type: none"> Returning permit fees to SCDOT to support the state funded bridge program 	<ul style="list-style-type: none"> Develop a program for designing/developing scour countermeasures, including stream armoring and channel protection, for scour critical bridges that are not currently scheduled for bridge replacement and likely, will not be for the foreseeable future Develop a succession plan to address long-term OSOW staffing needs Develop permit application forms that can be completed electronically (e.g., in a writable “.pdf” format) to support direct submission to the SCDOT permit office Reach out to the states identified as <i>Hexagon</i> users (Louisiana, Oklahoma and Tennessee) for lessons learned on implementing and using this system Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to develop updated truck route maps Perform a biennial evaluation of the OSOW permits issued based on category (single trip, multiple trip, superload, etc.) to identify opportunities to consolidate/simplify permit categories and to determine the fairness and equity of the fee structure

Appendix B: Interview Guide

Appendix B – Peer States Interview Guide

Bridge Maintenance Best Practices Study—Interview Guidelines

PURPOSE: As part of the SCDOT’s Bridge Maintenance Best Practices Study, these Guidelines are intended to assist Kercher/GPI SMEs in conducting on-site benchmarking and best practice interviews with several willing State DOTs. Thank you in advance for your cooperation!

A. Agency Organizational Structure of Bridge Programs

1. DOT Maintenance Organization Structure

- a. Describe your bridge programs organization
 - i. Centralized/decentralized?
 - ii. Is an org chart available?
- b. Where in the organization is bridge inspection?
- c. Where in the organization is load rating?
- d. Where in the organization is hydraulics?
- e. Where in the organization is over-size/over-weight permits (OS/OW)?
- f. Where in the organization is bridge preventive maintenance?
- g. Where in the organization in bridge rehabilitation? Bridge replacement?
- h. If the DOT is not responsible for all bridges, please describe who is and their responsibilities (Inspection, Posting, Maintenance, etc.).

B. Bridge Inspection Program

1. Bridge Inspection Procedures for Department of Transportation (DOT) Owned and Maintained Bridges

- a. Total number of NBIS bridges
- b. Do your requirements for Team Leader (TL) exceed FHWA NBIS requirements for the various types of inspections? If so, how?
- c. Who performs routine inspections?
 - i. Percent Bridge Inspections performed by DOT in-house
 - ii. Percent Bridge Inspections performed by Consultant
- d. Who performs other type of bridge inspections?
 - i. Complex Bridges
 1. DOT (in-house) inspector percentage
 2. Consultant inspector percentage
 - ii. Fracture critical inspection
 1. DOT (in-house) inspector percentage
 2. Consultant inspector percentage
 - iii. Underwater inspection
 1. DOT (in-house) inspector percentage

- 2. Consultant inspector percentage
 - iv. Special inspections
 - 1. DOT (in-house) inspector percentage
 - 2. Consultant inspector percentage
 - e. Is there bridge inspector guidance as to when to request hands-on inspection to examine suspect or hidden defects?
 - f. What method(s) do you use to determine bridge inspection frequencies?
 - i. Has your agency considered going to reliability-based bridge inspection frequencies for some bridges as shown in NCHRP REPORT 782 Proposed Guideline for Reliability-Based Bridge Inspection Practices? If yes, please describe.
 - 1. If yes, do you have FHWA approval for the reliability-based inspection process? If yes, can you share your approved procedure?
- 2. Staffing**
 - a. Where do bridge inspection teams report? (District or Central Office)
- 3. Funding**
 - a. What is your annual bridge inspection budget? In House and Consultant.
- 4. Manuals, Guidance, Procedures**
 - a. Do you have a bridge inspection manual? If yes, please provide link.
 - b. Do you have a bridge inspection QA/QC manual? If yes, please provide link.
 - c. Do you have a bridge element manual? If yes, please provide link.
- 5. Quality Assurance and Quality Control (QA/QC)**
 - a. Describe your bridge inspection quality control procedures.
 - b. Describe your bridge inspection quality assurance program.
- 6. Training**
 - a. Describe your bridge inspector training program
- 7. Bridge Inspection/Equipment**
 - a. How many under bridge access vehicles (snoopers) do you own? How many are rented?
 - b. Does your agency have the ability to perform non-destructive evaluation? If yes, what methods do you “self” perform?
 - c. Do you have boats, diving equipment, and certified diver bridge inspectors?
- 8. Bridge Inspection Data Collection Software**
 - a. What software tools does your agency use for collecting bridge inspections? Is it web-based? Is it tablet capable? Does it support detailed and quality bridge inspections? Please describe
- 9. What one or two changes would you make to your bridge inspection program if you had the authority to make such changes?**
- 10. What do you consider is a best practice or practices in your bridge inspection program?**

C. Bridge Load Rating Program

- 1. Who does bridge load ratings?**
 - a. Percent by DOT (in-house)
 - b. Percent by Consultant
 - c. Who performs complex bridge load ratings?
 - d. How often do you update your load ratings?
 - e. What are the triggers for updating load ratings?
- 2. Staffing**
 - a. What are the roles/composition of this group?
- 3. Funding**
 - a. Do you separately track costs for load rating? If so, what is your annual bridge load rating budget?
- 4. Manuals, Guidance, Procedures**
 - a. Do you have a bridge load rating manual or a documented load rating policy?
 - b. Do you have written QA/QC Procedures for Load Ratings? If so, can you provide a link or copy?
- 5. Quality Assurance and Quality Control (QA/QC)**
 - a. Describe your bridge inspection quality control procedures.
 - b. Describe your bridge inspection quality assurance program.
- 6. Training**
 - a. Do you have a formal or informal training program for load raters? If so, please describe.
- 7. Software**
 - a. What software does your agency use for load rating?
 - b. Does your agency use different software for complex bridges?
- 8. What one or two changes would you make to your bridge load rating program if you had the authority to make such changes?**
- 9. What do you consider is a best practice or practices in your bridge inspection program?**

D. Scour Assessment/Hydraulics Program

- 1. Staffing**
 - a. What percentage of your scour evaluations are done in-house (DOT staff) versus by consultant?
- 2. Manuals, Guidance, Procedures**
 - a. Do you have written procedures for when and how to perform scour calculations that supplement the FHWA Hydraulic Engineering Circular (HEC) manuals? If so, can you provide a link or copy?
 - b. Do the POAs identify when a scour critical bridge should be monitored or inspected during a flood event?

3. Flood Event Procedures

- a. Do you perform post flood inspections on scour critical bridges?
- b. Do you perform post flood inspections on non-scour critical bridges? If so, please describe your process/triggers.

4. Scour Critical Bridge Management

- a. What is your process to address/improve scour critical bridges, that are otherwise in fair to good condition, to remove them from the Scour Critical List?
- b. Do you have a risk-based approach to prioritize mitigation or replacement of scour critical bridges?

5. How well is your scour program working?**E. Oversized / Overweight Permits (OS/OW) Program****1. Oversize/Overweight Permitting**

- a. Describe your OS/OW permit process –percentage consultant use, number of permits processed monthly, and budget.
 - b. Do you charge applicants for performing super or mega load ratings?
 - c. Do you have written procedures including QA/QC?
 - d. Is your permit application process automated? If so, what software do you use and please provide a link.
 - e. Are your load ratings calculated for each OS/OW permit or are certain truck configurations predetermined using moment and shear envelopes? If yes, how were these developed? What software do you use for OS/OW analysis?
2. How well is your OS/OW Permitting system working?
- a. Do you have a cost table for OSOW permits? If so, please provide.
3. **What one or two changes would you make to your oversized overweight permitting program if you had the authority to make such changes?**
4. **What do you consider is a best practice or practices in your OS/OW program?**

F. Bridge Operations Program (Includes Maintenance and Repair Implementation including Clearing Flags and Signing for Load Posting)**1. Constraints / Authority**

- a. How does your agency respond to high priority repairs (DOT in-house bridge crews or on-call contractors)?
 - i. What is a typical funding amount included in the annual budget for this type of repair?
- b. Do you have staff dedicated to assuring that bridge posting/closed signs are placed properly?

2. Bridge Maintenance Budget

- a. What is your bridge maintenance annual budget? Is funding allocated to Routine Maintenance and Preventive Maintenance separately?

- b. Do you have dedicated bridge maintenance funds or do you have to compete for funding from a general maintenance fund?
 - c. Do you have any special programs to ensure proper maintenance is performed on significant structures? If so, how is that funded?
- 3. Manuals, Guidance, Procedures**
- a. Do you have a bridge maintenance manual?
- 4. Training**
- a. Do you provide bridge maintenance training?
- 5. What bridge maintenance and repair activities can your in-house staff perform?**
- a. Crack sealing
 - b. Patching
 - c. Coatings
 - d. Joint repair
 - e. Other
- 6. Responding to Bridge Inspection findings**
- a. Do you have a process to prioritize and implement inspector recommendations/findings? (Yes/No). If yes, please describe.
 - b. Do you have a process to manage inspector recommendations/findings? (Yes/No) If yes, please describe.
 - c. Who performs the corrective actions to address the recommended high priority and critical findings from Bridge Inspection; In-house maintenance crews or Contractor forces?
 - d. What process do you use for following up on high priority and critical findings from bridge inspections (flags)?
 - e. How are high priority repair and critical findings reported, programmed, repaired and closed out? Do you have a process? Is it written down?
- 7. What one or two changes would you make to your bridge operations program if you had the authority to make such changes?**
- 8. What do you consider is a best practice or practices in your bridge operations program?**

G. Bridge Management Program

- 1. Bridge Management System (BMS)**
- a. Do you have an operating BMS?
 - Are you using the BMS for anything other than capturing the inventory data?
 - Can you do bridge condition or performance measure trend monitoring?
 - Do you have deterioration models for your BMS?
 - Are you able to forecast bridge condition? Network and/or bridge level?
 - Does your BMS currently provide project level recommendations for replacement, rehabilitation and preservation?
 - Are you able to do optimization and strategic investment planning?

- Is this information used to determine budget needs?
 - b. Do you collect element level data and is it being used for bridge management?
 - c. Do you have a written risk-based prioritization process for selecting bridge projects?
 - d. Do you report to senior management and/or the public with bridge performance dashboards?
- 2. Key Performance Indicators**
 - a. What key performance indicators or performance measures are used to evaluate the bridge program's effectiveness in achieving the agencies bridge goals/objectives (aside from FHWA metrics)?
 - 3. Bridge Project Selection**
 - a. Describe your current process for prioritizing projects for replacement, rehabilitation, preservation and maintenance.
 - b. Do you have written procedures for project selection?
 - c. How was the bridge program developed in your TAMP?
 - d. Describe the scoping process for identifying potential bridges for preservation, rehabilitation and replacement projects.
 - 4. Staffing**
 - a. Do you have a designated Bridge Preservation Engineer? More than one?
 - 5. Bridge Capital Program Annual Budget (Projects that are let to contract)**
 - a. Rehabilitation and Replacement
 - b. Preservation
 6. Do you have an agreement with FHWA defining preservation work? If so, can you provide a copy?
 7. **What one or two changes would you make to your bridge management program if you had the authority to make such changes?**
 8. **What do you consider is a best practice or practices in your bridge management program?**

H. Coordination of Local Agency Bridge Program

- 1. Local Agency Organizational Structure**
 - a. Do local agency's (counties, cities, townships) own and maintain highway bridges? (Yes/No)
 - b. Do local agencies inspect bridges they own or maintain? (Yes/No)
 - c. Do local agencies load rate bridges they own or maintain? (Yes/No)
 - d. Do local agencies issue OS/OW permits? (Yes/No)
- 2. Local Agency Bridge Inspection**
 - a. Who does the routine bridge inspections for local owned highway bridges and
 - b. Who conducts the QC/QA on these inspections?
- 3. Local Agency Bridge Load Rating**
 - a. Who load rates local agency bridges including complex structures?
 - b. Who conducts the QC/QA on these load ratings?

- 4. Who is responsible for maintenance, repair, rehabilitation, and replacement of local agency and other owner highway bridges?**
 - a. Does the DOT have any responsibility for posting and/or closing local agency bridges? If so, are there state laws or local agreements authorizing DOT to take these actions?
- 5. Does the DOT have legal authority in your state to self-perform and/or oversight of any of these activities for local agency or other owner bridges?**
- 6. What one or two changes would you make to coordination of your local agency and/or other owner program if you had the authority to make such changes?**
- 7. What do you consider is a best practice or practices in your coordination with local agency and/or other owner bridge programs?**

Appendix C: Peer State Answers to Interview Guide

1. Bridge Inspection Procedures														
Category	Number of Bridges Owned		Who Performs Inspections (Percentage)										Hands On Inspection Guidance	Methods to Determine Bridge Inspection Frequency
	State	Local	Routine		Complex Bridges		Fracture Critical		Underwater		Special			
			In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant		
Delaware	848 (NBI) / 827 (Interview)	24 (NBI) / 11 (Interview)	75%	25%	50%	50%	50%	50%	0%	100%	75%	25%	Yes – in Bridge Inspection Manual (BIM) https://deldot.gov/Publications/manuals/bridge_inspection/pdfs/bridge_inspection_manual.pdf 110617	
Florida	7213	5269	10%	90%	10%	90%	10%	90%	10%	90%	50%	50%	Yes -in Bridge and Other Structures Reporting Manual http://fdotwp1.dot.state.fl.us/ProcedureInformationManagementSystemInternet/FormsAndProcedures/ViewDocument?topicNum=850-100-030	Base is 24 months, topside and underwater, bridges rated 4 (Deck, Super, Sub, Culvert) and the mechanical and electrical portions of movable bridges are inspected every 12 months. Bridges rated 3 are inspected every 6 months. District Bridge Management Engineer (DBME) has the authority to require more frequent inspections if the DBME believes it is warranted
Georgia	6709	7906	99%	1%	99%	1%	100%	0%	100%	0%	100%		Yes	NBI Requirements and condition of the bridge.
Michigan	4487	6612	80%	20%	60%	40%	100%	0%	0%	100%	100%		Yes, in the Michigan Structure Inspection Manual, Chapter 5. https://www.michigan.gov/mdot/0,4616,7-151-9625_24768_24773-326737--,00.html https://www.michigan.gov/documents/mdot/BridgeInspectionFrequencies_COMBINED_2017-11-15_606650_7.pdf https://www.michigan.gov/documents/mdot/Chapter_5_Inspection_Procedures_2017-11-16_606212_7.pdf	Judgment of inspector using the following Guidelines for Bridge Inspection Frequency. https://www.michigan.gov/documents/mdot/BridgeInspectionFrequencies_COMBINED_2017-11-15_606650_7.pdf

1. Bridge Inspection Procedures														
Category	Number of Bridges Owned		Who Performs Inspections (Percentage)										Hands On Inspection Guidance	Methods to Determine Bridge Inspection Frequency
	State	Local	Routine		Complex Bridges		Fracture Critical		Underwater		Special			
			In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant		
New Jersey	2389	4364	0.5	0.5	0.1	0.9	0.2	0.8	0	1	0.5	0.5	Follow AASHTO guidance for all inspection types.	
North Carolina	17012	868	50%	0.5	0.8	0.2	100%		100%	0%	100%		Starting with element inspections, all inspections required hands on, but now up close with measurements	Inspector judgment

1. Bridge Inspection Procedures														
Question	Number of Bridges Owned		Who Performs Inspections (Percentage)										Hands On Inspection Guidance	Methods to Determine Bridge Inspection Frequency
			Routine		Complex Bridges		Fracture Critical		Underwater		Special			
	State	Local	In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant	In-House	Consultant		
Virginia	12038 NBI/192 08 Interview	1433 NBI/152 7 Interview	70%	30%	20%	80%	40%	60%	0%	100%	70%	30%	Yes, routine inspection techniques shall be sufficient to quantify the condition and remaining section of structural members. Special inspections that may involve advanced NDT, material sampling, destructive testing, etc. is evaluated on a case by case basis.	
West Virginia	6993 (NBI) / 6977 (Interview)	244 (NBI) / 102 (Interview)	99%	1%	14%	86%	92%	8%	98%	2%	91%	9%	All bridges are inspected hands-on a minimum of every six (6) years. In addition, Section 5.5 of the WV DOT Bridge Inspection Manual (see attachment) requires the following to receive hands-on inspection a minimum of every two (2) years: all Fracture Critical Members; structural steel where cracking has previously been documented; significant movement of substructure elements; documented scour conditions; members with previously documented section loss exceeding 30% and/or highly stressed members (stresses above inventory level); bearing devices where previously documented deficiencies exist; Pin and Link Assemblies and Direct Bearing Hinges.	Bridge Maintenance Directive BMD-1285-2 (see attachment).

Category		2. Staffing		3. Funding	4. Manuals, Guidance, Procedures			5. Quality Assurance and Quality Control		6. Training
Question	Do you use Reliability-Based Bridge Inspection Frequencies?	Are Bridge Inspection Team Leaders Engineers or Non-Engineers?	Where do bridge inspection teams report? (District or	Annual Bridge Inspection Budget	Bridge Inspection Manual	QA/QC Manual or Directives	Bridge Element Manual	QC	QA	Describe your bridge inspector training program
Delaware	Have done for our non-NBI State length bridges / We have briefly evaluated it for our NBI length bridges back in 2010, but it didn't seem advantageous enough.	Both	Central Office	In-house not tracked. Consultant \$4 Million.	Yes	Yes	Yes	Yes (In manual)	Yes (In manual)	2-week course. Refresher every 5 years. Doc in manual
Florida	Have approval to go to 48 month inspection cycle for certain bridge types that ar considered low risk, but are not going to RBI at this time	Both	Districts	Talk to John Clark in the Office of Maintenance Structures Section	Yes	QA/QC requirements found in the Bridge and Other Structures Inspection and Reporting Procedure.	Yes	Yes, each District is required to have a QC plan and to periodically review bridge inspection consultants quality control plans. The office of Maintenance conducts QA reviews of each District every two years (used to be annual).	Yes	2-week course. Refresher in Manual. Encourage Fracture Critical, Ancillary Structures and Underwater inspection course. When BrM is updated conduct training on the use of the system.
Georgia	No		Central Office	GDOT Salaries approximately \$4,000,000.00	Yes	Yes	Yes	Yes. Regional inspector review 100% of bridge reports submitted by Inspectors. They also perform field visits to evaluate the bridge inspectors. We have consultants perform follow-up inspections and compare their inspection result with our own in house inspection results.	Bridge Asset manager runs a TAPE monthly and corrects any errors discovered.	i.On the job training. ii. Annual Bridge Maintenance University 1.Covers BMU specific material 2.Frequently incorporates NHI Classes on 5 year rotating schedule a.Fracture Critical b.Scour c.Elements d.In-Service Bridge Inspection Refresher e.Non-Destructive Testing f.Safety Inspection Refresher 3.NHI Safety Inspection of In-Service Bridges class
Michigan	No, not currently. Inspections are required for asset management as well as safety inspection. Inspection frequencies longer than 2 years don't provide the appropriate asset management information.	Mostly engineers	Districts (complex done by central office	\$3 to 4\$ Million	Yes	Yes	Yes	Yes (In manual)	Yes (In manual)	2-week course. Refresher every 5 years. Doc in manual

Category		2. Staffing		3. Funding	4. Manuals, Guidance, Procedures			5. Quality Assurance and Quality Control		6. Training
Question	Do you use Reliability-Based Bridge Inspection Frequencies?	Are Bridge Inspection Team Leaders Engineers or Non-Engineers?	Where do bridge inspection teams report? (District or	Annual Bridge Inspection Budget	Bridge Inspection Manual	QA/QC Manual or Directives	Bridge Element Manual	QC	QA	Describe your bridge inspector training program
New Jersey	No. Follow AASHTO guidance for all inspection types.	Engineers	Central Office	\$30 Million	Use the BIRM	Yes. Part of procedures manual	Yes	Field monitoring of In House and Consultant projects (cross check field data with report and SIA/PONTIS. County/Agency monitoring every 4 years minimum.	Data checks, FHWA Metric checks quarterly	All inspectors are trained. Doug Tittle oversees training scheduling. All are required to take NHI 130055 and 130053 (every 5 years). Other NHI courses are taken periodically (such as Fracture Critical, Scour, Fatigue details, Load Ratings, NDT, etc.
North Carolina	Not at this time, but will consider for future. Plan on moving to risk based inspection frequencies. Methods for inspection frequency is typical 24 months and frequency is reduced for bridges in poor condition as recommended by the bridge inspector. Doing underwater inspections at 48 months.	Typically non-engineers	Work in Divisions (regions) but report to central office.	\$22 Million (but high for first time collecting elements.	Working on	No		QC is done for every inspection It is reviewed by supervisor, then area superintendent review (two levels of review).	A percentage of reports (currently ad-hoc) selected for QA where the bridge is re-inspected.	2-week course. Refresher every 5 years. Doc in manual. After training, supervisor goes out with new inspector for first few inspections to confirm training. Follow federal requirements on training using NBI refresher course.

Category		2. Staffing		3. Funding	4. Manuals, Guidance, Procedures			5. Quality Assurance and Quality Control		6. Training
Question	Do you use Reliability-Based Bridge Inspection Frequencies?	Are Bridge Inspection Team Leaders Engineers or Non-Engineers?	Where do bridge inspection teams report? (District or	Annual Bridge Inspection Budget	Bridge Inspection Manual	QA/QC Manual or Directives	Bridge Element Manual	QC	QA	Describe your bridge inspector training program
Virginia	Not yet, we are aware of the NCHRP Report, but have not assessed implementing any of the guidelines.	Both	Districts	\$30 million total with \$20 million spent by Consultants and \$10 million spent by State Forces	Have a Policy Document	Have a Policy Document	Yes	Quality Control is performed at the District and Central Office levels. The District Bridge Safety Inspection Engineers (or designee) perform 100% office review of all completed bridge safety inspection reports. The BSIE also performs field reviews of documented inspection findings for accuracy and completeness. The Central Office QA/QC Engineer for BSI visits each District annually to perform office and field reviews concurrently with the District staff and makes recommendations based on findings.	Part of the QA is perpetual due to an annual re-write of policy. CO does a sample of district inspections. The sample is not random. They intentionally choose bridges that they expect they might find a problem. If they find a problem, they expand the search to look for further similar problems. QA inspections are not punitive.	Formal classroom training is normally coordinated centrally via the VDOT Learning Center. This would include NHI courses and in-house developed training. Field training is conducted by the Districts and normally involves Senior Inspectors or Team Leaders paired with new and developing inspectors while conducting bridge safety inspections.
West Virginia	No consideration has been given to date towards going to reliability-based bridge inspection frequencies with respect to NCHRP Report 782.	Primarily non-engineers, but a few are engineers	Disticts	\$14.5 million for state inspectors, \$6.2 million for consultant contracts	Yes	Yes	No. Use AASHTO BEIM	yes (have directive)	yes (have directive)	State certified exam. Associate of Applied Science (A.A.S.) in Highway Engineering Technology

Category	7. Bridge Inspection/Equipment				8. Bridge Inspection Data Collection Software				9. Changes they would like to make to their program	10. Activities the Agency considers Best Practice	
Question	Under Bridge Inspection Vehicles		Non-Destructive Evaluation (NDE)	Boats	Diving Equipment, Certified Diver Bridge Inspectors	Data Collection Software Used	Web Based (Yes/No)	Tablet Capable? (Yes/No)	Does it support detailed and quality inspections?		
	Own	Rent									
Delaware	1 in house UBIV/ Consultants rent their own. 1- bucket truck. Snooper is operated by DOT staff.		Dye-Penetrant only	Yes	No	BrM and custom INSPECT Program	Capable of but IT does not allow	Yes	Yes	The Bridge Section has the authority to make changes as needed to accomplish their goals. The one thing they do not have the authority to do is to add more positions. If they had the authority to add staff, they would have 4 – 2 man teams (8 inspectors) and 2 additional staff to assist with bridge maintenance projects.	QC/QA Process
Florida	6 in house UBIV		State Materials Office - Several NDT methods and FDOT State Materials Office maintains contracts with several NDE firms, which allows the District to use these contracts when needed.	Yes	Yes	BrM	Yes	Yes	Yes		Review of each bridge inspection report recommendation by the District's Feasible Action Review Committee. This allows an evaluation of the inspection reports findings and doing the small repairs before they become Large Repairs. FDOT's QC/CA process is good. FDOT's process for emergency repairs, which allows with the approval of the Department's Secretary, requesting telephone quotes from selected contractors instead of having to go through the normal design, bid build process.
Georgia	2 currently UBIVs, 1 additional ordered.		Dye penetrant and mag particle.	Yes	Yes	Currently AgileAssets. Moving to Inspect X	Yes	Yes	Yes	We are doing that by going to Inspect X (tablets use in the field, mobile app, etc)	
Michigan	3 UBIVs		has a structural evaluation and material testing units that have ability to many types of NDE including place tilt sensors, strain gauges, vibrating wire sensors, and do UT, dye-penetrant, GPR, ground vibrations, load testing	Yes	No	In-house developed Mi-Bridge program	Yes	No	Yes	We are in process of automating QA/QC tracking, automating notifications, and increasing requirements to be a team leader.	MiBridge is considered a best practice. The use of dashboards in tracking assignments. We are moving toward a test based qualified team leader certification.

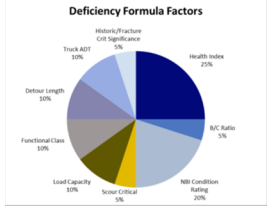
Category	7. Bridge Inspection/Equipment			8. Bridge Inspection Data Collection Software						9. Changes they would like to make to their program	10. Activities the Agency considers Best Practice
Question	Under Bridge Inspection Vehicles		Non-Destructive Evaluation (NDE)	Boats	Diving Equipment, Certified Diver Bridge Inspectors	Data Collection Software Used	Web Based (Yes/No)	Tablet Capable? (Yes/No)	Does it support detailed and quality inspections?		
	Own	Rent									
New Jersey	None. We get 3 bids from vendors (see attached list)		District Team Leaders and Senior Inspectors (in most cases) are trained in level 2 NDT techniques such as liquid penetrant and magnetic particle testing. The Central Office Materials Division maintains requirements and a list of qualified inspector	Yes	No	AssetWise Asset Reliability Inspections by Bentley (ComBIS).	Yes	yes	YES – the system has customizable forms capable of meeting our inspection report requirements, stores all bridge inspection data (NBI & NBE) and serves as our bridge file, meeting MAP-21 legislation.	Hire more staff, so could do more in-house bridge inspections	Batch Consultant selections to twice a year & include County selections
North Carolina	3 UBIVs		Dye-pen and UT	Yes	Yes	In-house developed WIGINS Program	Yes	No	Yes	Would adopt risk-based inspection frequencies and do more in-house inspections. When using consultants have fewer number of firms so less training needed. Have more bridge inspection equipment available.	In-house paperless WIGINS system

Category	7. Bridge Inspection/Equipment				8. Bridge Inspection Data Collection Software				9. Changes they would like to make to their program	10. Activities the Agency considers Best Practice program	
Question	Under Bridge Inspection Vehicles		Non-Destructive Evaluation (NDE)	Boats	Diving Equipment, Certified Diver Bridge Inspectors	Data Collection Software Used	Web Based (Yes/No)	Tablet Capable? (Yes/No)	Does it support detailed and quality inspections?		
	Own	Rent									
Virginia	VDOT owns 2 machines. Many are rented – no exact count – but VDOT performs more than 10k safety inspections per year.		Yes. District Team Leaders and Senior Inspectors (in most cases) are trained in level 2 NDT techniques such as liquid penetrant and magnetic particle testing. The Central Office Materials Division maintains requirements and a list of qualified inspectors who can perform ultrasonic testing services. Most ultrasonic testing is outsourced. The Districts occasionally use other NDT such as eddy current, impact echo, Schmidt Hammer, rebar locator, etc. All complex NDT is outsourced (i.e. x-ray).	Yes	Virginia does not do underwater inspection in-house	VDOT uses AASHTOWare Bridge Management (BrM) as the repository of our inventory and element data. VDOT has no standard field data collection application. The Commentary bridge safety inspection report is developed in MS Word, or for larger files as a PDF. Element level reports are generated from Crystal Reports internally within BrM. BrM does not allow them to track schedules and progress of inspections. They are developing software to interface with BrM	No	No	Yes	We have an active project to procure and deploy a Digital Bridge Inspection Reporting application that will act as a front end to BrM. It will also enable tablet or mobile based data collection along with automated report development and other integrated work flows such as critical findings to improve oversight abilities related to workflow & tracking for QA/QC of production activities. We are evaluating ways to integrate UAS technology and other advancements (i.e. 3D rendering, virtual and augmented reality, etc.). Looking for digital data collection to eliminate errors. Did an RFI and they are looking at different vendors. Important that they are keeping the same report structure for ease of use in all districts. CO will leave flexibility in the software for use by each District.	VDOT's Consultant practice & procedure review is robust, resulting in comprehensive manual/guidance updates that enhance deliverables. Additionally, we have overlapping QA oversight (e.g. multiple layers at district/CO, multiple report sources & formats for scheduling/etc) that results in thorough programmatic controls. Decentralization can be a strength. They have a lot of standardization from the CO through policies, manuals, etc. The flexibility that is still permitted in the districts is a strength. Plus the districts each have a smaller amount of bridges and know their bridges well. VA thinks that 3000 bridges is a max to the number of bridges that a single report (office) can be responsible for.
West Virginia	3 UBIVS		Dye-pen, UT, Mag Particle	Yes	Yes	Bentley AssetWise Connect Edition (formerly InspectTech),	Yes	Yes, but do not use	Yes	Increase our ability to hire/retain quality bridge safety inspectors and funding to update older equipment.	Our A.A.S. Highway Engineering Technology – Bridge degree program, where each inspector ultimately earns an A.A.S. degree that is geared directly toward their daily job and is paid for by WVVDOT, the narrative style of our inspection reports, and our QA/QC inspection and evaluation program.

Category Question	1. Who Does Load Rating (Percentage)				How Often Are Ratings Updated?	What Are Triggers For Updating?	3. Funding Annual Load Rating Budget	4. Manuals, Guidance,		5. Quality Assurance/Quality		
	Routine		Routine					Load Rating Manual	Written QA	QC Procedures	QA Program	
	In House	Consultant	In House	Consultant								
Delaware	25%	75%	25%	75%	10 Years or As Needed	10 years or GCR of 4 or Less	\$100K for consultants	Currently some guidance in Bridge Design manual. Plans to develop a Load Rating Manual	Yes. In BDM.	The Load Rating Engineer reviews all load ratings.	10% of load ratings are subject to a QA review.	
Georgia	1%	99%	0%	100%	As field conditions warrant. We also load rate the substructure on all bridges.	Determined by field condition changes	\$800K	Yes	Yes	We have a 5 step review of all load ratings	The GDOT Load Rating Engineer reviews all load rating that have been completed and then updates GAMS.	
Michigan	50%	50%	20%	80%	When section loss is reported or work done	Code changes (for example the ASR to LFR transition, some years ago)	\$1.2 Million in house, \$2 Million consultants	Yes	Yes, internal use	100% QC check for every model, internal and by consultant.	Bridge load rating QA is done by consultant contract along with bridge inspection QA as described in the Structure Inspection manual, Chapter 2.	
New Jersey	50%	50%	0%	100%	As per NJDOT policy, there is no specific time period to re-rate any NBIS bridge.	Major rehab., section loss to load carrying member, added overlay, changes in spec or code, change in bridge geometry	500000	Yes	No	No		
North Carolina	100%	0%	60%	40%	In the past, each time a bridge was inspected, it would have it's load rating reviewed and updated. This was very expensive to do and the DOT has modified this practice.	- New vehicles (Emergency Vehicles)		Today NCDOT has a policy memo and guidance in the bridge inspection manual that is under development when to update load rating. The guidance will be written into the WIGINS program to flag bridges that meet load rating update criteria.	No	QC load rate then reviewed by separate person. Squad leader does oversight review then initials (to levels of review).	Does not have a QA program	
Virginia	25%	75%	1%	99%	As needed, see below.	- Unexpected results (low, high, or atypical Operating/Inventory ratio) reassess for accuracy	\$6 Million	Have a Policy Document	Load ratings shall be performed and checked by different persons. One of the individuals (rater / checker / reviewer) shall be a Professional Engineer in the Commonwealth of Virginia, who will sign and seal the Load Rating Summary Form for Structures (SB502).	The quality control (QC) review will verify that appropriate assumptions were made to develop the load rating, calculations were performed correctly and any discrepancies were satisfactorily addressed.	The quality assurance (QA) review will verify that the load rating analysis, including the load rating output and calculations, has been performed, checked and/or reviewed by a Professional Engineer in the Commonwealth of Virginia and assure that the results and assumptions are reasonable.	
West Virginia	99%	1%	30%	70%	Review after each inspection or condition changes. Recently load ratings have needed updating because of FHWA requirements for SHV's and EV's.	Condition, work done, also with in depth inspections every 6 years.	\$3 Million	Yes	Yes	See WV BLRM and BMD-1300.	See WV BLRM and BMD-1300.	

Category Question	6. Training	7. Software		8. Changes They Would Like to Make to Their Program	9. Activities the Agency Considers Best Practice
		Routine	Different Software		
Delaware	Informal: The DeIDOT Load Rating Engineer provides classroom-style training for younger engineers as needed. Formal: NHI course, but nobody has attended in a while	BRASS	STAAD, MDX and other programs as used as needed.	Need to create a stand-alone Bridge Load Rating Manual	QC/QA Process
Georgia	Informal	In-house developed program along with BRASS.	Yes.	Currently the SBME is trying to obtain approval to develop a new load rating program through a University.	Ability to load rate substructures and be able to perform batch load rating down a highway corridor.
Michigan	Mostly on-the-job augmented by the Mich Tech Univ Center of Technology and Training, which does two load rating workshops per year for AASHTO BrR software, and series of webinars each year for certain topics. There have been workshop for LRFR and statewide workshops for local agencies and consultants. Also bridge advisories when applicable.	AASHTOWare BrR	Yes, it varies depending upon need. Examples include; consultants use MIDAS Civil 3D, STAAD, MDX, Conspan, ...	Get live connection to bridge database in permit software.	MDOT overload classification has worked very well for many years. Simple but effective. Creating the contract with LTAP Training and reporting bugs for software. Purchase super site license for AAHTOWAre BrR, as it promotes consistency.
New Jersey	Yes. Load Rating team provides informal training sessions to In House staff.	Bentley LARS, PENNDOT programs, AASHTOWARE Virtis, STAAD	Yes	Developing QA/QC procedures and Developing a new load rating manual for all types bridges (Simple and Complex))	Specific load rating approach for each type of bridge, when plans are missing or plans are incomplete. Developing a load rating approach in excel for corrugated metal structures. Utilizing 2D/3D Finite element models to rate steel curved girder bridges. Performing load ratings for cross frames/Diaphragms for Curved I-girder Bridges. Developing a load factor rating (LFR) approach in excel for bolted/riveted Gusset Plates.
North Carolina	Training for load raters is on the job in the squad (Unit).	In-house developed software, also third party design and load rating software such as Conspan.		Provide a more systematic QA process for load rating.	During NBIS tour with FHWA, the FHWA suggested do not need to load rate each and every time. New process to determine when load ratings should be updated has been put into the NCDOT in-house inspection tool, WIGINS, to flag bridges that meet load rating updated criteria. Criteria includes condition indicators such as defect quantities, and GCR overall rating., and flags such as Critical finding or priority maintenance, or change to structure configuration, or change in wearing surface or temporary repairs. If the bridges posting is less than 19 tons a review of the inspection report is reviewed with each inspection.
Virginia	The training program is informal and consists of both OJT and scheduled courses through the VDOT Learning Center as they are made available. In previous years we have arranged various training courses for LRFD and LRFR topics. This year, we are hosting training in LARSA and DESCUS.	AASHTOWare BrR	DESCUS for curved steel girders and LARSA for finite element analysis.	Centralization of the load rating production efforts vs. having them currently spread across all Districts could enhance consistency, leverage efficiencies, reduce coordination costs and improve data accuracy. Each District would still be responsible for review and acceptance of the resulting data and for making posting determinations.	Evaluating our heavy permit suite for complex structures. For structures that were beyond the capabilities of our standard approved software (BrR and DESCUS), we required that additional load ratings be completed for carefully chosen vehicles to enable decisions on hauling permits. Please see pdf for these 8 special permit vehicles. This is not an issue with LARSA if it can be used.
West Virginia	All load raters attend our annual Bridge Inspection Conference, sessions are conducted over a three day period that are geared toward structural evaluation. Otherwise, relatively informal, dependent on the position and location. Sometimes, district staff engineers train underneath a more seasoned evaluation engineer, but sometimes new hires must rely more heavily on guidance from the central office.	Bentley's LARS Bridge, also use AASHTOWare BrR and Midas Civil. Some in-house spreadsheets.	AASHTOWare Bridge Rating (BrR) or Midas Civil would be used in-house. Consultants may use other software as requested and approved.	One current change we are looking at is migrating away from Bentley's bridge products. We've historically used Bentley for all bridge load rating and OS/OW permitting (Bentley's Superload for live load analysis coupled with GotPermits for the mapping and routing). For several years, Bentley has under-performed, in our opinion, with regards to updating the software for bug fixes, etc. In addition, LARS is very one-dimensional. BrR would be a much better fit for a production load rating system with much more capability than LARS. In addition, BrR's new Load Rating Tool for permitting will help maintain the same level of service in our automated permitting system that we currently have in place through Bentley.	<p>1.) I would consider our routine updates to bridge load ratings as one of our best practices, as well as our QA/QC Program. From exposure I've had to other state agencies, most have a hard time keeping up with updated load rating files. This could be attributed to other states not having jurisdiction over local/county bridges, versus WVDOH basically having all bridges in the state under jurisdiction.</p> <p>2.) We have good coordination between our inspection efforts and load rating efforts, based on almost all inspections being done in-house. This is helpful at the local district office, as the inspection crews performing the inspections are typically under the supervision of the local evaluation/load rating engineer and District Bridge Engineer.</p> <p>3.) Our QA/QC program continues to grow and provide in-depth review and training to district load rating staff. We host a yearly conference where information and training are given to all statewide staff, and throughout the year district specific QA/QC meetings are held to review findings and provide hands-on training as needed.</p>

Category	Number of Scour Critical Bridges		1. Scour POA Process			2. Scour Critical Bridge Management
	State	Local	Do POAs identify when SC bridge should be monitored during flood?	Do you perform post flood inspections on SC bridges?	Do you perform post flood inspections on non- SC bridges?	What is your process to remove bridges from Scour Critical List?
Delaware	44	0	Yes	Yes	Yes: if bridge flows full, is overtopped, or if damage has been observed. If bridges are overtopped, they remain closed until an inspection team checks for damage due to scour.	The original scour critical list was generated through a screening process. Bridge Design is doing an analysis to see if the bridges on the list are actually scour critical. If so, countermeasure projects are periodically programmed. Also, if a scour critical bridge gets rehabilitated or replaced through the Bridge Preservation program, the work will also address any scour concerns. There is not a methodical approach.
Georgia	67	6		On all bridges regardless if scour critical or not.	On all bridges regardless if scour critical or not.	Analysis or armoring.
Michigan	338	866	Yes. POA are part of MiBridge.	Yes, at the judgment of the Region bridge engineer and bridge inspectors.	If a bridge goes pressure flow, it will receive a post flood inspection.	In the annual call for projects, Michigan DOT identifies scour critical bridges and those at higher risk. They monitor progress toward eliminating SC bridges that carry Interstates. They have a Scour Committee to give technical guidance and direction.
New Jersey	136	265	Yes. As part of Scour POA, we monitor stream gauges associated with scour critical bridges during extreme rain events.	Yes	No	Countermeasure Installation
North Carolina	106	18	POA does not say when should be monitored for extreme flood event. Do by judgment.	Yes.	Yes, for all bridges when they go pressure flow (flows above bottom of superstructure beam) and flow over roadway at approaches.	Mitigate scour when major rehab.
Virginia	12	2	Yes – but generally it is unsafe to conduct the inspections during a flood event so if needed, remote monitoring (by local staff) may be utilized. Normally, inspections are done after the weather event has passed and conditions are safe for inspectors to access the site.	Ye	Yes. This varies by structure type, waterway and field conditions such as amount of rainfall – but is generally applicable to scour susceptible bridges and those that have reported flooding or overtopping during high water events.	We provide scour countermeasures, which almost always consist of riprap. We have found that smaller riprap provides marginal value. We do not grout our riprap as a general rule. We do occasionally perform underwater concreting to repair undermined footings.
West Virginia	102	4	Scour Critical Plan of Action is developed on a case-by-case basis for each individual structure and identifies at what frequency a particular bridge should be inspected for scour.	Yes.	After a significant flood event, all structures in the affected area undergo inspection for damage and to ensure safety.	We routinely install reinforced concrete scour toes, pile encasements, grout bags, rock foundation protection, etc. to address our most vulnerable scour critical bridges.

Category		3. How well is your scour program working?
Question	Do you have a risk-based approach to prioritize mitigation or replacement of SC bridges?	
Delaware	<p>Scour critical bridges get additional points in the Deficiency formula that push it up the list. (See diagram below)</p> 	<p>There only 44 scour critical bridge remaining. DeIDOT is working to eliminate them through the Bridge Preservation and the general bridge replacement program.</p>
Georgia		
Michigan	<p>Yes. the parameters have been reviewed by the Scour Committee and it is included as part of the annual Call For Projects (CFP).</p>	<p>Reasonably well, though they would like to have greater ability to mitigation scour critical bridges using stream armoring or other methods.</p>
New Jersey	<p>Yes</p>	<p>It is working well. No issues</p>
North Carolina	<p>No, but scour POA recommend to mitigate, repair, or monitor.</p>	
Virginia	<p>Not specifically for scour projects, but scour appraisal ratings give them a bump in score. Because scour ratings overlap with poor ratings, these bridges get on the list for work. Also, VDOT is currently undergoing a project to evaluate effects of extreme weather on infrastructure. Not sure what the results of that study will be.</p>	
West Virginia	<p>We do not utilize a statistically drive risk-based approach, but we maintain good documentation on scour deficiencies and try to address our most vulnerable scour critical bridges as soon as possible and as funding/equipment availability allows.</p>	<p>Based on historical data and events, the current approach seems to be effective.</p>

Category	1. Oversize and Overweight Permitting			
Question	Describe the OS/OW Process	Do you charge for permits requiring superload ratings?	Do you have written procedures?	Is your permit process automated?
Delaware	DelDOT processes over 50,000 OS/OW permits per year. DelDOT Bridge processes 400 OW permits per month. OS/OW program managed by Traffic section. OW permits come to Bridge. OS permits are processed by Traffic.	There is no fee for performing super or mega load ratings. Haulers often resubmit the same load with different axle configurations until they get an approved permit. Fees for permits are cheap and can be found in Section 3.2 of the OS/OW Hauling Permit Policy and Procedures Manual.	Yes. See link in 1b.	DelDOT has been working on an automated permit program for the past 4 years. It has proven more difficult to complete than was previously promised. Currently using in-house programs while it is being finished. In-house staff is efficient at
Georgia	Applications can be submitted online or by calling our permit department. Three full time DOT Permit Routers Majority of the permits less than 150,000 lbs. are processed by our consultants in the remote permit office in Texas About 15,000 permits per month	Yes	We do have written procedures detailing the different requirements for acquiring permits and for acceptable rig. Our requirements can be found online http://www.dot.ga.gov/PS/Permits/OversizePermits We do not have a standalone QA/QC program, everything is done on a case by case basis as the need arises	Yes, it is. https://gapros.dot.ga.gov/
Michigan	Utility permits section issues permits for standard axle configurations based on A-B-C-D overload classifications and/or width/height of load. There are 5 agents and 1 supervisor (6 total) who issue permits. All permits are issued by in-house staff. Michigan DOT has a customized, commercial off the shelf (COTS) permit software using Bentley Superload the web based interface is called the Michigan Transport Routing and Internet Permitting System (MiTRIP) which allows applicants to order oversize/overweight single trip and extended/annual permits.	No more than other permits, and not nearly enough to cover the cost of analysis.	See overload section of bridge analysis guide for the rating process. The permitting process has procedures for applicants that are available online by performing a google search for Michigan-Truckers.	It is largely automated. The software is called MiTrip but it is updated with file from the bridge database periodically. There is no live connection between MiTrip and the bridge database.
New Jersey	There are 5 total DOT FTEs (3 administrative/clearance, 2 load) working on OS/OW permits. 0% consultant use. Approximately 10,000 permits processed per month. Fee structure: https://nj.gotpermits.com/njpass/Content/state/NJ/PublicMaterials/Fee-Schedule.pdf	No	We do not currently have written procedures specifically for reviewing/possessing OS/OW permits. We do, however, have a variety of documentation available under "Reference Material" on the permitting website at https://nj.gotpermits.com/njpass/Home/Index#	Yes, Bentley GotPermits. https://nj.gotpermits.com/njpass/Home/Index#
North Carolina		Yes.	No, because comparing	No.
Virginia	We have 2 FTEs that are dedicated to the structural review of hauling permits plus a percentage of 3 more FTEs.	Our salaries are paid for by DMV which administers the permit program. So the charges come from the revenue generated by the permit fees.	We have instructions on how to use our spreadsheet, and we have the manuals for the various software packages.	Portions of it are. DMV currently uses Bentley's Superload, however, a significant portion of the program remains a manual effort to review pertinent data that is refreshed nightly from BrM and transmitted to DMV.
West Virginia	WVDOT employees two full-time technicians supervised by one full-time licensed engineer to oversee our OS/OW permit process out of our central office. OS/OW haulers log on to www.wv.GotPermits.com/wvpass/login.asp website and enter the route they wish to take. The route is analyzed by the Superload software and any structure with a dimensional or capacity violation is flagged for further investigation by the evaluation engineering staff in the appropriate district. The district evaluation staff will either approve, approve with conditions, or deny the permit. The number of permits issued in a given month varies greatly. However, in 2018 WVDOT issued 146,207 OS/OW permits and took in \$10,280,982 in user fees.	Not at the current time.	Yes. WVDOT website has procedures and a list of permit agencies. Internal procedures are incorporated into the WVDOT Maintenance Manual.	Yes, by Bentley GotPermits program that is backed by the Superload software.

Category	2. How well is your OS/OW Permit Process Working?	3. Changes They Would Like to Make to Their Program
Question	Do you have a cost table?	
<p>Delaware</p> <p>No – load ratings are not calculated for all OS/OW permit trucks. We use the FHWA Bridge Formula along with a screening process that includes using rating factors for 4 permit vehicles from the most recent load rating analysis for each bridge. If we can't get the permit truck to successfully pass for the requested route using the bridge formula or the screening process, then we will perform a load rating analysis for that specific permit truck.</p>	<p>The load raters are very efficient at processing the permits through the in-house developed programs. However, the number of permits continues to increase. The automated program will help and is much needed.</p>	<p>Link provided in 1b.</p> <p>Completing the automated program is the top priority.</p>
<p>Georgia</p> <p>We start analysis for loads grossing more than 180,000 lbs (Super load plus). Every load grossing less than that is evaluated based on the configuration requirement (number of axles, set up, and spacing); if the configuration falls within our guidelines, then the permit is issued without problems. The guidelines were developed based on what worked on our bridges (different analysis for different configurations in the past). Currently, we use the super load batch run option from our load rating program.</p>	<p>It works fine.</p>	<p>Yes, located at https://gaproz.dot.ga.gov/</p> <p>Finding a way to link the load rating program to the permitting program. Which will eliminate the step of having to generate the bridge list and load file, then upload them to the load rating program to run the analysis.</p>
<p>Michigan</p> <p>See the bridge analysis guide, there are many standard overload axle configurations that are rated for each bridge to produce the A-B-C-D classification. All bridges are rated using AASHTOWare BrR.</p>	<p>Think pretty well. There are a handful of special loads annually requiring special analysis, otherwise the overload class system is quite efficient.</p>	<p>Not a table, but the OS/OW permits section has the following website with permit costs: https://www.michigan.gov/mdot/0,4616,7-151-9623_26662_26679_27267_48606-182174--,00.html</p> <p>Cost for a single trip permit is as follows: Oversize \$15.00, Oversize/Overweight \$50.00</p> <p>Cost for an extended permit is as follows: Oversize \$30.00/12 month period, Overweight \$100.00/12 month period</p> <p>Convert all extended permit types to true annual permits. Have a seamless integration with all relevant data sources such as MiBridge databases, to feed live (or close to it) data into MiTrip and allow OS/OW permit applicants to login in straight to the application from MiLogin and not have to go through the Michigan Permit Gateway which is an extra step in the process, essentially I'd like to make it a better online shopping experience that is familiar to most</p>
<p>New Jersey</p> <p>Currently we do not calculate a rating for each bridge for each OS/OW configuration. We instead calculate an "equivalent rating". Since we have the existing computed operating ratings for each legal load for each bridge as well as the bridge geometric data, a comparison is done between each legal load configuration/loading compared to the configuration/loading of the permit vehicle. This method is not ideal but it has been being applied conservatively until we are able to start performing ratings for each bridge / permit vehicle.</p>	<p>Working well</p>	<p>Yes.</p> <p>https://nj.gotpermits.com/njpass/Content/state/NJ/PublicMaterials/Fee-Schedule.pdf</p> <p>Currently our system is applying an "equivalent rating" to each permit vehicle based on a comparison between its configuration/loading and the configuration/operating ratings of the three legal loads in NJ. It has always been NJDOT's intention to utilize the Superload system in collaboration with LARS Bridge in order to perform vehicle-specific ratings for as many bridges as possible along each route, but we have not yet linked our LARS files to Superload due to complications upgrading our load rating files to LRFR. We hope to begin testing LARS files with a limited number of Superload structures in the near future.</p>
<p>North Carolina</p> <p>Note: described above</p>	<p>Pretty good.</p>	<p>Yes</p> <p>Process was reviewed and updated several years ago. Loose control over permitting when municipalities.</p>
<p>Virginia</p> <p>Load ratings are calculated for each OS/OW permit. We use a spreadsheet to check by the moment comparison method and use BrR, DESCUS, or LARSA for in-depth analysis when required.</p>	<p>The automated portion of the permitting (Superload) is only issuing 20% of the permits. The manual process is labor intensive, but routinely efficient, accurate and timely. Bentley system was in place around 2008. Going to put out an RFP to upgrade the OS/OW permitting program. They turn around permits in 3-4 hours typically.</p>	<p>This is available from the DMV at the following link: https://www.dmv.virginia.gov/general/#hauling.asp</p> <p>Consolidation of the program to a single agency could simplify the complex system and data processes providing opportunities for better efficiency, reduced costs, improved data integrity and a more streamlined work flow with third party vendors hosting the hauling permit application.</p>
<p>West Virginia</p> <p>Predetermined configurations are not utilized. Each truck configuration is calculated separately with a full analysis by the Superload software which utilizes Bentley LARS models that have incorporated any deficiencies current with the most recent inspection.</p>	<p>We feel it is the best option we currently have available, but we continue to search for better options.</p>	<p>Yes (see attached).</p> <p>Would like for automated permit procedure to have the capabilities of analyzing complex structures via finite element analysis, 3D modeling, etc. Would also like to see increased fines for OS/OW violators.</p>

Category	4. Activities the Agency Considers Best Practice
Question	
Delaware	The in house Q-Permit program works pretty well. Also, DelDOT has consistency in reviews because only 2 people are processing permits. Despite the number of permits, most permits done the same day (3 day max allowable by state law)
Georgia	Our permits turnaround time is very competitive. Some straight forward permits can be self-issued We are very accessible to our customers
Michigan	Michigan analyzes OS/OW permits by axle weight and spacing, which is an important consideration for Michigan because they allow very heavy legal and permit loads.
New Jersey	Approximately 85% of permits are system-issued without human intervention. That has resulted in a major time and cost savings from when 100% of permits required manual review prior to the implementation of the automated online program.
North Carolina	Capacity of bridge established each time bridge is load rated. New software being used linked WIGINS. Permit provides axle load and spacing, and software determines the capacity for each bridge, then calculate demand. If capacity is high enough, green, if within 10 percent above or below, then additional work done.
Virginia	Requiring before and after inspections for mega-loads when determined to be necessary and entering into a separate agreement with haulers for such oversized loads. Office of the Attorney General wrote the agreement. They are willing to share.
West Virginia	We perform daily QA/QC to ensure correctness of automated permit procedure. Excellent communication exists and is encouraged between permitting and load rating staff.

Category	1. Constraints/Authority			2. Bridge Maintenance Budget
Question	How does your agency respond to high priority repairs? (In-house crews or contractors?)	What is a typical budget amount for this type of repair?	Do you have staff dedicated to assure that posting/closed signs are placed properly?	What is your bridge maintenance annual budget? Is funding allocated to Routine Maintenance and Preventive Maintenance separately?
Delaware	In-house or on-call structure maintenance contract, depending on the type of repair.	Varies, but we fund 5 separate on-call structure maintenance contracts Statewide for a total of ~\$4-5M/year. Not all of this amount is for high priority repairs.	The Bridge Management Engineer reviews all postings. All posting signs are clearly recorded (with locations and pictures) in the inspection reports.	Averages around \$10-11M per year. No, it is all broken out as one category and allocated to maintenance through the Structure Maintenance and Painting contracts.
Georgia	It can be either or depending on the emergency	Not tracked	This is through the Districts, so we don't know how many.	Budget – Total budget FY 20 – 48.5 million Funding allocations – 8.5 million for overhead (salaries, equipment, load rating, consultant inspections, etc). 25 million for preservation/rehab of Interstate Bridge structures 15 million for preservation/rehab of SR bridge structures
Michigan	Primarily by the Statewide Bridge crew that has ability to do steel repairs and place temporary supports. There also are as-needed contracts in place for contractors to be used if needed.	\$0.75 million emergency contract fund and \$8 to 10 million for RFAs, and \$3M for special needs.	Region responsibility. It is required that a photo showing the placed load posting sign be uploaded in MiBridge. This was initiated as part of a FHWA agreed upon Plan of Action. Also, part of the inspection procedure is to verify that the sign is present and matches the recommended posting.	The bridge maintenance budget is part of the Region's overall maintenance budget and it fluctuates based upon winter snow removal needs. Preventive Maintenance is part of the capital program. The work types are often similar.
North Carolina	Bridge inspector issues Prompt Action Request (PAR) need as; critical finding, priority maintenance, or routine. As per policy memo, if critical finding, action to be taken by Division within 10 days, (they must respond with plan within 10 days and repair done in 45 days. Priority maintenance; general expectation with year. Routine maintenance up to Division. Central office tracks follow up on Critical findings. Used to follow-up also on Priority maintenance. All handled in WIGINS. Manager can review all tiers anytime.	Not known. Contained in Division overall maintenance program.	SIA group sends out notification for posting signs. Division staff are responsible to assure posting/closed signs are placed. Field operations does follow-up. SIA group sends letter by email and tracks. Letter sent to Division. Filed in the bridge. Signed off when action is completed. Email process vs a automated process	Budget is part of overall division maintenance budget.
Virginia	We use both in-house crews and on-call contractors, as well as hired equipment contractors	\$8M per year statewide	Yes, although this is no their sole responsibility	\$215M per year. Preventive maintenance should be about 20%, although that number varies by district.
West Virginia	Virtually all high priority repairs are responded to by state personnel. However, statewide contracts are sometimes available as a tool to utilize on-call contractors if necessary.	There is no budget specially allocated for this type of work. It is primarily funded with existing allocations.	Bridge safety inspectors are required to include photographs of all bridge restriction signs to be included in each inspection report.	A total of \$12.2 million is proportionally allocated among the ten district bridge departments, based partly on the size of the district and the number of bridges, to be used toward bridge maintenance. The annual plan funding is expended primarily by state personnel. A special funding category is allocated to each district for bridge maintenance to perform some of the more complex and time-consuming maintenance activities (i.e. bridge renovation), which can be expended by either state personnel or by contract forces. Another special funding category is allocated to each district for bridge cleaning and painting, performed either by state personnel or contract forces. The two special funding categories vary year to year and by district based on available funding and the size of the district. The bridge cleaning and painting funding category is the only funding that is specially set aside for preventative maintenance activities, although the other funding categories can be used for preventative maintenance.

Category			3. Staffing	4. Manuals, Guidance, Procedures	5. Training
Question	Do you have dedicated bridge maintenance funds or do you have to compete for funding from a general maintenance fund?	Do you have any special programs to ensure proper maintenance is performed on significant structures? If so, how is that funded?	Number of DOT FTEs dedicated to high priority bridge repair crews	Do you have a bridge maintenance manual?	Do you provide bridge maintenance training?
Delaware	Bridge Preservation is funded separately, and does not compete for funds. Bridge maintenance is funded before projects are funded.	Yes – for our movable bridges. We have a 5-year open-end statewide movable bridge cyclical maintenance project. The funding is ~\$9M over 5 years and is funded through our Bridge Maintenance pot of monies.	Yes – as they can fit them in with all of their other responsibilities	No.	No.
Georgia	Dedicated.	We have a sole Master contract for our two cable stay bridges (covers preservation/rehab and inspection). It is funded out of my 15 million SR lump sum.	This is through the Districts, so we don't know how many.	Yes. Along with the Bridge Repair manual.	No, the Districts do that.
Michigan	Must compete with other needs. There is a dedicated bridge preservation fund (2019 \$39 Million) which is money allocated to bridge preventive maintenance done by contract.	There is a Big Bridge Committee that plans rehab activities for large or complex structures. This would include PM as well as rehab/replacement. There is a pot of money set aside for these bridges taken from the top of the overall bridge program budget. On average it amounts to \$20 Million annually, but this covers replacement as well.	Statewide bridge repair crew in central office is 6 crew members plus one supervising engineer. There are 3 electricians assigned to movable bridges.	MDOT has a general Capital Preventive Maintenance (CPM) manual. It does not provide specific repair instructions.	Central office provides training for new materials and procedures. We also participated in the NHI Bridge Maintenance class.
North Carolina	No.	No.	Not known	Don't have yet.	No. On the job training only.
Virginia	Both. Each district bridge office gets a budget at the beginning of the fiscal year, but district bridge office reports to an overall maintenance manager who must redistribute funds throughout the year to meet goals and spending targets.	We have developed a list of 25 "special structures" that include large, complex and important structures. It includes all movable bridges, all tunnels, and very large or complex bridges. We are in the process of developing a special budget and prioritization process for those structures.		Yes. Chapter 32 of VDOT's Manual of the Structure and Bridge Division. See link below: Chapter 32 of VDOT's Manual of the Structure & Bridge Division	Yes. We conduct a three day workshop on a biennial basis in addition to ad-hoc training
West Virginia	Bridge maintenance funds are dedicated as described above.	Special programs are not routinely allocated toward significant structures, although projects might be programmed and funded periodically to address needed repairs/renovations.	No full-time employees are dedicated solely to high priority bridge repairs. The high priority repairs are assigned to one of our existing maintenance crews as needed.	Policies are handled through bridge maintenance directives in lieu of a manual.	We offer bridge maintenance training in the form of fall protection, first aid/safety, traffic control certification, product specific classes, commercial drivers' license, crane certification, welding certification. We also recently hosted FHWA-NHI-130108, Bridge Maintenance, for many of our construction supervisors. Basic construction and trade skills are learned through on-the-job training conducted by our more experienced personnel.

Category	6. What bridge maintenance and repair activities can your in-house staff perform?	7. Responding to Bridge Inspection Findings		
Question		Do you have a process to prioritize and implement inspector recommendations/findings?	Who performs the corrective actions to address the recommended high priority and critical findings from Bridge Inspection?	What process do you use for following up on high priority and critical findings from bridge inspections (flags)?
Delaware	Cleaning, sealing concrete, spall repairs	Only for a few low priority actions that aren't addressed through our Bridge Management Software or the standard NBI Elements. These few low priority actions are entered by the inspection team into Maximo (Maintenance Software) and assigned to the corresponding area maintenance yard.	Could be either or depending on the severity and complexity of the corrective action but is typically contractors except for replacing deteriorated/failed cmp culvert bridges.	The Bridge Management & Inspection Engineers visits bridges that are downgraded to condition state 4 or lower (Poor Condition) from an inspection to confirm the finding.
Georgia	None, our staff only inspects and develops plans sets. The District staff can perform the following: Spall repairs (Deck, Super and Sub) Correction of Erosion issues Reconstruction of damaged concrete elements <i>Joint repair</i>	Yes. Highway Maintain Systems – Informs District of recommended work required on a bridge structure.	Both.	Inspector and/or Regionals inspect repairs when finished and update bridge file.
Michigan	Deck patching (both structural and for ride quality), beam end repairs, heat straightening, temp supports, sealing decks, epoxy overlays, epoxy injection, rocker bearing alignment, ... Counties are also contracted to do maintenance. They also assist bridge authorities (Michigan has three signature bridge long span bridge authorities, Mackinac Bridge, Blue Water Bridge, International Bridge.)	Yes. Michigan DOT has the Request For Action (RFA) process and Bridge RFA Coordination Committee. A guidance document for the committee is provided and is described in the presentation in following link: http://sp.maintenance.transportation.org/Documents/Michigan%20DOT%20Bridge%20Request%20For%20Action%20Process.pdf MDOT Bridge RFA Coordination Committee prioritizes RFAs in four priorities; Priority Level 1 - Emergency, Priority Level 2 – Critical, Priority Level 3 – Primary, and Priority Level 4 – Non-Critical. A guidance document describes each of the priority level as and make-up of the committee. The committee meets monthly to prioritize RFAs and track action items. MiBridge is used to track and manage RFAs.	Statewide bridge crew, region or county maintenance crews, as-needed contractors, and bid contractors.	RFA process is well defined. Critical findings are tracked, there is a standing committee on handling them, tasks are assigned and progress is monitored in MiBridge and reported on each month at the RFA committee meeting.
North Carolina	types of bridge maintenance activities done; repair concrete spalls, shotcrete, small pipe replacement, beam end painting, small bridge replacement. NCDOT does not do deck joints as much as they would like to.	Yes. Described above.	Depends upon work needed.	Track in WIGINS
Virginia	All actions from cleaning, patching, epoxy overlays, and full bridge replacement. Our bridge crews are capable of spot painting but generally do not perform recoating. We do not generally install concrete overlays.	Yes, but each district currently performs this prioritization in a unique fashion	Either/both depending on the need. The work is completed at the district level. Tracking is all done at the district level. The authority and accountability falls at the district level.	Varies by district
West Virginia	Steel fabrication and repair, concrete pouring and formwork, reinforcing bar installation, new bridge construction, deck replacement, resetting of bearing devices, expansion device replacement, cleaning and painting, concrete patching.	The District Bridge Engineer creates a list and prioritizes based off bridge inspection reports. However, if the finding meets certain criteria and deemed to be a critical finding, the deficiency and recommended repair is placed on the FHWA Critical Findings database where it is closed out once the needed repairs have been accomplished.	Primarily state personnel except in cases were repairs are extremely time consuming or specialized.	The FHWA Critical Findings database. If not a critical finding, repairs are tracked through a standard work order that is issued by the District Bridge Engineer and assigned to a bridge maintenance crew by the District Construction Superintendent. Once the repair has been accomplished, the superintendent visits the site to verify the work order has been satisfactorily performed and signs off on the work order. The work order is then stored in the files for that particular bridge for future reference

Category	8. Changes they would like to make to their program	9. Activities the Agency considers Best Practice
Question		
Delaware	Bring back pile jacketing program. Start up a bridge washing program. Incorporate dedicated bridge crews (in-house) for each District. Develop a full Bridge Maintenance Section.	As a result of an incident report on I-495 in 2014 that was not directed to the Bridge Section, DelDOT initiated a High Priority Road Condition Process to address any notifications of concerns about bridges. DelDOT Bridge Personnel must respond to High Priority concerns immediately. All High Priority Road Conditions are tracked internally until they are closed out at the level of the Chief Engineer. Also, DelDOT follows up with the person who initiated the concern to notify them of how their concern was resolved.
Georgia		
Michigan	The underlying issue is lack of funding for the capital program. With appropriate funding, there would be less operational issues.	RFA process and committee and statewide bridge crew. Having reach-all available for inspection and repair. Able to do hands-on inspections. Also available for locals. Smaller reach-all less weight for locals. Everyone works well together and helps out.
North Carolina	Create dedicated fund for preservation and rehab. Changes-inconsistency between Divisions	Good practice; Staffing for division maintenance crews. Washing bridges. Joint repairs.
Virginia	Have one bridge crew per district dedicated to five actions: <ul style="list-style-type: none"> •Overlays •Joint elimination •Beam end coating •Beam end repairs •Culvert liners for steel culverts 	<ul style="list-style-type: none"> •Overlays •Joint elimination •Beam end coating •Beam end repairs •Culvert liners for steel culverts
West Virginia	Additional funding for bridge maintenance and replacement. Increase preventative maintenance activities with a dedicated funding source.	Our Transportation Apprenticeship Program encourages the career growth of each bridge maintenance employee by requiring additional training, certification, etc. in order to be classified into higher tiers within their classification series. This program has not only helped the employee, it has also helped the department to develop seasoned and well-rounded bridge maintenance employees.

Category	1. Bridge Management System (BMS)		
Question	Do you have an operating BMS?	Can you do bridge condition or performance measure trend monitoring?	Do you have deterioration models for your BMS?
Delaware	Yes. AASHTO BrM.	We are currently developing the program/software and we will be able accomplish this once implemented.	Yes
Florida	Yes. AASHTO BrM.	Yes	Yes
Georgia	Yes. AASHTO BrM.	Yes.	Yes
Michigan	Yes, AASHTOWare BrM and in-house developed tools; Bridge Condition Forecast Systems (BCFS) for doing network level forecasting of condition.	Yes, through database queries and standard MiBridge reports. We are currently developing the program/software and we will be able accomplish this once implemented.	Yes, for NBI General Condition Ratings (GCRs) and elements.
New Jersey	Yes, we do have an operating BMS. It is BrM.	Yes. We have developed excel-based historical NBI data tool, which has enabled us to create bridge condition trends (both by count and by deck area). It has helped us in monitoring performance measure typically grouped by the bridge owners, NHS and Non-NHS, and MPOs.	Yes. We have developed both NBI Component as well as Element Level Deterioration models in BMS initially based on the expert judgement and solicitation process. Using BrM 6, we have calibrated initial deterioration rates using zero-fund optimization runs. In order to give realistic results, we have fine-tuned these models inside BrM couple of times. We are still working on validating these models specific to NJDOT conditions.

Category	1. Bridge Management System (BMS)		
Question	Do you have an operating BMS?	Can you do bridge condition or performance measure trend monitoring?	Do you have deterioration models for your BMS?
North Carolina	Working on. Yes. AgileAssets	Yes. Not satisfied with Agile optimization engine. We have do manually. Build custom report Can do easier writing own SQL from bridge database. Performance measures are reduce SD and what is shown in TAMP.	yes, done by university research. Can show bridge by bridges and apply life-cycle analysis to set treatments.
Virginia	Yes, but not using a standard software package. We have developed all of the logical input components for a functional BMS, but our work is currently performed in customized spreadsheets. We are working to fully adopt the BrM software for our BMS system.	Yes	yes
West Virginia	Yes. Deighton DTIMS (latest version).	Yes	Yes

Category			
Question	Are you able to forecast bridge condition? Network and/or bridge level?	Does your BMS currently provide project level recommendations for replacement, rehabilitation and preservation?	Are you able to do optimization and strategic investment planning?
Delaware	We are currently developing the program/software and we will be able accomplish this once implemented.	The software has this capability, however, we don't envision using this feature.	We are currently developing the program/software and we will be able to optimize our forecasting analysis. Regarding the investment planning – this really falls to DelDOT's Finance Section.
Florida	Yes/Yes	Yes	Yes
Georgia	Yes/Yes	Yes	Yes.
Michigan	Yes at the network level using BCFS (spreadsheet) and using spreadsheets at the bridge level (more accurate at short term) based on processes in BrM but not yet implemented.	No, not yet. AAHTOWAre BrM will be used to do this when it is up and running.	Yes, at the network level using inhouse tool called Bridge Condition Forecast System (BCFS).
New Jersey	No, we have not manually forecast bridge condition. We have utilized Markovian as well as Weibull functions developed in BrM to perform both bridge level and network level forecasting on bridge condition. We have planned to enhance this process in BMS by improving this functionality in BrM 6.	Yes. BMS is currently using manual methods to recommend projects under replacement, rehabilitation, and preservation by initiating TP1 (Transportation Problem Statement 1). However, we have programmed BrM 6 also to run these individual programs for Bridge Replacement, Bridge Rehabilitation, and Bridge Preservation constraint by their respective budgets for a 11-year time period. The sequence of running these programs on the set of bridges, the assigning a project to a program, or freezing a treatment to a bridge within a particular year are some of the key factors we dealt with. We are enhancing our Bridge Preservation Program by adding more action-benefit-cost models into BrM. The results from BrM further modified by the expert judgement from our Subject Matter Experts, other system needs, and internal bridge lifecycle and historical analysis.	BMS have not completed the implementation of the BrM 6 optimization functionality. Although we have set BrM 6 to do optimization and strategic investment planning on multiple test runs, we are not getting reasonable results at this time. This effort will be in accordance with New Jersey FHWA-complied TAMP (Transportation Asset Management Plan). We have manually performed Gap Analysis to figure out our bridge needs for the State of Good Repair versus Planned Funding.

Category			
Question	Are you able to forecast bridge condition? Network and/or bridge level?	Does your BMS currently provide project level recommendations for replacement, rehabilitation and preservation?	Are you able to do optimization and strategic investment planning?
North Carolina	Five year out, apply deterioration, deck, super and sub, and treat structure, what we find is we have so many just outside 5, when you apply deterioration, all of those drop into a lower condition rating. Huge amount of structures fall into five all at once. Another issue, interface is not set up to do level of service constraint, very well. If monetary, can identify okay. If LOS is objective the model does not do very well. They go year by year, and satisfy constraint. If year three not enough treatments, then will produce and error.	yes. It does it well. As long a decision trees are set up it does a good job. Set up treatments correctly is very important.	yes. But not a lot of buy-in yet for strategic planning. Trust factor and learn to understand the results
Virginia	yes	Yes	Yes
West Virginia	Yes, at network level only.	Yes, at network level only.	DTIMS model provides this, but review of model will be paramount.

Category				
Question	Is this information used to determine budget needs?	Do you collect element level data and is it being used for bridge management?	Do you have a risk-based prioritization process for selecting bridge projects?	Do you report to senior management and/or the public with bridge performance dashboards?
Delaware	We are currently developing the program/software and we will be able accomplish this once implemented. We don't plan to hang our hat completely on this, but will use it to get a general sense of future funding needs.	Yes.	Yes. A Deficiency Formula is used. See Section D, question 2b for formula.	
Florida	Being Developed	Being Developed	Being Developed	Currently we report percentage of bridges in excellent, good, fair and poor condition, by FDOT standards. 8 & 9 = Excellent, 6 & 7 = Good, 5 = Fair, 4 and below = Poor. (Based on lowest of Deck, Superstructure and Substructure. Also report number of bridges inspected, bridges replaced and funds spent on bridge replacement. These are reports and not dashboards. Reports go to senior management and the Florida Transportation Commission.
Georgia	Yes.	Yes.	No.	Yes.
Michigan	BCFS and other in-house tools are used to determine budget needs at this time.	Yes. It is starting to be used for management decisions.	Yes, for river crossing there is calculated risk at the bridge level. While it doesn't use a calculated scoring system, the bridge call for projects is built based on risk – we have a stricter goal for serious/critical bridges as well as for our higher importance routes (Interstate and Freeway).	Yes. Public dashboard is available.
New Jersey	Yes. The approved strategies from BMS analyses are incorporated into budget needs through a process called "pool-sheets". The results from pool sheets are fed into the Capital Program, which is updated annually, and the 10-year STIP, which is updated every 2 years. Capital Investment Strategies are also actively involved in this process.	Yes. We have utilized element level data for our Bridge Management System. The old CoRe (Commonly Recognized) element data was migrated into new National Bridge Element (NBE) data. Agency defined elements and protective systems are also developed inside the system. Since 2015, we have been actively collecting this data statewide and reporting to the FHWA every year.	Yes. The risk-based prioritization process for project selection is done manually within the BMS. In order to achieve this prioritization, we have utilized historical data, asset management experts, structural engineering experts, and the current bridge inspection experts. Also, BrM 6 has the risk assessment module, which is developed and utilized based on the study done by our research partner to calculate initial risk values. The risk values are incorporated into utility function to perform multi-objective optimization analysis. Currently, we are not actively collecting risk data during our inspections; however, we are going to enhance this process in future where approved team leaders can modify the risk values as needed based on the field conditions.	

Category				
Question	Is this information used to determine budget needs?	Do you collect element level data and is it being used for bridge management?	Do you have a risk-based prioritization process for selecting bridge projects?	Do you report to senior management and/or the public with bridge performance dashboards?
North Carolina	do outside of BMS Budget for Capital bridge program for all systems, replacement bridge program, rehab can be either bridge program or preservation, preservation program, general maintenance Bridge program STIP and general bridge program (state funded) General maintenance done in-house. Maint allocated to each division. Do not use BMS for that. Based on current maint needs that are existing. Also look at past expenditures Make recommendations for executing budget	yes. Three years. Not being used for management yet. Do not have element modeling in BMS. They told me they are able to do. In 7.3 has. Schema set up to store element data.	No, not by formula. It is considered through engineering knowledge and judgment. Going through candidate lists. Not doing cost benefit analysis yet.	yes. Have internal dashboard and public showing percent SD and BHI (Bridge Health Index) and divided by three road systems (fund interstate, primary, secondary)
Virginia	Yes.	Yes	Yes	
West Virginia	We are in the initial stages. Information was used in TAMP creation to determine additional bridge funding required.	Yes, on National Highway System (NHS) routes only. However, element level data is not currently used in BMS.	Not presently but risk is defined in TAMP.	

Category	2. Key Performance Indicators	3. Bridge Project Selection		5. Bridge Capital Program Annual Budget (Projects that
Question	a. What key performance indicators or performance measures are used to evaluate the bridge program's effectiveness in achieving the agencies bridge goals/objectives (aside from FHWA metrics)?	Describe your current process for prioritizing projects for replacement, rehabilitation, preservation and maintenance.	How was the bridge program developed in your TAMP?	Rehabilitation and Replacement
Delaware	DelDOT uses strictly NBI condition ratings to track bridge performance. DelDOT tracks the condition of NBI bridge deck area on the NHS and the overall condition of the bridge inventory. DelDOT has a Bridge Inventory Dash Board. Condition of bridges as Good/Fair/Poor are tracked annually.	Bridges are ranked for work using the Deficiency Formula. The Bridge Design and Bridge Management Sections meet quarterly to go through the list, track progress of projects, and make updates as necessary to ensure that the most critical bridges are getting worked on.	Link is below. https://deldot.gov/Publications/tamp/pdfs/DelDOT-Transportation-Asset-Management-Plan-2019.pdf	\$45M +/- Annually
Florida	Percent bridges in good condition (see previous answer). Percent of work orders completed on time. Bridge inspections completed on time.	Project is elevated through management based on cost and criticality. From district bridge maintenance office to district production office to district secretary to state secretary	Followed FHWA guidelines.	\$154M
Georgia	Percent bridge in Good or Poor condition. Strength and Condition	Currently we utilize spreadsheets and queries to determine projects, however GDOT has purchased the AASHTO BrM program and is beginning the process of utilization of that program (as per GDOT TAMP)	We are starting to implement BrM.	We attempt to utilize 50 to 60% of our lump sum budgets to Rehab
Michigan	Good, Fair Poor bridges on freeway and non-freeway similar to FHWA national performance measures except Michigan DOT does by bridge and not deck area. Deck Area on NHS in Good, Fair, Poor condition.	The optimal balance between replacement, rehabilitation, and preventive maintenance is determined including current, project level commitments to meet condition goals. The funding is distributed between regions based on candidates. Prioritization within these limits is at discretion of the region and in coordination with the road program. Project selection is through the Call for projects annual process, which is reviewed by a team of bridge managers for conformance to the annual objectives.	Using in-house tools and AASHTOWare BrM.	\$180 Million typical.
New Jersey	We are using the FHWA required performance metrics, which are percentage of bridges in GOOD condition by deck area and the percentage of bridges in POOR condition by deck area. We are also using the same metrics by count. Other than this, our key performance indicators (KPI) is for the inspection program, which includes number of structures inspected every year by in-house staff and the consultant community. We are looking into adding more KPI based on bridge attributes such as age, importance, etc. Internally, we have been creating Bridge Fact Sheets for our inventory, and Fast Facts on our goals and objectives.	BMS uses manual process to evaluate prioritization which focus primarily on the bridge condition, and other factors such as risks (like scour, fatigue, flood, vehicle collision, etc.), route importance (e.g. interstate, major corridor, evacuation route, etc.), ADT (including percentage of truck traffic), current status of project phase, bridge type, other than bridge needs, etc. The Replacement and Rehabilitation programs uses historical condition data to prioritize projects, and further reviewed by the team made of experts from asset management, structural engineering, and current bridge inspection staff. Bridge Maintenance unit currently manages the Preservation and Maintenance programs which include priority repairs and preventive maintenance contracts. We are collaborating with Maintenance to develop a data-driven and planned Preservation program using BMS tools.	We utilized Consultant to develop our TAMP. As a part of FHWA compliance, we have been collecting NBI data statewide on all NBIS bridges on the NHS regardless of the ownership.	For SFY 2018, the Bridge Capital Program Annual Budget for Rehabilitation and Replacement is about \$214.34 Million

Category	2. Key Performance Indicators	3. Bridge Project Selection		5. Bridge Capital Program Annual Budget (Projects that
Question	a. What key performance indicators or performance measures are used to evaluate the bridge program's effectiveness in achieving the agencies bridge goals/objectives (aside from FHWA metrics)?	Describe your current process for prioritizing projects for replacement, rehabilitation, preservation and maintenance.	How was the bridge program developed in your TAMP?	Rehabilitation and Replacement
North Carolina	Performance measures are reduce SD and what is shown in TAMP.	<p>NCDOT has a prioritization process with a lot of factors; PRI (priority ranking index) priority, rating index,</p> <p>Projects are selected in cooperation with central office and Division. Each Division has a program manager with knowledge of WIGINS. They are mandated to focus on SD bridges, PRI team selects candidates. Team includes BMS engineer, and 6 other people. Division bridge engineers,</p>	now what TAMP goals are and know GAP, look at goals. What to get to in time period.	Bridge management is run centrally but work is programmed by divisions - based on funding set by Division
Virginia	Condition	<p>Construction program prioritizes according to a selection formula that includes parameters for risk, functionality, condition, cost-effectiveness, and importance. See link for explanation: Virginia's State of Good Repair Process</p> <p>Maintenance program provides more flexibility for district offices. We have our office practice (see response to item 4 of Section F of this survey), and our performance metrics. District bridge offices are expected to formulate plans that meet both metrics and office practice requirements.</p>	Program reflected current practices. Projections of future conditions used element-level deterioration, recommended actions, budget constraints, and past actions to predict future conditions on NHS NBI structures. Work was performed in a customized spreadsheet.	\$225M for construction program + approximately \$90M from the maintenance budget. ~\$315M total per year
West Virginia	Within the BMS, all key performance indicators are defined and modeled in DTIMS (see attached WVDOH Transportation Asset Management Plan).	District Bridge Engineer determines prioritization based on structure type and condition, average daily traffic, type of traffic, alternate detour length, etc. as funding is available.	Starting point for systematic prioritizations. Reliance will be given to BMS for prioritizations.	Approximately \$280,000,000 in state funding (FY 2019)

Category		6. Changes they would like to make to their program	7. Activities the Agency considers Best Practice
Question	Preservation		
Delaware	Bridge Management side of things is ~\$5.5M per year.	Obtain additional staff to accommodate a full time Bridge Maintenance Squad. Currently, the Bridge Maintenance Engineer oversees the entire program with assistance from 2 engineer bridge inspectors as their schedule allows.	Quarterly meetings between Bridge Management and Bridge Design staff to discuss all projects is critical to ensuring that no bridge falls through the cracks. Bridge Management staff have the opportunity to discuss concerns from recent inspections. Bridge Design staff provides updates on projects. Projects that hit delays can sometimes have interim maintenance to extend life. Every bridge in critical condition is discussed.
Florida	\$92M	Increase staff funding	Inspection Program
Georgia	We attempt to utilize 40 to 50% of our lump sum budgets to Preservation		
Michigan	\$39 Million (2019)	We are currently underfunded and cannot maintain bridge conditions. There is also significant underfunding of bridge in the local system. We are in process of making other changes such as BrM implementation.	We have a lot of people that have embraced a mix of fixes at every level of the organization. Through the RFA process and the fact that we include the regions in the call for projects process, proposed projects are reviewed by peers. Since funding allocations are impacted by the condition of all regions, the group has done well in holding each other accountable and in maintaining alignment.
New Jersey	For SFY 2018, the Bridge Capital Program Annual Budget for Preservation is about \$167.50 Million		I. Enhance interactions with Bridge Maintenance Unit to improve the Bridge Preservation/Preventive Maintenance Program. II. Increased technical staffing that are experts in Data Science

Category		6. Changes they would like to make to their program	7. Activities the Agency considers Best Practice
Question	Preservation		
North Carolina		Would like more integration between what we capital program does and maintenance does. Would like real-time updating of what done and track cost. Don't have enough experience right now. Better coordination of best practice among Divs Improve algorithms and forecast models	
Virginia	~\$15M	Have a robust user group that coordinates to provide general agreement on the input parameters and values of the BMS system. FYI, we are in the process of doing exactly that.	
West Virginia	Approximately \$10,000,000 in state funding (FY 2019)	Too early to give an answer	Too early to give an answer

Category	1. Local Agency Organizational Structure	2. Local Agency Bridge Inspection		3. Local Agency Load Rating		4. Do local agencies issue OS/OW permits? (Yes/No)
Question	Do local agency's (counties, cities, townships) own and maintain highway bridges? (Yes/No)	Who does the routine bridge inspections for local owned highway bridges	Who conducts the QC/QA on these inspections?	Who load rates local agency bridges including complex structures?	b. Who conducts the QC/QA on these load ratings?	If yes, please describe.
Delaware	Yes. There are only 11 NBI local bridges	DelDOT does all inspections.	DelDOT does all QC/QA on these inspections	DelDOT does the load ratings.	DelDOT does all QC/QA for load ratings.	No.
Florida	Yes	Consultants	State	Consultants	State	No
Georgia	Yes	GDOT BMU	GDOT BMU	GDOT BMU – thru consultant	GDOT BMU – thru consultant	No
Michigan	Yes	Vast majority by consultant, a few locals do it in-house.	QC and QA is done in accordance to the Michigan DOT Structures Inspection Manual. QA is done annually by a consultant contract.	Virtually all by consultant.	Consultants are required to have their own QC procedures in accordance to the Structures Inspection manual. QA is done by statewide consultant contract, and is being implemented this year for the first time.	A few do but most don't.
New Jersey	Yes	NJDOT selected Consultants	Consultant PM's and NJDOT In House staff	Consultants	Consultant PM's and NJDOT In House staff	Yes. NJDOT does not issue permits on behalf of agencies / local owners. Based on limited discussions with other owners, most do have their own procedures in place to issue permits, but they find low levels of compliance by the trucking industry.
North Carolina	Counties do not own bridges. Cities own some bridges. NCDOT inspects and load rates all bridges unless the municipality requests to do.	NCDOT	NCDOT	If the local agency inspects their bridges, they also become responsible for load rating, otherwise NCDOT	NCDOT if NCDOT does load rating.	No.

Category	1. Local Agency Organizational Structure	2. Local Agency Bridge Inspection		3. Local Agency Load Rating		4. Do local agencies issue OS/OW permits? (Yes/No)
Question	Do local agency's (counties, cities, townships) own and maintain highway bridges? (Yes/No)	Who does the routine bridge inspections for local owned highway bridges	Who conducts the QC/QA on these inspections?	Who load rates local agency bridges including complex structures?	b. Who conducts the QC/QA on these load ratings?	If yes, please describe.
Virginia	Yes, some do, however, the State owns and maintains the vast majority of the Secondary routes within the Counties.	Most of the routine inspections for localities are performed by Consultants.	QA/QC is performed by the owner, however, where VDOT has oversight responsibilities (NBIS) we also perform QA/QC in accordance with our policies.	Most load ratings for locality owned bridges are performed by Consultants.	The owner is responsible for QA/QC, however, where VDOT has oversight responsibility (NBIS) we will perform QA/QC in accordance with our policies.	Yes, in some cases. DMV does have some agreements to permit through certain localities, however, where there is not such an agreement with DMV the locality will issue the permit.
West Virginia	Yes, cities and townships. Structures located on county routes are maintained by the state.	WVDOT	WVDOT	WVDOT	WVDOT	WVDOT issues all OS/OW permits for all bridges and routes under state control, including permits that travel the WV Turnpike. WVDOT reimburses the WV Turnpike for fees they should collect for permits that were issued on their behalf. Permit applicants are encouraged to contact the local townships for procuring the necessary permits to travel on the routes under their control.

Category	5. Who is responsible for maintenance, repair, rehabilitation, and replacement of local agency and other owner highway bridges?	7. Does the DOT have legal authority in your state to self-perform and/or oversight of any of these activities for local agency or other owner bridges?	8. Changes they would like to make to their program	9. Activities the Agency considers Best Practice
Question	Does the DOT have any responsibility for posting and/or closing local agency bridges? If so, are there state laws or local agreements authorizing DOT to take these actions?			
Delaware	The local agency is responsible for maintenance, repair, rehabilitation and replacement of locally owned bridges. DelDOT will work with the local agency to secure funding and assist with design and/or design plan reviews. The Local agencies are responsible for posting and closing their bridges.	Yes – regarding inspections.	N/A	DelDOT inspects local bridges.
Florida	County maintain & repair, DOT has legal responsibility to post/close local bridges	No		
Georgia	The Owners. GDOT may assist with replacement under several programs (such as low impact bridge replacement programs and LMIG).	Typically yes, but exception exists		
Michigan	The local agency is required to provide photos showing the posting or closing of bridges that require it, else risk losing federal funding. State law requires locals follow federal procedures in order to get transportation funding, and so following the NBIS is a requirement for state	Michigan Attorney General office advised Michigan DOT that they do not have legal authority to inspect local agency bridges when the locals fail to do so, but the Michigan DOT has chosen to do these inspections to maintain Federal compliance when needed.	Additional funding.	Michigan Bridge conference and workshop plus CTT center for training.
New Jersey	The owner. No.	No but provide support and recommendations	FHWA should have direct oversight of Agency bridge inspection activities and provide funding as needed.	
North Carolina	Cities are responsible for bridges they own.	Yes	Not much of a “stick” to get locals to take action. Locals should take responsibility for permitting.	NCDOT and large municipalities doing bridge asset management, but small municipalities really struggling.

Category	5. Who is responsible for maintenance, repair, rehabilitation, and replacement of local agency and other owner highway bridges?	7. Does the DOT have legal authority in your state to self-perform and/or oversight of any of these activities for local agency or other owner bridges?	8. Changes they would like to make to their program	9. Activities the Agency considers Best Practice
Question	Does the DOT have any responsibility for posting and/or closing local agency bridges? If so, are there state laws or local agreements authorizing DOT to take these actions?			
Virginia	The owner, No.	VDOT has a legal right to perform bridge safety inspections for certain localities that fail to perform them in a timely manner as required by the NBIS. VDOT can recoup the costs by withholding portions of maintenance allocations. They are proposing current legislation to allow them to bill the locals for the inspection.	? The FHWA appears to be working towards expansion of the NBIS regulations to encompass more bridges that are owned by instrumentalities or private entities. Legislation to authorize the State to enter upon such property and conduct bridge inspections required by Federal Law and to recoup associated costs may be needed to ensure the State is not held responsible for the inactions of others after reasonable efforts to facilitate their compliance are made by the State.	VDOT has a Local Assistance Division that specializes in providing policy and communication guidance for business interactions between the Department and localities.
West Virginia	The bridge owner (city, township, etc.) is responsible for maintaining any bridge not owned by the state. WVDOT makes recommendations for repairing, posting, and/or closing local agency bridges based on findings from inspections we perform, however local agencies have the ultimate responsibility of posting or closing their structures.	No	Require local agencies to fund any/all inspection and maintenance requirements. To have more formal agreements in place between state and local agencies.	All local agency bridges are kept in accordance with NBIS requirements.

Appendix D: Peer State Comparative Statistics

Appendix D - Peer State Comparative Statistics

State	Comparative Statistics						Fuel Excise Tax		Bridge Data								Population	Land Area
	% DOT Bridges to All Bridges	State Sq. Miles per DOT Bridge	Sq. Miles per All Bridges	Population Per All Bridges	Population Per DOT Bridge	Population Per All Bridges	Gas Excise Tax	Diesel Excise Tax	Federal	State highway agency	State toll authority	Other state agency	Local highway agency	Local toll authority	Other local agency	Private (including railroad)	Total	Population
South Carolina	90%	3.8	3.4	603	545	22	22	69	8,431	0	1	780	0	0	19	9,336	5,084,127	32,020
Delaware	96%	3.0	2.9	1,164	1,121	8	8	5	831	0	0	11	16	0	0	863	967,171	2,489
Florida	46%	12.0	5.5	3,887	1,773	18	26	150	5,480	1,149	44	5,069	9	46	65	12,012	21,299,325	65,758
Georgia	45%	8.9	4.0	1,581	712	22	23	175	6,652	0	1	7,902	0	1	46	14,777	10,519,475	59,425
Michigan	40%	21.8	8.7	2,251	903	42	36	89	4,441	4	27	6,480	0	20	3	11,064	9,995,915	96,714
New Jersey	37%	3.7	1.3	3,759	1,373	22	21	34	2,370	1,145	215	2,675	31	2	18	6,490	8,908,520	8,723
North Carolina	93%	3.2	3.0	616	574	25	44	394	16,861	22	3	815	0	0	2	18,097	10,383,620	53,819
Virginia	86%	3.6	3.1	715	617	23	22	357	11,911	12	5	1,404	62	0	49	13,800	8,517,685	42,775
West Virginia	96%	3.5	3.4	262	252	24	24	49	6,890	99	3	103	0	10	9	7,163	1,805,832	24,230
Alabama	36%	9.1	3.3	852	304	18	19	167	5,734	0	9	10,115	0	2	30	16,057	4,887,871	52,420
Alaska	53%	822.5	436.0	912	483	28	31	560	809	0	4	149	0	3	1	1,526	737,438	665,384
Arizona	59%	24.0	14.2	1,513	893	16	16	438	4,741	0	19	2,826	0	1	6	8,031	7,171,646	113,990
Arkansas	57%	7.3	4.2	414	235	32	32	186	7,271	0	41	5,305	0	0	2	12,805	3,013,825	53,179
California	49%	13.3	6.5	3,204	1,563	19	22	816	12,347	0	79	11,998	5	54	16	25,315	39,557,045	163,695
Colorado	40%	30.2	12.0	1,654	657	29	48	294	3,444	0	0	4,787	121	6	14	8,666	5,695,564	104,094
Connecticut	69%	2.0	1.4	1,270	878	31	33	7	2,814	0	0	1,246	0	0	4	4,071	3,572,665	5,543
District of Columbia	84%	0.3	0.3	3,298	2,777	24	26	36	213	0	1	2	0	1	0	253	702,455	68
Hawaii	64%	15.0	9.6	1,949	1,249	25	22	36	729	0	1	369	0	0	2	1,137	1,420,491	10,932
Idaho	30%	63.1	18.9	1,324	396	20	20	717	1,325	0	13	1,716	0	655	1	4,427	1,754,208	83,569
Illinois	29%	7.5	2.2	1,641	480	30	31	41	7,766	454	2	18,171	0	8	93	26,535	12,741,080	57,914
Indiana	29%	6.6	1.9	1,220	352	35	36	64	5,484	332	61	13,044	1	12	19	19,017	6,691,878	36,420
Iowa	17%	13.7	2.3	769	130	24	24	34	4,103	0	17	20,136	1	0	2	24,293	3,156,145	56,273
Kansas	20%	16.4	3.3	579	116	26	26	115	5,031	363	1	19,535	0	0	1	25,046	2,911,505	82,278
Kentucky	63%	4.5	2.8	496	315	29	29	98	9,005	0	7	5,045	0	2	32	14,189	4,468,402	40,408
Louisiana	60%	6.7	4.0	600	360	18	18	265	7,769	0	17	4,872	5	26	5	12,959	4,659,978	52,378
Maine	81%	18.0	14.6	679	553	17	17	19	1,971	166	8	230	0	1	24	2,419	1,338,404	35,380
Maryland	48%	4.9	2.3	2,367	1,143	32	29	93	2,553	313	36	2,289	0	1	4	5,289	6,042,718	12,406
Massachusetts	67%	3.1	2.1	1,995	1,344	30	30	19	3,460	8	83	1,565	1	1	0	5,137	6,902,149	10,554
Minnesota	28%	24.0	6.7	1,552	436	23	27	88	3,616	0	7	9,136	0	3	34	12,884	5,611,179	86,936
Mississippi	34%	8.4	2.8	517	175	22	22	462	5,775	0	1	10,833	0	0	17	17,088	2,986,530	48,432
Missouri	42%	6.7	2.9	592	251	11	14	64	10,344	0	1	13,878	1	67	20	24,375	6,126,452	69,707
Montana	47%	59.3	28.0	429	202	17	21	803	2,478	0	0	1,970	0	0	0	5,251	1,062,305	147,040
Nebraska	23%	22.0	5.0	549	125	8	8	82	3,512	0	35	11,599	0	99	46	15,373	1,929,268	77,348
Nevada	56%	103.4	58.3	2,839	1,600	36	36	40	1,069	0	2	728	0	47	10	1,896	3,034,392	110,572
New Hampshire	53%	7.2	3.8	1,043	551	23	23	71	1,300	163	1	923	1	1	3	2,463	1,356,458	9,349
New Mexico	75%	40.9	30.8	704	530	28	28	234	2,975	0	2	736	0	1	3	3,951	2,095,428	121,590
New York	43%	7.3	3.1	2,610	1,128	19	19	49	7,487	774	94	8,542	172	109	105	17,332	19,542,209	54,555
North Dakota	26%	62.6	16.0	673	172	34	34	80	1,129	0	2	3,199	0	4	10	4,424	760,077	70,698
Ohio	38%	4.3	1.7	1,128	433	58	74	11	10,361	462	0	16,075	0	4	59	26,972	11,689,442	44,826
Oklahoma	29%	10.3	3.0	581	170	33	33	128	6,791	766	10	15,431	0	4	2	23,132	3,943,079	69,899
Oregon	34%	36.2	12.3	1,542	523	20	20	1,186	2,718	0	18	4,033	2	48	6	8,011	4,190,713	98,379
Pennsylvania	68%	3.0	2.1	845	571	28	28	67	15,153	777	9	6,147	46	6	225	22,430	12,807,060	46,054
Rhode Island	78%	2.6	2.1	1,804	1,404	25	24	2	586	14	3	146	0	1	1	753	1,057,315	1,545
South Dakota	31%	42.9	13.1	891	150	34	34	122	1,797	0	20	3,933	0	0	0	5,872	882,235	77,116
Tennessee	41%	5.1	2.1	819	338	30	30	353	8,265	0	6	11,406	0	2	3	20,035	6,770,010	42,144
Texas	64%	7.9	5.1	844	543	26	27	179	34,002	298	19	17,755	524	85	36	52,898	28,701,845	268,596
Utah	60%	47.0	28.2	1,748	1,049	16	20	177	1,808	0	2	1,027	0	0	0	3,014	3,161,105	84,897
Vermont	40%	8.8	3.5	576	228	49	49	26	1,087	0	0	1,626	0	0	6	2,745	626,299	9,616

Appendix D - Peer State Comparative Statistics

Comparative Statistics										Fuel Excise Tax		Bridge Data							Population	Land Area
State	% DOT Bridges to All Bridges	State Sq. Miles per DOT Bridge	Sq. Miles per All Bridges	Population Per DOT Bridge	Population per All Bridges	Gas Excise Tax	Diesel Excise Tax	Federal	State highway agency	State toll authority	Other state agency	Local highway agency	Local toll authority	Other local agency	Private (including railroad)	Total	Population	Sq. Mi.		
Washington	40%	21.8	8.8	2,300	930	21	21	779	3,277	1	4	4,032	3	8	3	8,107	7,535,591	71,298		
Wisconsin	37%	12.6	4.6	1,118	412	31	31	117	5,200	0	0	8,776	0	0	16	14,109	5,813,568	65,496		
Wyoming	63%	50.0	31.3	296	185	23	23	319	1,955	0	3	844	0	0	3	3,124	577,737	97,813		
United States, total								10,766	283,157	7,322	937	301,414	1,001	1,341	1,075	607,013				
U.S. total (incl. Puerto Rico)								12,385	283,176	7,322	1,278	301,414	1,002	1,341	1,075	607,014				

NOTES: Some discrepancies exist between the total number of bridges reported in tables 1-5, 1-6, and 1-7 because of bridges not identified in one or more of the categories and other anomalies. Other state agency includes state parks, forests, reservations, and other state agencies. Local highway agency includes county, town or township, and city or municipal highway agencies. Other local agency includes local parks, forests, reservations, and other local agencies. Private includes highway bridges owned by railroads and other private entities. Details for each state may not add to totals because totals include bridges for which ownership is unknown.

Data Sources:

- "Fuel Excise Tax" data was compiled January 1, 2019 and accessed at <https://www.taxadmin.org/assets/docs/Research/Rates/mf.xls>
- "Bridge Data" is from <https://www.bts.gov/content/number-road-bridges-owner>, Table 1-6: Number of Road Bridges by Owner: 2014; SCDOT bridge data updated with TAMP information
- "Bridge Area" and "Bridge Count" data is derived from <https://www.fhwa.dot.gov/bridge/nbi/no10/owner.xlsx>
- "2018 Population" estimates are from: U.S. Census Bureau, Population Division, Table 1. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2018 (NST-EST2018-01)
- "Land and Water area" data from: <https://www.census.gov/geographies/reference-files/2010/geo/state-area.html>

Appendix E: Sample Local Road Authority Statutes

2019 Florida Statutes

http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0335/Sections/0335.074.html)

Title XXVI, PUBLIC TRANSPORTATION

Chapter 335, STATE HIGHWAY SYSTEM

335.074 Safety inspection of bridges.—

(1) Those bridges having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches or extreme ends of openings for multiple boxes and those bridges consisting of multiple pipes where the clear distance between openings is less than half of the smaller contiguous opening are subject to inspection in accordance with the provisions of this section.

(2) At regular intervals as required by the Federal Highway Administration, each bridge on a public transportation facility shall be inspected for structural soundness and safety for the passage of traffic on such bridge. The thoroughness with which bridges are to be inspected shall depend on such factors as age, traffic characteristics, state of maintenance, and known deficiencies. The governmental entity responsible for maintenance of any such bridge is responsible for having inspections performed and reports prepared in accordance with this section.

(3)(a) Each bridge inspection required by subsection (2) shall be performed by an inspector who is qualified, as prescribed in subsection (4), who shall determine the load-carrying capacity and safety condition of the bridge.

(b) Each inspection shall be reported on a format designated by the department and forwarded to the department. A copy of such report shall also be provided to the local governmental entities in the jurisdictions of which the bridge is located. Data on a newly completed structure, or on any modification of an existing structure, which would alter previously submitted data on any inspection report shall be submitted to the department and the appropriate local governmental entities within 90 days of completion of the new construction or modification by the governmental entity having maintenance responsibility.

(c) The department shall maintain an inventory of bridges and appropriate records on the inspections of such bridges reported pursuant to this section.

(4)(a) An individual who inspects bridges and completes reports required by this section must possess the following minimum qualifications:

1. Be a registered professional engineer with expertise in civil engineering; or
2. Have a minimum of 5 years' experience in bridge construction or maintenance inspection assignments in a responsible capacity and have completed a comprehensive training course approved by the department.

(b) An individual who executes reports required by this section shall be a registered professional engineer.

(5) Upon receipt of an inspection report that recommends reducing the weight, size, or speed limit on a bridge, the governmental entity having maintenance responsibility for the bridge must reduce the maximum limits for the bridge in accordance with the inspection report and shall post the limits in accordance with s. 316.555. The governmental entity must, within 30 days after receipt of an inspection report recommending lower limits, notify the department that the limitations have been implemented and the ¹bridge has been posted accordingly. If the required actions are not taken within 30 days after receipt of an inspection report, the department shall post the limits on the bridge in accordance with the

recommendations in the inspection report. ²All costs incurred by the department in connection with providing notice of the bridge's limitations or restrictions shall be assessed against and collected from the governmental entity having maintenance responsibility for the bridge. If an inspection report recommends closure of a bridge, the bridge shall be immediately closed. If the governmental entity does not close the bridge immediately upon receipt of an inspection report recommending closure, the department shall close the bridge. ²All costs incurred by the department in connection with the bridge closure shall be assessed against and collected from the governmental entity having maintenance responsibility for the bridge. ³Nothing in this subsection alters existing jurisdictional responsibilities for the operation and maintenance of bridges.

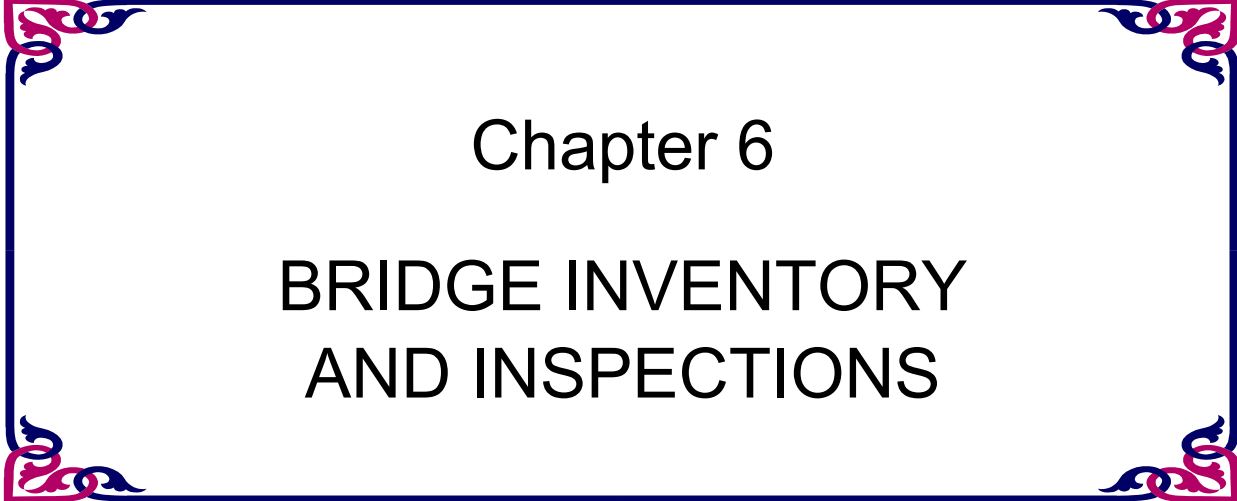
History.—ss. 1, 2, 3, ch. 69-271; ss. 23, 35, ch. 69-106; s. 1, ch. 75-137; s. 1, ch. 77-174; s. 40, ch. 84-309; s. 16, ch. 85-81; s. 94, ch. 92-152; s. 77, ch. 99-385; s. 21, ch. 2012-128; s. 25, ch. 2012-174; s. 3, ch. 2017-42.

¹Note.—As created by s. 25, ch. 2012-174. Section 21, ch. 2012-128, also created subsection (5), and that version used the words "limits have" instead of "bridge has."

²Note.—As created by s. 25, ch. 2012-174. Section 21, ch. 2012-128, also created subsection (5), and that version used the word "The" instead of the word "All."

³Note.—As created by s. 25, ch. 2012-174. Section 21, ch. 2012-128, also created subsection (5), and that version used the phrase "This subsection does not alter" instead of the phrase "Nothing in the subsection alters."

Note.—Former s. 338.071.



Chapter 6

BRIDGE INVENTORY AND INSPECTIONS

BUREAU OF LOCAL ROADS AND STREETS MANUAL

June 2018

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6(i)

Chapter 6
BRIDGE INVENTORY AND INSPECTIONS

Table of Contents

<u>Section</u>	<u>Page</u>
6-1	NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)..... 6-1-1
6-1.01	General 6-1-1
6-1.02	Definitions 6-1-1
6-2	BRIDGE INVENTORY 6-2-1
6-2.01	National Bridge Inventory (NBI)..... 6-2-1
6-2.02	Illinois Structure Information System (ISIS) 6-2-1
6-2.03	Inventory Requirements 6-2-1
6-2.04	Structure Number (SN)..... 6-2-1
6-2.05	ISIS Structure Reports 6-2-2
6-2.06	Sufficiency Rating (SR) 6-2-2
6-2.07	Inventory Updates 6-2-4
6-3	BRIDGE INSPECTIONS..... 6-3-1
6-3.01	LPA Responsibility 6-3-1
6-3.01(a)	Publicly Owned Structures 6-3-1
6-3.01(b)	Privately Owned Structures..... 6-3-1
6-3.02	Reporting Requirements 6-3-2
6-3.02(a)	New Structure, or Initial Inspection of Old Structure not in ISIS 6-3-2
6-3.02(b)	Re-inspection of Structures on File in ISIS 6-3-2
6-3.02(c)	Reconstruction of an Existing Structure 6-3-2
6-4	LOAD RATING AND POSTING..... 6-4-1
6-4.01	Requirements..... 6-4-1
6-4.02	Responsibilities 6-4-1
6-4.02(a)	Load Rating by IDOT 6-4-1
6-4.02(b)	Load Rating by Others 6-4-2
6-4.02(c)	Reporting 6-4-2
6-4.03	Bridge Closure and Weight Limit Posting 6-4-2
6-4.04	Bridge Closure and Weight Limit Posting Review..... 6-4-2
6-5	ACRONYMS..... 6-5-1
6-6	REFERENCES..... 6-6-1

Chapter 6

BRIDGE INVENTORY AND INSPECTIONS

6-1 NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)

6-1.01 General

The NBIS is the Federal regulation that establishes the requirements for a bridge inspection organization, inspection procedures, frequency of inspections, qualifications of personnel, and preparation and maintenance of a state bridge inventory. The NBIS applies to all structures defined as bridges carrying a roadway and open to the public. The bridge inspection program resulting from the NBIS is intended to detect structural and functional deficiencies in order to minimize the probability of structural failure and improve bridge traffic safety. The Federal Highway Administration (FHWA) has promulgated regulations to establish the applicable criteria that each state transportation department must meet, see 23 CFR, Part 650, Subpart C.

To properly implement the NBIS program requirements for local public agencies (LPAs) in Illinois, the Department relies on the LPA to perform the NBIS requirements for structures under its jurisdiction. All LPAs with jurisdiction of a structure eligible for inclusion in the National Bridge Inventory (NBI) must designate a Program Manager to ensure compliance with the NBIS and provide guidance and management of their bridge inventory. The designated Program Manager must meet the qualifications as described in Section 3 of the [Structural Services Manual](#), maintained by the Bureau of Bridges and Structures (BBS). Statewide oversight of the LPA bridge inspection program is provided by the Statewide Program Manager in the Bridge Management Unit (BMU) of the BBS.

IDOT policies and procedures for Bridge Inspection are located in the BBS' [Structural Services Manual](#).

6-1.02 Definitions

The following definitions apply to the NBIS and its implementation:

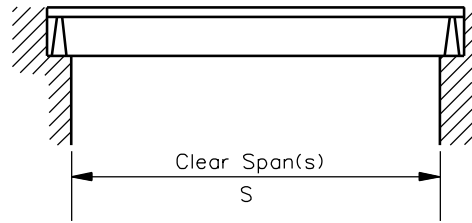
1. Bridge. A structure, including supports, erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening, measured along the center of the roadway of more than 20.0 ft (6.1 m) between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. See Figure 6-1A for examples of various bridge openings.

6-1-2

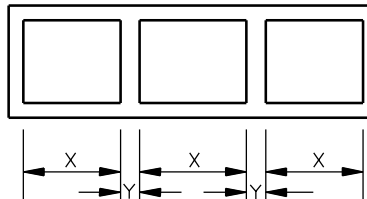
BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

June 2018

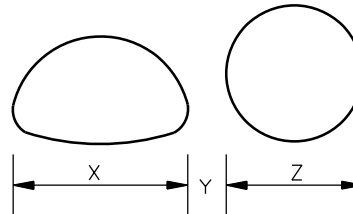
Abutment Supported
Bridges


 $S \geq 20.0' (6.1 \text{ m}): \text{Bridge}$

Concrete Box Culvert
at Grade or Under Fill
(Single or Multi-Span)


 $X + Y + X \dots \geq 20.0' (6.1 \text{ m}): \text{Bridge}$
 Where $Y < \frac{X}{2}$

Metal Pipe Under Fill
(Single or Multi-Span)


 $X + Y + Z \dots \geq 20.0' (6.1 \text{ m}): \text{Bridge}$
 Where $Y < \frac{A}{2}$, where A
 is the Smaller of X or Z

**DETERMINATION OF BRIDGE LENGTH FOR
 THE PURPOSE OF DEFINITION OF A BRIDGE**

Figure 6-1A

2. National Bridge Inspection Standards (NBIS). The Federal regulations establishing requirements for a bridge inspection organization, for inspection procedures, frequency of inspections, qualifications of personnel, and preparation and maintenance of a state bridge inventory. The NBIS applies to all structures defined as bridges carrying roads open to the public.
3. National Bridge Inventory (NBI). The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the NBIS, which require that each state prepare and maintain an inventory of all bridges subject to the NBIS.
4. NBI Record. Data that has been coded according to the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Guide)* for each structure carrying highway traffic or each inventory route which passes beneath a structure.

June 2018 **BUREAU OF LOCAL ROADS & STREETS**
BRIDGE INVENTORY AND INSPECTIONS 6-1-3

5. Master Structure Report. The representation of the data recorded and stored for each NBI record in accordance with the *Guide*.
6. Sufficiency Rating. A numerical value from 0.0 to 100.0 which indicates a bridge's overall sufficiency to remain in service. The rating is calculated from the Structure Inventory and Appraisal (SI&A) data and reflects the following factors:
 - structural adequacy and safety,
 - serviceability and functional obsolescence,
 - essentiality for public use, and
 - any special considerations.

June 2018 **BUREAU OF LOCAL ROADS & STREETS**
BRIDGE INVENTORY AND INSPECTIONS 6-2-1

6-2 BRIDGE INVENTORY

6-2.01 National Bridge Inventory (NBI)

The NBI is a national program that requires each state to prepare and maintain an inventory of all bridges on public roads that are subject to the NBIS. The purpose is to maintain a national database of structures and applicable structural analyses data. This information is used by the FHWA to develop reports to submit to Congress on the status of the nation's bridges, and by states in managing their bridge maintenance, rehabilitation, and replacement programs.

6-2.02 Illinois Structure Information System (ISIS)

IDOT maintains a computerized bridge inventory system, designated as the Illinois Structure Information System (ISIS). This is part of the Illinois Highway Information System (IHIS). The ISIS database system contains information required by the NBIS, including inspection data.

The ISIS data is available from the Structure Information Management System (SIMS). LPAs may obtain the database file of local bridges for each county from IDOT's website and use the SIMS with the Microsoft Access database application program.

6-2.03 Inventory Requirements

The bridge inventory must include the following:

- all structures carrying public roads meeting the definition of a bridge, and
- all other structures where an opening length (measured along the centerline of the roadway) of less than or equal to 20.0 ft. (6.1 m) and involving a highway. These may be accepted into the system if prior approval is given by the Central Office of Planning and Programming – Data Collection Unit.

Structure numbers (SN) should be assigned and the inventory should be completed for non-highway, railroad and pedestrian structures over roads open to the public. This establishes the structure in the ISIS for inventorying its location, and vertical and horizontal clearances. NBIS inspections are not required for pedestrian structures. However, regular maintenance inspections are encouraged.

The responsibility for reporting the required information for the ISIS rests with the agency having jurisdiction of the road leading to and from the bridge. If there is no public road on the structure, the reporting responsibility rests with the agency having jurisdiction of the road under the structure.

6-2.04 Structure Number (SN)

Each structure is identified by a 7 digit SN composed of a 3 digit county number and a 4 digit structure sequence number. The county number can be found as Item 3 in the [Structure Information and Procedure \(SIP\) Manual](#). The [SIP Manual](#) also provides additional information on the sequence number. The SN is assigned by the district or the maintaining agency from a block of numbers reserved for each agency. The SN is to be assigned prior to submittal of the

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-2-2

June 2018

Preliminary Bridge Design and Hydraulic Report (PBDHR) or Type, Size & Location (TS&L) plans, as applicable, and shall be included in the ISIS to avoid possible duplicate use of the SN.

Data for deleted structures is retained in the ISIS and the SN shall never be used again. Similarly, a bridge constructed using any portion of the original substructure may keep its same SN. Completely new bridges erected at the same location on the same or new alignment that does not use any part of the old bridge will be assigned a new SN. Structures moved to a new location should receive a new SN. New structures may be assigned SNs using the next available SN by district scheme. There is no official statewide scheme for the assignment of SNs according to jurisdiction.

Once the maintaining agency and IDOT have agreed on a SN for a bridge, that SN is permanent and will not be changed for any reason even if there is a change in maintenance responsibility. This avoids confusion in record retrieval and retention. To make the bridge numbering system effective in the field, one SN tag should be painted or installed on each end of the bridge.

6-2.05 ISIS Structure Reports

Figure 6-2A presents the Structure Reports necessary to communicate information for entry into ISIS. The forms for the initial recording of inventory, route, and inspection information may be available from the district, copied from the [SIP Manual](#), or printed from the Structure Information Management System ([SIMS - County](#)), which can be downloaded from the IDOT website. Forms for reporting changes and information on existing structures can be obtained directly from [SIMS - County](#) or from the IDOT website. Ensure the most recent [SIMS – County](#) files are downloaded prior to printing these reports.

6-2.06 Sufficiency Rating (SR)

Based on the inventory, traffic, inspection, and load-rating data submitted to ISIS, the Department calculates a SR for each structure. The SR is between 0.0 and 100.0, with the lower numbers implying a higher priority of need for improvement.

June 2018

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-2-3

Report	Usage of Report
Inventory/Status Initial Report (R105-I) (SIMS)	Reporting inventory and bridge status information to ISIS on new-to-system bridges.
Inventory Turnaround Report (S105) (SIMS)	Reporting revisions of inventory data to ISIS. The inspector should have this form or Forms S114 and S111 at each NBIS inspection.
Inspector's Inventory Report (S114) (SIMS)	Form S114 is for reporting revisions of inventory data to ISIS. The inspector should have this form or Form S105 and Form S111 at each NBIS inspection.
Key Route/Construction Initial Report (R111-I) (SIMS)	Reporting route information to ISIS on new-to-system bridges.
Key Route Turnaround Report (S111) (SIMS)	Reporting revisions of key route data to ISIS. The inspector should have this form and Form S114 or S105 at each NBIS inspection.
Master Structure Report (S107) (SIMS)	Reports most information contained in ISIS for each bridge. This form is not for reporting revisions to the System. The inspector should have this form at each NBIS inspection.
Routine Bridge Inspection Report (BBS-BIR)	The BBS-BIR form is used for recording specific inspection notes and ratings for each bridge. The BBS-BIR is used for a single inspection and contains current ratings information. The inspector should have this form at each NBIS inspection, and the signed original copy must be in the bridge file kept by the owner of the bridge.
Fracture Critical Inspection Form (BBS-BIR-FC1)	Form BBS-BIR-FC1 is used for recording results of Fracture Critical (FC) inspections. The inspector should have this form at each FC inspection.
Fracture Critical Member Inventory Form (BBS-BIR-FC2)	Form BBS-BIR-FC2 is used to record the FC Type, number of spans, and number of members in each FC bridge. The inspector should consult this form before each FC inspection, and the signed original must be in the bridge file kept by the owner of the bridge.
Underwater Bridge Inspection Report (BBS-BIR-UW1)	Form BBS-BIR-UW1 is used for recording results of Underwater (UW) inspections. The inspector should have this form at each UW inspection.
Special Inspection Report (BBS-SI-1)	Form BBS-SI-1 is used to record the Special Inspection Type Code and Condition Status for all bridges requiring a Special Inspection. The inspector should consult this form before each Special Inspection, and the signed original must be in the bridge file kept by the owner of the bridge.
Scour Critical Evaluation Coding Report (BBS SCE)	Form BBS SCE is used for reporting coding recommendations for Scour Critical Evaluations (ISIS Item 113).
Scour Critical Bridge Plan of Action (BBS 2680)	Form BBS 2680 is used to record actions to be taken to monitor scour critical or scour susceptible bridges during and after major storm events. The inspector should consult this form before each Routine Inspection and when a major storm event occurs. The form should be updated to reflect current field conditions and the signed original must be in the bridge file kept by the owner of the bridge.
Bridge Posting / Closure Review (BBS PCR)	Form BBS PCR is used for recording results of each Bridge Posting / Closure review inspection. The inspector should have this form at each review.
Bridge File Checklist (BBS BFC)	Form BBS BFC is used to document the contents of each official Bridge File and the location of required information that may be stored separately or electronically. The inspector should consult this form before each inspection, and the original copy must be in the bridge file kept by the owner of the bridge.

Note: All forms listed are available from [SIMS - County](#) or from the [IDOT website](#). BBS and BIR forms may be found on the [IDOT website](#).

STRUCTURE REPORTS

Figure 6-2A

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-2-4

June 2018

6-2.07 Inventory Updates

IDOT is required to maintain and report on the accurate operational status of all bridges in the NBI. New bridges or any conditions that require revision of existing structure information must be reported to the district promptly. The district must include the revision in ISIS within 90 days after the change in status for LPA structures. The 90 days start when the structure is opened or reopened to unrestricted traffic or when other events occur that result in changes to inventory or inspection data for a structure.

Refer to the [SIP Manual](#) Item 41 for appropriate Bridge Status codes. NBIS requirements state that changes in Bridge Status must be entered in ISIS within 90 days of that change. When a LPA bridge is load posted (ISIS Codes 2-6), under staged construction (ISIS Code 7), closed for construction (ISIS Code A), or closed but anticipated to be rehabilitated or replaced within 5 years (ISIS Code B), the owner should report that change in Bridge Status to the district.

Structures with Bridge Status B for more than 5 years will be considered permanently closed and the Bridge Status will be changed to E or may be deleted. When structures are coded with Bridge Status 5 or 6 (Temporary Measures) for more than 5 years, the temporary measures become permanent for the structure. Condition Ratings, Load Ratings, and Bridge Status will be based on these measures. In addition, all inventory information should be updated as necessary.

June 2018 **BUREAU OF LOCAL ROADS & STREETS** BRIDGE INVENTORY AND INSPECTIONS 6-3-1

6-3 BRIDGE INSPECTIONS

The bridge owner (LPA) must have a systematic strategy for conducting field inspections and reporting the findings. The inspection team must be led by a qualified Team Leader. The bridge inspection report should accurately and clearly record all findings and should include photographs of the overall structure and of any significant defects.

Per the NBIS, the owner of a bridge should have an individual bridge file for each structure. Counties may hold files on behalf of townships or other LPAs for which they provide services. In addition, the LPA, as the owner of the structure, must have a systematic means of entering, storing, and retrieving all bridge inspection data. The file should contain a full history of the structure.

A Bridge File Checklist (Form [BBS BFC](#)) must be maintained with each Bridge File. This form may be found on the [IDOT website](#) or by contacting the appropriate district office.

6-3.01 LPA Responsibility

6-3.01(a) Publicly Owned Structures

In order to satisfy the requirements of the NBIS, the LPA is responsible for inspections of all structures on roads open to public travel that meet the definition of a bridge, see Section 3.1.2 in the [Structural Services Manual](#) for facilities under its jurisdictional responsibility. In addition, all closed structures are required to be inspected for proper closure by the LPA.

Though not required by the NBIS, for structures under their jurisdiction and responsibility that do not meet the definition of a bridge or are not carrying highway traffic, LPAs are strongly encouraged to perform regular inspections to ensure public safety.

The responsible LPA may perform the inspection with qualified in-house personnel or retain the services of a qualified inspector proficient in the performance of NBIS inspections. See Section 3.9.2 in the [Structural Services Manual](#) for Personnel Qualifications.

6-3.01(b) Privately Owned Structures

Privately owned structures, and those owned by government agencies that are not highway agencies, carrying public roadways, are subject to inspection and inclusion in ISIS; see Section 6-2.02. Therefore, it is the responsibility of the owners of these structures to have timely inspections performed according to the provisions of the NBIS. The BBS BMU and the Local Bridge Unit (LBU) will work with the owner to:

- ensure the owner is aware when the NBI inspection is due, and
- obtain copies of the inspection forms to keep on file and for submission to the district for inclusion in ISIS.

In general, a LPA has a responsibility to post and warn the public of any hazards on a public highway carried by a structure. When it becomes apparent that the private owner (e.g., railroad, drainage or sanitary district, developer) of a bridge carrying a public highway will not or cannot

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-3-2 June 2018

perform the safety inspections required by the NBIS, the LPA having jurisdiction over the public highway leading to the bridge is responsible for performing the necessary inspection. If the private owner also has jurisdiction of the road leading to the bridge (e.g., private business that allows customers to use the road), the LPA may need to consider closing the public road leading to the private road until an inspection is performed and the bridge is considered safe. The NBIS requirements are not directly applicable to privately owned structures, but owners are strongly encouraged to follow the requirements of the NBIS.

6-3.02 Reporting Requirements

This Section discusses the process for entering field inspection results into the ISIS. See Figure 6-2A for a list of inspection report forms.

6-3.02(a) New Structure, or Initial Inspection of Old Structure not in ISIS

The following applies:

1. Complete the Inventory / Status Initial Report (R105-I) and the Key Route / Construction Initial Report (R111-I) and submit copies to the district. If a bridge has been replaced, then also indicate in the submittal the SN of the replaced structure so the replaced bridge can be marked for deletion.
2. Complete the Bridge Inspection Report (Form [BBS-BIR](#)). The signed original of Form [BBS-BIR](#) is retained in the individual bridge file kept by the owner of the bridge. The Bridge Inspection Report (Form [BBS-BIR](#)) should be completed and a copy submitted to the district.
3. The Scour Critical Evaluation Coding Report ([BBS SCE](#)), if applicable, must be filled out and submitted at the same time as the other two initial reports if it has not been submitted previously.
4. The LPA should submit all reports within 90 days of opening the bridge to traffic to allow the district proper time to enter the data within the required timeframe.

6-3.02(b) Re-inspection of Structures on File in ISIS

The following applies:

1. Complete the Bridge Inspection Report (Form [BBS-BIR](#)).
2. Submit copies of Reports [BBS-BIR](#) and S105, and S114 if required, to the district. The LPA should submit the inspection report within 90 days of the inspection to allow the district proper time to enter the data within the required time frame.

6-3.02(c) Reconstruction of an Existing Structure

Any reconstruction, rehabilitation, or major repair of an existing bridge currently in ISIS should be recorded in the ISIS within 90 days of reopening the bridge to unrestricted traffic. Work that changes the inventory data of a bridge open to traffic must also be recorded within 90 days of the completion of the work. A bridge reconstructed using the same abutments or piers may

June 2018 **BUREAU OF LOCAL ROADS & STREETS**
BRIDGE INVENTORY AND INSPECTIONS 6-3-3

keep the same SN so long as the geometry, span lengths, etc. have not significantly changed.
The following applies:

1. Complete Form [BBS-BIR](#).
2. Revise and submit copies of Reports [BBS-BIR](#) and S105, and S114 if required, as described in Section 6-3.02(b).

June 2018 **BUREAU OF LOCAL ROADS & STREETS**
BRIDGE INVENTORY AND INSPECTIONS 6-4-1

6-4 LOAD RATING AND POSTING

6-4.01 Requirements

All bridges must be load rated to determine their load-carrying capacity. This includes the Inventory Rating Factor, Operating Rating Factor, and the ratings for the Illinois Legal Loads as defined in the *Illinois Vehicle Code* ([625 ILCS 5/15-111](#)). These ratings provide an indication of the bridge's capacity to safely resist the loads it is likely to be subjected to. This information assists in the determination of necessary load posting, the issuance of special overload permits, and the scheduling for rehabilitation or replacement. These ratings must be performed by IDOT or receive IDOT's concurrence, in accordance with [625 ILCS 5/15-317\(b\)](#).

According to IDOT's load rating policy, as described in Section 3.3.9 of the [Structural Services Manual](#), re-evaluation of the load-carrying capacity must be performed when significant deterioration in structurally critical areas has occurred since the last rating. Such deterioration is typically indicated when the ISIS Superstructure (Item 59), Substructure (Item 60), or Culvert (Item 62) is reduced to a "4" or less, or when the Condition Rating of Deck (Item 58) falls to "3" or less.

In addition, load rating is performed at a maximum 10-year interval for bridges meeting any of the following criteria:

- a Condition Rating of "4" or less for Items 59, 60, or 62;
- a Condition Rating of "3" or less for Item 58; or

Load rating of bridges not meeting the above criteria, although not specifically required, may be requested by the LPA.

6-4.02 Responsibilities

All bridges must be rated for load capacity by IDOT, or by a qualified Illinois Licensed Structural Engineer with IDOT's concurrence. Generally, existing structures do not need to be load rated unless they have deteriorated, have been repaired or modified, have a modification to the wearing surface or meet the requirements in Section 6-4.01.

6-4.02(a) Load Rating by IDOT

IDOT will rate bridges at the request of the LPA or upon its own initiative. A request for rating should state any unusual or notable conditions. The LPA should provide a copy of the "as-built" construction plans or, if plans are not available, a dimensioned sketch of the bridge and its significant structural members. Representative photographs showing the overall condition and specific problem areas should also be included.

Rating requests may be made in writing through the district using Form [BLR 06510](#). A representative of the BBS will schedule a field investigation of each structure to determine actual conditions of the bridge which affect the load-carrying capacity.

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-4-2

June 2018

6-4.02(b) Load Rating by Others

Structure ratings performed by others must receive the concurrence of IDOT (BBS). A summary report for all bridges rated should detail the procedures, findings, inventory and operating ratings, and posting recommendations based on a field inspection and analysis performed by an Illinois Licensed Structural Engineer in accordance with provisions of the current AASHTO *Manual for Bridge Evaluation (MBE)*. The structural engineer's seal must be affixed to the Structure Load Rating Summary (Form [BBS 2795](#)) along with computations and analysis model. Excerpts from detailed inspection reports or other similar submittals will not be accepted.

6-4.02(c) Reporting

The LPA should submit the summary report, original Form [BBS 2795](#) and other attachments to the district for forwarding to the BBS. The LPA should accept the consultant's findings prior to submittal of the report.

6-4.03 Bridge Closure and Weight Limit Posting

When a structure cannot carry legal loads, as defined in the Illinois Vehicle Code [625 ILCS 5/15-317](#), IDOT is required to ensure suitable signs are erected and maintained to inform the public of the maximum weight limit. The agency having jurisdiction over the roadway is responsible for the posting of signs, regardless of structure ownership or maintenance responsibility.

When IDOT determines a structure carrying traffic on a public road is not capable of carrying the legal loads as defined in [625 ILCS 5/15-111](#), it will inform the LPA. Upon notification from IDOT of a required load posting, the LPA shall erect signs as soon as possible and notify IDOT within 30 days that signs are in place, or within 14 days for closures.

Per [625 ILCS 5/15-317](#), the load posting signs must match the load posting requirements determined by the Department. Posting at a lower or higher level is not permitted. Likewise, a single posting level is not permitted when a combination posting level is required. The LBU should be contacted for re-evaluation if a combination posting level is required but the LPA believes a single posting level would be more appropriate for the structure location. See Figure 6-4A for bridge weight limit posting traffic control.

When a structure is to be closed, the LPA should immediately erect barricades that will prohibit traffic access to the structure. Those barricades are to remain in place until permanent closure measures can be installed. See Figure 6-4B for the proper permanent bridge closure traffic control. Additional information may also be found in the [Illinois Supplement to the Manual of Uniform Traffic Control Devices \(IL MUTCD\)](#).

6-4.04 Bridge Closure and Weight Limit Posting Review

In accordance with the Illinois Vehicle Code, [625 ILCS 5/15-317](#), the districts annually monitor local bridges that are listed in the ISIS as requiring load postings or closure. The district will

June 2018 **BUREAU OF LOCAL ROADS & STREETS**
BRIDGE INVENTORY AND INSPECTIONS 6-4-3

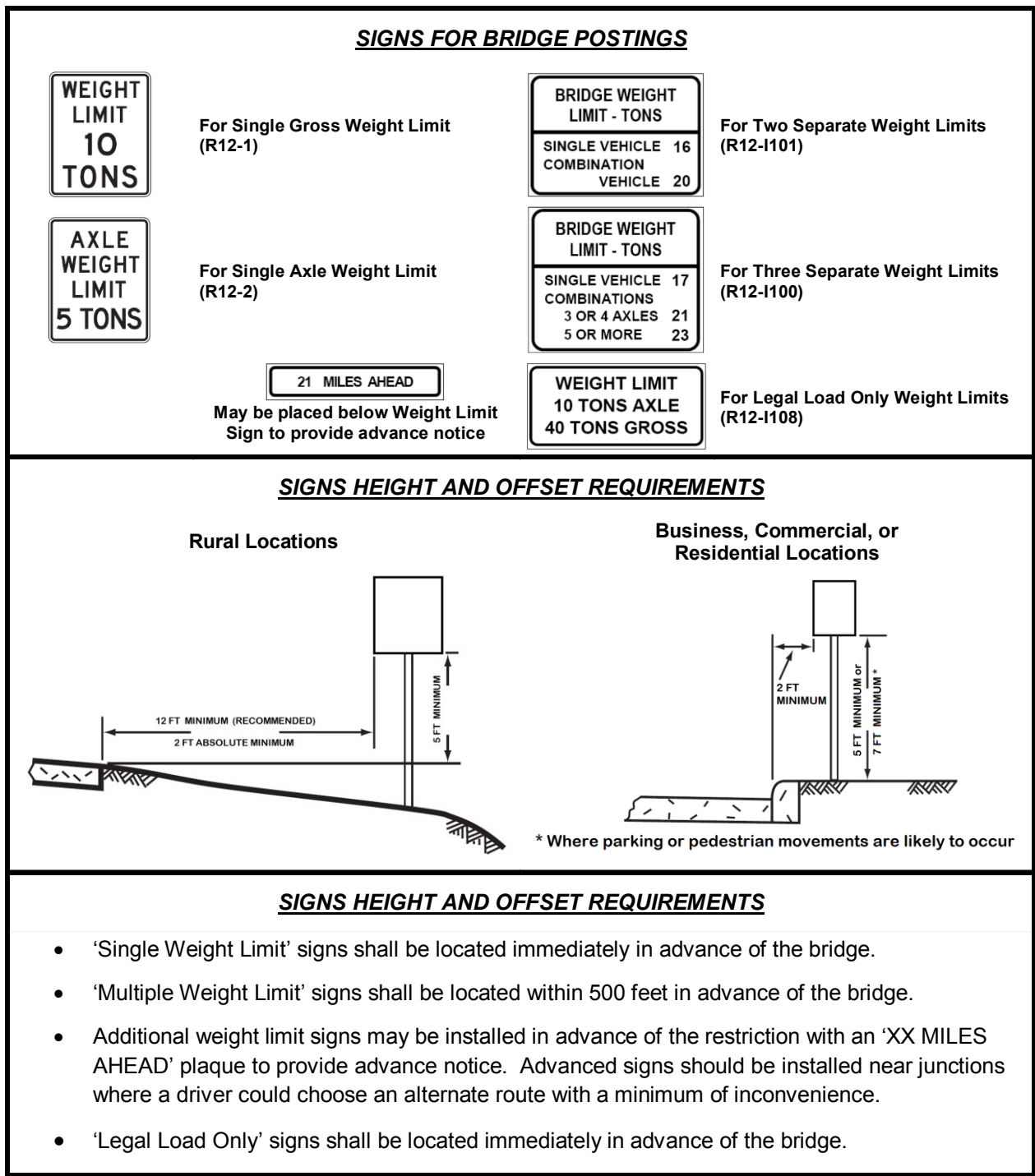
notify the appropriate LPA when a bridge is not properly posted or closed by sending a letter (see Figure 6-4C for example) with a copy of the Bridge Posting / Closure Review (Form BBS PCR) by certified mail.

The LPA shall correct any signing in accordance with the [LMUTCD](#) or other deficiencies in a timely manner and notify the district within 30 days (see Figure 6-4D for example). All notifications to the district will include a signed copy of the BBS PCR form with photographs, preferably digital, certifying the deficiency at the bridge has been corrected. If the LPA is unable to complete the required corrections within 30 calendar days, they must provide the district with an estimated compliance date with justification. Failure of a LPA to comply may result in the withholding of Motor Fuel Tax (MFT) allotments and the district not approving current MFT expenditures, or other actions determined by the Department.

**BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS**

6-4-4

June 2018



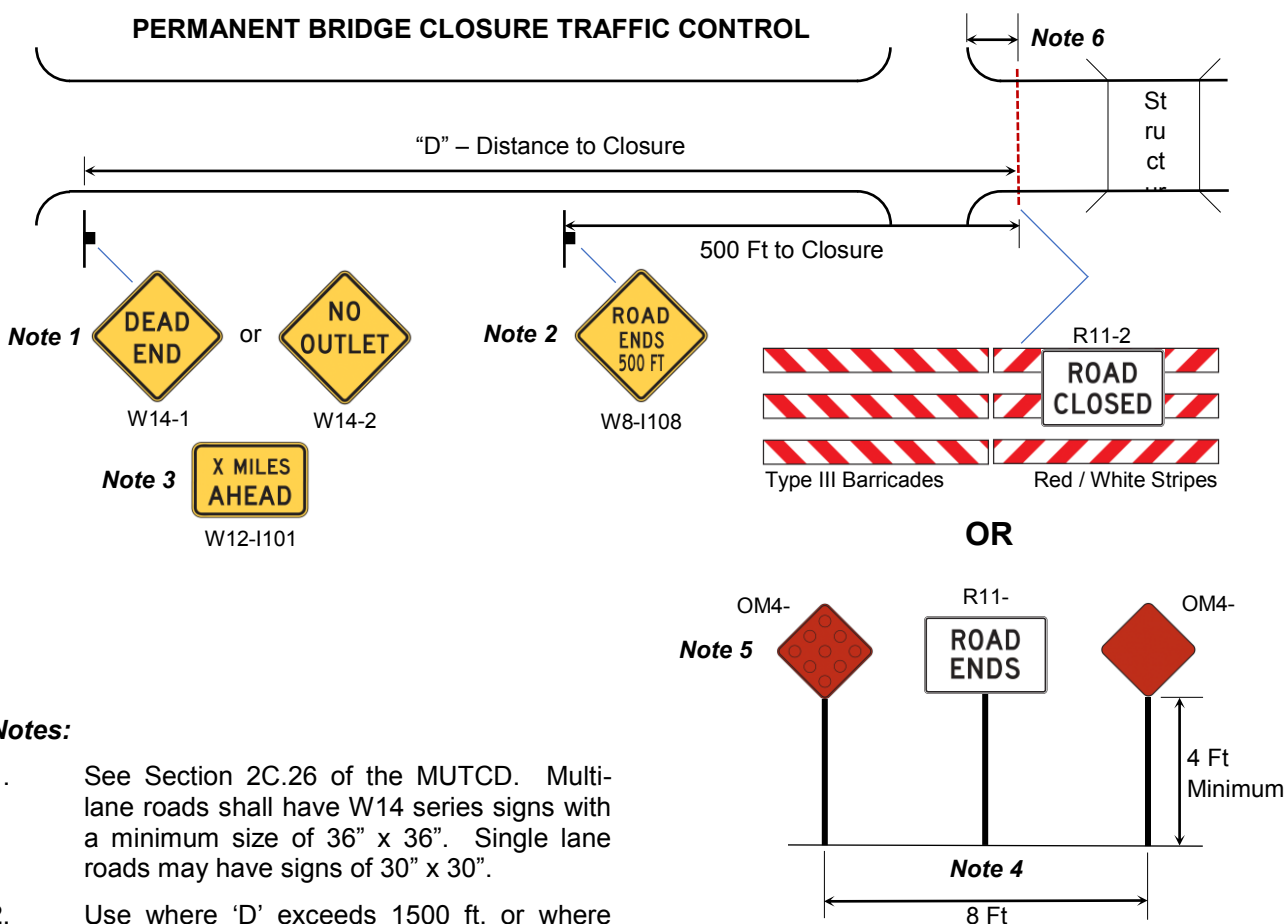
BRIDGE POSTING TRAFFIC CONTROL

Figure 6-4A

**BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS**

June 2018

6-4-5



Notes:

1. See Section 2C.26 of the MUTCD. Multi-lane roads shall have W14 series signs with a minimum size of 36" x 36". Single lane roads may have signs of 30" x 30".
2. Use where 'D' exceeds 1500 ft. or where sight distance to the closure is less than 500 ft.
3. Where the point of closure is over 1 mile from the last cross road, an "X MILES AHEAD" plaque (W12-1101) may be used.
4. Type III Barricades with a "ROAD CLOSED" sign (R11-2) or a "ROAD ENDS" sign (R11-1100) with red object markers (OM4-1 or OM4-3) shall be used at the point of closure. Guardrail may be used in conjunction with barricades or "ROAD ENDS" sign (R11-1100). If used, barricades shall be retro-reflectorized red/white and permanently installed into the pavement. Any barriers used shall extend beyond the edge of shoulder. If practical, old pavement should be removed beyond the closure point or covered with dirt/rocks to minimize the illusion of the road continuing. Barricades or "ROAD ENDS" sign (R11-1100) should be installed at least 100 ft. In advance of broken pavement or dirt/rocks.
5. Object markers (OM4-1 or OM4-3) used in conjunction with a "ROAD ENDS" sign (R11-1100) shall be red and conform with Section 2C.66 of the MUTCD.
6. If a cross road or entrance is located near the road closure, the closure devices shall be outside the clear zone of the cross road or entrance.
7. If the bridge is under active construction, traffic control shall be in accordance with Part 6 of the MUTCD.

PERMANENT BRIDGE CLOSURE TRAFFIC CONTROL

Figure 6-4B

6-4-6

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

June 2018

[Date]

Certified Mail No.:

[LPA Contact Information]

RE: Bridge Posting & Closure

Dear _____:

In accordance with the *Illinois Vehicle Code* ([625 ILCS 5/15-317](#)), an inspection of all structures within your jurisdiction that are load posted or closed was recently conducted by this office. This inspection was done to ensure that all load posted structures are properly signed and closed structures are properly signed and barricaded. The following deficiencies of structures under your jurisdiction were noted during this inspection:

<u>Structure Number</u>	<u>Structure Status</u>	<u>Deficiency</u>	<u>Corrective Action to be Taken</u>
-------------------------	-------------------------	-------------------	--------------------------------------

Please correct the deficiencies in a timely manner and notify this office in writing by completing and returning the attached Notice of Compliance form with digital photos within 30 calendar days from the date of this letter. If you are unable to complete the required corrections within the 30 calendar days, please provide this office with an estimated compliance date. Do not return the attached Notice of Compliance until the deficiencies have been corrected.

All signage must be in accordance with the [Illinois Supplement to the Manual of Uniform Traffic Control Devices \(IL MUTCD\)](#). The [ILMUTCD](#) may be accessed using the IDOT website. When performing your regular maintenance procedures during warmer weather, please ensure that all signing is clearly visible and not blocked by the growth of foliage.

If you have any questions regarding this issue, please contact **[Name]** at **[Contact Information]**.

Sincerely,

[Regional Engineer]By: **[Local Roads and Streets Engineer]**

SAMPLE DISTRICT POSTING AND CLOSURE LETTER

Figure 6-4C

June 2018

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-4-7

[Date]

[Regional Engineer Information]

Attn: Local Roads and Streets

[District Contact Information]

RE: NOTICE OF COMPLIANCE

I have completed the required corrections for the local posting / closure related discrepancies. Attached are photos of the corrections.

Structure

Number

Date Correction Completed

 Local Public Agency's Signature

 Title

 County

 Township / Municipality

SAMPLE POSTING AND CLOSURE COMPLIANCE LETTER

Figure 6-4D

June 2018

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-5-1

6-5 ACRONYMS

This is a summary of the acronyms used within this chapter.

AASHTO	American Association of State Highway and Transportation Officials
BBS	Bureau of Bridges & Structures
BFC	Bridge File Checklist
BIR	Bridge Inspection Report
BMU	Bridge Management Unit
CFR	Code of Federal Regulations
FC	Fracture Critical
FHWA	Federal Highway Administration
Guide	Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges
IDOT	Illinois Department of Transportation
IHS	Illinois Highway Information System
<i>ILMUTCD</i>	<u>Illinois Supplement to the Manual of Uniform Traffic Control Devices</u>
ILCS	Illinois Compiled Statutes
ISIS	Illinois Structure Information System
LBU	Local Bridge Unit
LPA	Local Public Agency
MBE	Manual for Bridge Evaluation
MFT	Motor Fuel Tax
NBI	National Bridge Inventory
NBIS	National Bridge Inspection Standards
PBDHR	Preliminary Bridge Design and Hydraulic Report
PCR	Posting/Closure Review
POA	Plan of Action
SI&A	Structure Inventory and Appraisal
SCE	Scour Critical Evaluation
SIMS	Structure Information Management System
SIP	Structure Information and Procedure
SN	Structure Number
SR	Sufficiency Rating
TS&L	Type, Size & Location
UW	Underwater

June 2018

BUREAU OF LOCAL ROADS & STREETS
BRIDGE INVENTORY AND INSPECTIONS

6-6-1

6-6 REFERENCES

For information on the inventory, inspections, appraisals, etc. of structures both bridges and culverts review the applicable publications listed below:

1. 23 CFR - Part 650 - Subpart C
2. [Structural Services Manual](#), IDOT
3. *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*, FHWA
4. *Illinois Highway Information System – [Structure Information and Procedure Manual](#)*, IDOT
5. [625 ILCS 5/15](#) et al, *Illinois Vehicle Code*
6. *Manual for Bridge Evaluation*, AASHTO
7. [Illinois Supplement to the Manual of Traffic Control Devices](#), IDOT