Report to the Mississippi Legislature

Selected Issues: Mississippi Department of Transportation and the Office of State Aid Road Construction: A Follow-Up to Report #618

November 27, 2018

PEER MISSISSIPPI
Joint Legislative Committee on Performance Evaluation and Expenditure Review

Selected Issues: Mississippi Department of Transportation and the Office of State Aid Road Construction: A Follow-Up to Report #618

Synopsis

In recent years, legislators have expressed concerns regarding how the Mississippi Department of Transportation expends its funds, whether it operates efficiently, and how it selects projects. Also, legislators have requested information regarding recent county and municipal bridge closures and how bridge inspections have changed.

MISS. CODE ANN. Sections 65-1-3 through 65-1-9 (1972) establish the Mississippi Transportation Commission as the governing body for the Mississippi Department of Transportation. MISS. CODE ANN. Section 65-9-5 (1972) establishes within the Department of Transportation the Office of State Aid Road Construction, which is responsible for managing "state aid roads," which are the network of collector and distributor routes that connect to the state highway system and other major county roads.

MDOT data show that Mississippi has approximately 9,000 lane miles (33%) in poor or very poor condition as of 2016. Also, although the percentage of deficient bridges decreased from 2012 to 2017, the state still had 861 deficient bridges (15%) as of 2017. MDOT officials state that safety and system preservation are currently the highest priorities for the state's transportation system.

MDOT Revenues and Future Commitments

The Mississippi Department of Transportation receives the majority of its federal funds through the Federal Highway Administration based on specific allocation formulas and receives state funding through legislative appropriations of special funds derived from the state fuel tax and other state taxes and fees (Exhibit 1, page 2).

To satisfy 540 multiyear project commitments authorized in fiscal year 2017 (or from previous periods), MDOT will be required to expend additional federal and state funds over the next three fiscal years (2018–2020) totaling approximately $652.3 million, and $345.7 million, respectively.[1]

[1]State revenues include state fuel taxes, other state taxes and fees, and other sources, including funds from the Mississippi Development Authority Community Development Block Grants, HELP bonds, and Bridge Revenue Bonds.

Exhibit 1: MDOT Revenues by Source (FY 2013–FY 2017)

Revenue/ Loss Source	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Federal Funds	$570,767,947	$570,776,991	$505,445,200	$509,643,847	$514,426,183
State Fuel Tax	$283,267,625	$286,177,885	$283,345,871	$315,769,123	$303,842,248
State Taxes & Other Funds	$224,046,515	$260,295,227	$225,428,503	$141,589,940	$234,592,540
Truck & Bus Taxes & Fees	$64,504,691	$67,149,385	$70,275,392	$69,048,623	$68,630,971
State Support Special Funds	–	–	–	–	$2,100,000
Governor's Budget Cuts	–	–	–	($1,143,214)	($2,953,121)
Total Funds	$1,142,586,778	$1,184,399,488	$1,084,494,966	$1,034,908,319	$1,120,638,821

SOURCE: MDOT legislative budget request documents.

MDOT Expenditures and Performance Metrics

Expenditures for capital outlays (i.e., payments to contractors) represent the greatest expenditure category for the Mississippi Department of Transportation from FY 2015 to FY 2017, at approximately 55%. Other notable expenditures include $159 million for personal services and $42.6 million for contractual engineering services in FY 2017.

Total MDOT expenditures were approximately $1.07 billion, $1.06 billion, and $1.15 billion for fiscal years 2015, 2016, and 2017, respectively. MDOT's total expenditures increased by approximately 8% from FY 2015 to FY 2017 primarily because of increases in payments for capital outlays and subsidies, loans, and grants. Exhibit 2, page 4, presents MDOT's expenditures for the past three fiscal years by major category.

PEER also examined MDOT's expenditures by budget and accountability program. For FY 2017, the department spent 86% of its funds on construction and maintenance.

Transparency and Accountability of MDOT's Project Selection Processes and Project Information

Over the past several years the Mississippi Department of Transportation has shifted its priorities from new construction and system preservation almost exclusively to system preservation.[2] For federal fiscal year 2018, MDOT's five-year plan includes work on 269 projects, with the majority involving bridge replacement/preservation, pavement overlay, and other system preservation projects.

[2]"System preservation" is defined as preserving existing transportation assets and maintaining a state of good repair for transportation infrastructure (e.g., roads, bridges).

Exhibit 2: MDOT Expenditures by Major Category (FY 2015–FY 2017)

Category	FY 2015	FY 2016	FY 2017	Average Percentage of Total Expenditures	Percentage Change from FY 2015 to FY 2017
Personal Services	$159,718,973	$156,974,697	$159,060,035	14.48%	(0.41%)
Travel	$2,002,817	$2,067,460	$1,949,051	0.18%	(2.68%)
Contractual Services	$136,581,715	$140,315,279	$134,586,030	12.53%	(1.46%)
Commodities	$36,267,182	$41,854,361	$36,507,474	3.49%	0.66%
Capital Outlays	$588,415,080	$571,285,792	$657,497,599	55.32%	11.74%
Subsidies, Loans, and Grants	$145,920,994	$149,486,340	$164,655,383	14.00%	12.84%
Total	**$1,068,906,761**	**$1,061,983,929**	**$1,154,255,572**	**100.00%**	**7.98%**

SOURCE: MDOT legislative budget requests for FY 2015–2016 and DFA/MDOT reports for FY 2017.

Contracting Methods and Impact of New Timber Bridge Inspections

As a result of the Federal Highway Administration's compliance review findings regarding deficiencies of the Office of State Aid Road Construction's current bridge load-rating system, as well as a lack of bridge closure enforcement and concerns for the safety of the traveling public, the Office of State Aid Road Construction and the Mississippi Department of Transportation developed an action plan to meet the requirements of the National Bridge Inspection Standards, a component of which included new timber bridge inspection contracts. Together, the two agencies procured new contracts for county bridge inspections. However, because no consultants had been compensated under the new contracts at the time of Report #618, PEER was unable to determine the per bridge inspection costs. But based on the not-to-exceed costs of the total contracts and the number of bridges to be inspected, PEER estimates an approximate average not-to-exceed cost of $10,500 per bridge. As of December 7, 2017, consultants had inspected 1,005 bridges with 166 having critical findings that warranted immediate closure.

NOTE: The information contained in the responses that follow was self-reported. It has not been independently reviewed or authenticated in whole or in part. The responses describe actions taken by the agencies to address the conclusions and recommendations included in PEER Report #618.

PEER Recommendation:

1. In order to ensure sufficient transparency in its new project selection processes beginning in FY 2019, the Mississippi Department of Transportation should have clearly written policies for project selection and prioritization processes using the dTIMS and BrM software and ensure that resulting data are presented in a clear, relevant, and useful manner to decision-makers. Deviations from using the written policies to select or prioritize projects should include written justification that is spread upon the minutes of the Mississippi Transportation Commission.

MDOT Action:

Attachment A is Chapter 4 of MDOT's Transportation Asset Management Plan. It includes the policy for project selection of pavement projects and explains how dTIMS will be incorporated into the pavement project prioritization process.

Attachment B is the bridge prioritization process taken from the 2018 Bridge Prioritization Annual Report. The Life-Cycle Management Section explains how the bridge element deterioration models and life-cycle cost optimization models from BrM will be incorporated into the bridge project prioritization process.

PEER Recommendation:

2. In order to demonstrate the cost-effectiveness of the systems implemented, the Mississippi Department of Transportation should determine, to the extent possible, and communicate the benefits and costs of using the new pavement management for project selection. While benefits could include predicting future conditions given a variable budget or documenting the condition of the transportation system, a quantifiable benefit is preferred, such as cost savings from certain treatment selections. Costs could include data collection, software development and updates, analysis, and reporting.

MDOT Action:

The software MDOT purchases for management of its bridges and pavements includes the optimization functionality. Therefore, there is no additional cost associated with the systems.

PEER Recommendation:

3. In order to increase the transparency of its decision-making and to communicate to stakeholders its ability to maximize its resources and its efficiency in completing projects on time and within budget, the Mississippi Department of Transportation should identify and implement the best reporting tools (both internal and external) to communicate its progress (e.g., online dashboard, as part of its annual report).

MDOT Action:

MDOT's Information Systems Division is developing a dashboard for the MDOT website which will provide the public real-time information on bridge and pavement condition and active construction projects. The dashboard should go live before the end of this calendar year.

PEER Recommendation:

4. The Federal Highway Administration, the Mississippi Department of Transportation, and the Office of State Aid Road Construction should work together to address the issues presented in this report regarding county bridge inspections. In particular, these three entities should seek to

a. establish and communicate any new OSARC specific processes necessary for the implementation and usage of NBIS standards for local bridge inspections;

b. establish training programs and schedules for the implementation and usage of NBIS requirements and OSARC specific processes pertaining to the Bridge Inspection Program for locally owned bridges; and

c. implement a quality assurance program to ensure that bridges are inspected in accordance with the NBIS requirements and OSARC specific processes pertaining to the Bridge Inspection Program for locally owned bridges.

MDOT Action:

On August 8, 2018, a training class was held to train County Engineers on capturing the data needed for load rating and input into InspectTech. The training was presented by MDOT, FHWA, and Michael Baker (consultant). Attachment C is the class agenda.

4. LIFE-CYCLE PLANNING

Identification and Selection of Pavement Projects

Due to the significant growth in traffic, particularly heavy truck traffic, over the last 40 years, pavements have been required to carry ever-increasing loads. At the same time, governments are cutting cost and attempting to find more efficient ways to construct and maintain pavements while still meeting the travel demands placed upon the roads. Studies have shown that investments in infrastructure reduce costs of transportation and contribute to economic growth. Also, many major routes such as interstates and state highways are aging and therefore need long-term preventive maintenance strategies.

PAVEMENT MANAGEMENT

With these ideas in mind, MDOT began development of its Pavement Management System (PMS) in 1986. MDOT began collecting condition and distress data in 1991 and has continued to do so approximately every two years since. Distresses collected include, but are not limited to, the following:

- Transverse cracking
- Longitudinal cracking
- Alligator/fatigue cracking
- Patching/potholes
- Rutting (on asphalt)
- Faulting (on jointed concrete)
- Roughness

The PMS divides the roadways into homogeneous pavement analysis sections of various lengths using geometric characteristics, county, route, and construction history. As of 2018, there are approximately 5,900 analysis sections. Currently, MDOT uses decision trees that can generate one treatment at a point in time for a pavement. The first decision trees were

developed in 1993 and were later refined to include new treatments and then piloted and adjusted (2009-2013) based on feedback from MDOT District maintenance staff. The trees are used to generate project recommendations for MDOT Districts on the two-lane and four-lane roadways. These project recommendations are generated annually; however, data is only updated on a two-year cycle to coincide with the data collection cycle noted in Section 2.

Interstate projects are chosen and prioritized by the Interstate Rating Committee (IRC), which is chaired by MDOT's Maintenance Division. The entire Interstate System in Mississippi is ridden and rated annually by the IRC. Projects are then chosen based on these ratings and recommended to upper management. The IRC raters are also shown the recommended decision tree treatments for the Interstate analysis sections during the annual rides.

The decision trees recommend repairs based on each pavement section's characteristics, condition, and distresses. There are decision trees for each pavement surface type, route type, and truck weight limit (for two-lanes only). There are decision trees for the following pavement "families":

- Interstate Flexible (FLEX)
- Interstate Composite (COMP)
- Interstate Jointed Concrete (JCP)
- Interstate Continuously Reinforced Concrete (CRCP)
- Four-Lane FLEX
- Four-Lane COMP
- Four-Lane JCP
- Four-Lane CRCP
- Two-Lane 80,000-lb. weight limit FLEX
- Two-Lane 80,000-lb. weight limit COMP
- Two-Lane 80,000-lb. weight limit JCP
- Two-Lane 80,000-lb. weight limit CRCP
- Two-Lane 57,650-lb. weight limit FLEX

LIFE-CYCLE MANAGEMENT

Life-cycle management applies data and analytics to develop a long-term strategy for managing an asset or group of similar assets at the lowest possible whole-life costs. This is accomplished by addressing all phases of an asset's life-cycle and applying the most effective treatment at each point in an asset's life. The emphasis is on long-term preservation and sustainability without sacrificing system performance or public safety.

Life-cycle planning is an approach to maintaining an asset during its whole life, from construction to disposal.

Life-cycle planning emphasizes maintaining existing system performance at a constant desired level while minimizing resource consumption and externalities over the long term.

MDOT's new pavement management system will support life-cycle management activities in two stages:

1. In the first stage, treatment strategies are generated for each analysis segment of the road network. Treatment strategies are comprised of one or more maintenance or rehabilitation treatments and are triggered during an analysis period according to specific decision trees. Decision trees use inventory data (such as pavement type and traffic volume) and condition data (such as pavement defects) to determine the appropriate intervention to trigger during the lifecycle of each pavement section in the road network.

2. The second stage results in the selection of the best strategy for each analysis segment, a process called optimization.

The optimization is based on a specific goal, called an objective function in MDOT's PMS, which defines what is to be maximized or minimized across the road network as a whole. Objective functions include maximizing an overall PCR, minimizing a pavement condition such as roughness, or minimizing risk among others. Optimization is also configured to consider a constraint, called a budget scenario.

It is important to note that much of this section describes the process for life-cycle planning and pavement project selection for the State maintained highway system. While MDOT is responsible for nearly 95% of the NHS, it is the responsibility of local jurisdictions to preserve and maintain the condition of the remaining 5%. In order to ensure NHS routes remain in a state of good repair, MDOT encourages local programs that support the NHS. One practice that MDOT recognizes as supporting the Federal requirements by a local entity is the adoption of selection criteria by the Jackson Metropolitan Planning Organization (MPO) that places emphasis on NHS routes. According to the MPO's project submittal guidelines "In the event two or more projects rank equally, priority shall be given to the project located on the National Highway System." This tie-breaking criterion encourages jurisdictions to consider projects on NHS bridges or roadways in order to secure funding.

Identification and Selection of Bridge Projects

BRIDGE REPLACEMENT, REHABILITATION, AND MAINTENANCE

Bridge replacement prioritization is based on three NBI Records: Average Daily Traffic, Bypass/Detour Length, and Structural Evaluation. In an attempt to develop a method which considers these issues, MDOT has created a model that assigns a Replacement Index (RI) to each of the State's bridges. The RI represents the overall significance of a bridge in comparison to the state bridge inventory. The three NBI Records used to calculate the Replacement Index ensures that bridges with the greatest impact on the traveling public are considered first by combining the exponential effect of traffic on a deteriorating bridge with the distance that traffic would have to travel in the event that the bridge was closed. This numerical component is the first step in the prioritization process. A higher value indicates a higher priority for replacement.

The next step in the prioritization process is the assessment of bridge data by the Initial Bridge Replacement Priority List Team. Bridges are initially sorted by Replacement Index from highest

to lowest. Decisions to perform repairs/maintenance or other actions that deviate from using the RI are made on a case-by-case basis. The team provides a comment describing the reason for/against replacement for every structure. An Initial Bridge Replacement Priority List is then developed and sorted by RI into fiscal years depending on the amount of funding anticipated. The list extends for five fiscal years.

Recommendations from the Initial Bridge Priority List Team are then distributed to the MDOT Districts for their input. The Districts provide information that cannot be calculated, such as anticipated growth areas, corridor improvement initiatives, environmental issues that may delay construction, and socioeconomic factors. Districts are required to provide documentation, such as traffic data, accident reports, etc., to support any deviations from the recommendations provided by the Initial Team.

In the final step of the prioritization process, District comments are evaluated and compared to statewide priorities. Upon completion, the Initial Bridge Priority List Team develops a Final Bridge Replacement Priority Report, which is updated annually. This report indicates the replacement indices for each bridge, as well as relevant information for bridge replacement projects such as the programmed cost.

PRESERVATION

MDOT has established a preventive maintenance program aimed at delaying the deterioration of structures and maximizing their usability in an effort to extend the service life of state-owned bridges. Preventive maintenance falls into two categories: corrective and cyclical. The former are repairs to deteriorated elements of bridges that are otherwise in good structural condition and the latter are performed regularly as per a schedule. Examples of cyclical maintenance would be joint repair at five to ten years and painting at 20 to 25 years, if warranted and depending on the condition of these elements. This program includes a wide array of bridge items ranging from superstructure and substructure repairs to bridge painting and erosion control. Annually, each District is given a fixed amount of Federal funding, and recommendations from the Districts with concurrence from the Director of Structures, State Bridge Engineer are used to develop lists of bridges with specific deteriorated elements. As element level deterioration and life cycle cost optimization models become available, these tools will also be utilized in the development of preservation projects. This program has been in place since 2013 and is funded annually at approximately $3 million per year for preservation. The money is divided evenly among the Districts. Annually, an additional $3M is dedicated to bridge painting projects which are prioritized on a statewide basis.

LIFE-CYCLE MANAGEMENT

To aid in making further improvements to the prioritization process, MDOT is currently working to develop bridge element deterioration models and incorporate life-cycle cost optimization models. Deterioration modeling is designed to forecast the future conditions of bridges and aid in developing optimal actions to take on the bridge in a given period of time. This approach utilizes Element Level Bridge Inspection, which breaks down each structure into individual elements that provide a more detailed assessment of the bridge. By using element level data, structure performance can be more accurately analyzed by predicting structure deterioration based on the average condition ratings collected for each bridge component. Ultimately the final goal of optimized maintenance, rehabilitation, and repair is to use probability, cost data, and condition rating data to determine the most cost-effective option for extending the service-life of each structure.

BRIDGE GOALS AND PERFORMANCE TARGETS

The FAST Act establishes a minimum standard for NHS bridge conditions, stating that no more than 10 percent of the total deck area may be on structurally deficient NHS bridges for three consecutive years. Consequently, MDOT's minimum performance target will reflect this standard and require that a minimum of 90% of the total deck area shall not be on structurally deficient NHS bridges.

A bridge is classified as structurally deficient if it requires significant monitoring, repair, and/or rehabilitation to remain in service. A bridge can also be classified as structurally deficient if its load carrying capacity is significantly below current design standards or if a waterway below frequently overtops the bridge during floods. This classification can also serve as an early warning sign for engineers to use when prioritizing funding and to initiate rehabilitation or to begin the process to replace the bridge.

As of the 2018 NBI submittal, Mississippi exceeds the FAST Act minimum standard for bridges located on the NHS with approximately 2.2 percent of the total deck area on structurally deficient bridges.

IDENTIFICATION & SELECTION OF BRIDGE PROJECTS

BRIDGE REPLACEMENT, REHABILITATION, & MAINTENANCE

The Bridge Replacement program will be administered by Bridge Division under the supervision of the Director of Structures - State Bridge Engineer. The FAST Act establishes a minimum standard for NHS bridge conditions. "If more than 10% of the total deck area of NHS bridges in a State is on structurally deficient bridges for three consecutive years, the State must devote NHPP funds in an amount equal to 50% of the State's FY 2009 Highway Bridge Program apportionment to improve bridge conditions during the following fiscal year (and each year thereafter if the condition remains below the minimum)." The Bridge Replacement Program's function is to keep the State within compliance with the above legislation while maintaining its current bridge system, ensuring economic efficiency and enhancing the mobility of the traveling public.

INITIAL BRIDGE REPLACEMENT PRIORITY LIST

Annually or as required by funding, the team as shown below will establish an Initial Bridge Replacement Priority List under the guidance of the Director of Structures – State Bridge Engineer. The list shall include all State owned and maintained bridges with corresponding AASHTO BrM data, calculated Replacement Indexes (RI), FMS project data, and individual bridge comments from both the Bridge Division and the Districts. Additionally, the list will indicate bridges with specialty structural issues that may not be quantifiable by AASHTO BrM data or RI. As needed, the team may also acquire documentation from the State Bridge Inspection Program Manager such as inspection reports and recommendations by the District Bridge Inspection Engineers to ensure bridges in similar structural condition on the same route are considered for replacement in the same fiscal year. The Initial Bridge Replacement Priority list will be sorted by the RI for all State owned bridges. The list shall be bridge based and not project based to include bridges not currently in programmed projects.

The Initial Bridge Replacement Priority List Team:

- Assistant Chief Engineer, Pre-Construction
- Director of Structures – State Bridge Engineer
- Deputy Director of Structures – Assistant State Bridge Engineer
- State Bridge Inspection Program Manager
- Bridge Management Engineer
- Bridge Design Section Engineers
- State Hydraulics Engineer

INITIAL BRIDGE REPLACEMENT PRIORITY LIST ANALYSIS

The Team will divide the Initial Bridge Replacement Priority List, sorted by RI, into fiscal years depending on the amount of funding anticipated to be appropriated for each fiscal year. The list will extend for five (5) fiscal years. Currently programmed bridges will be reevaluated to determine if they should remain in the current programmed fiscal year. Once divided into fiscal years, the Team will assess the placement of these bridges to determine whether or not they should be moved into another fiscal year as a result of specialty structural issues not quantifiable by RI, updated inspection reports, or other supporting documentation. If the Team determines that revisions should be made, the list will be adjusted and revised to reflect these changes. The revised Initial Bridge Replacement Priority List will then be sorted by fiscal year and truncated to include only the bridges that fall within the five (5) fiscal years analyzed. This list will be provided to the District Engineers for comment as the Recommended Bridge Replacement Priority List.

RECOMMENDED BRIDGE REPLACEMENT PRIORITY LIST COMMENT

The Recommended Bridge Replacement Priority List will be provided to each of the six (6) District Engineers for their comments and recommendations. Districts may recommend that bridges be moved to another fiscal year as long as a properly documented reason is provided for such a change. The reasons for requesting a change to the recommended fiscal year may include but are not limited to:

- Structural
- Unknown or undeterminable timber decay
- Bridges of similar structural condition
- Fracture critical
- Pin and link
- Steel spans with significant section loss and/or delaminated decks
- Safety
- Severely narrow
- Fire, police and/or emergency response disruption
- Socioeconomic
- Schools
- Hospitals
- Industrial facilities
- Agricultural

- Postings
- Posted lower than practical use of facility
- Repair
- Repairs possible that will significantly extend life span
- Repair cost significantly lower than replacement with extended life span
- Life Span limitation
- Bridge is significantly older than its design life
- Bridge beyond design life and repairs do not extend life
- Traffic
- Hurricane evacuation
- Possible high volume detour
- Location
- Bridges in very close proximity
- Relief to a hydraulic bridge
- Scour

Any recommended changes from the Districts must be accompanied by documentation to substantiate the need for moving the bridge replacement or repair to another fiscal year. This documentation may include but is not limited to the following:

- Accident reports
- Photographs
- Life span data
- Existing plans
- Design data
- Inspection data/reports
- Maps locating areas of concern (ex. Schools, Hospitals, Fire stations)
- Traffic data
- Proposed detour routes
- Trucking routes
- Community or environmental input data
- Cost comparisons with supporting calculations
- ROW information
- Previous repairs
- Future projects that may impact the structure

The District's recommendations and documentation will be provided to the Initial Bridge Replacement Priority List Team for consideration. The Team will review all recommendations and documentation by the Districts to revise the list. If a revision is substantiated, the Team will revise the list. If conflict exists between the Team's recommendations and the District's recommendations and documentation that can't be resolved, the Assistant Chief Engineer – Preconstruction will provide a recommendation to the Chief Engineer. The Chief Engineer will decide the course of action to be taken. Once all revisions are

- Postings
- Posted lower than practical use of facility
- Repair
- Repairs possible that will significantly extend life span
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The District's recommendations and documentation will be provided to the Initial Bridge Replacement Priority List Team for consideration. The Team will review all recommendations and documentation by the Districts to revise the list. If a revision is substantiated, the Team will revise the list. If conflict exists between the Team's recommendations and the District's recommendations and documentation that can't be resolved, the Assistant Chief Engineer – Preconstruction will provide a recommendation to the Chief Engineer. The Chief Engineer will decide the course of action to be taken. Once all revisions are

complete, the list will be provided to the Assistant Chief Engineer – Preconstruction for concurrence as the Final Bridge Replacement Priority List.

FINAL BRIDGE REPLACEMENT PRIORITY REPORT

The Final Bridge Replacement Priority Report will be developed to document the decisions made during the prioritization process and stored in ProjectWise. These reports may include but are not limited to the following:

- District recommendations and documentation
- Meeting minutes of all prioritization meetings including attendance list
- Emails and correspondence
- Final Bridge Replacement Priority List

PROJECT DEVELOPMENT PROJECT MANAGEMENT (PDPM) COMMENTS

For each programmed bridge project, excerpts of the final decisions from the Final Bridge Replacement Priority Report will be entered into PDPM in the comment section. These comments will be used for reference during District PDPM meetings.

REPLACEMENT INDEX MODEL

The primary factors that have a substantial impact on the decision to replace a structure are overall structural condition, average daily traffic, and the bypass distance that traffic would have to travel in the event that the bridge was closed. In an attempt to develop a method which considers these issues, MDOT has created a model to compute the "Replacement Index" of a bridge. As its name indicates, this number shows the overall significance of replacing a bridge in comparison to the rest of the bridges in the state-maintained inventory. A higher value indicates a higher priority for replacement.

TRAFFIC-DETOUR FACTOR

For the first part of our model, we account for the effects of the traffic and how far the traffic would have to travel in order to detour the bridge in the event that it was closed. This is accomplished by multiplying the bridge's Average Daily Traffic (ADT) (NBI item 29) with the bridge's bypass detour length (NBI item 19). However, the result of this product varies widely. In order to keep provide both practical and manageable values, we created the Traffic-Detour Factor which varies from 0 to10. A range of factors for the product of the ADT and Bypass Detour Length was established, and interpolations are used to obtain an actual Traffic-Detour Factor.

Table 3.0 Traffic Detour Factor

(ADT) X (Bypass Detour Length)	Traffic-Detour Factor
0	0
3000	2.5
10000	5
30000	7.5
90000	10

Bridges with a product of ADT and Bypass Detour Length greater than 90000 have a Traffic-Detour Factor of 10.

Example: For a bridge with an ADT of 1500 and Bypass Detour Length of 10 miles, the interpolated Traffic-Detour Factor is 5.625

TRAFFIC WEIGHT AND STRUCTURE EVALUATION WEIGHT

The "Replacement Index" is computed considering a combination of the effects of the Traffic-Detour Factor and the Structure Evaluation (NBI item 67). In computing this, we decided that for bridges in worse structural condition, the "traffic effects" should take on more significance. This means that as a bridge's structural condition worsens, traffic has an exponential effect on the bridge's deterioration and possible failure. In order to model this behavior, a range of weights was established for the effects that the Traffic-Detour Factor and Structure Evaluation can have on the Replacement Index based on a range of Structural Evaluation values. As with the Traffic-Detour Factor, interpolation is required to obtain the actual Traffic Weight and Structure Evaluation Weight.

Table 4.0 Traffic Weight & Structure Evaluation Weight

Structure Evaluation	Traffic Weight	Structure Evaluation Weight
0	35	65
3	30	70
5	25	75
7	10	90
10	10	90

Example: For a bridge with a Structure Evaluation of 4, the Traffic Weight is 27.5 and the Structure Evaluation Weight is 72.5

EXAMPLE CALCULATION

The "Replacement Index" may be computed as follows:

$$RI = [TDF \times (TW/100) + (10 - SE) \times (SEW/100)] \times 10$$

RI = Replacement Index
TDF = Traffic-Detour Factor
TW = Traffic Weight
SE = Structure Evaluation
SEW = Structure Evaluation Weight

Example:

For a bridge with an ADT of 1500, Bypass Detour Length of 10 miles, and Structure Evaluation of 4

Replacement Index = [5.625 X (27.5 / 100) + (10 – 4) X (72.5 / 100)] X 10 = 58.96875

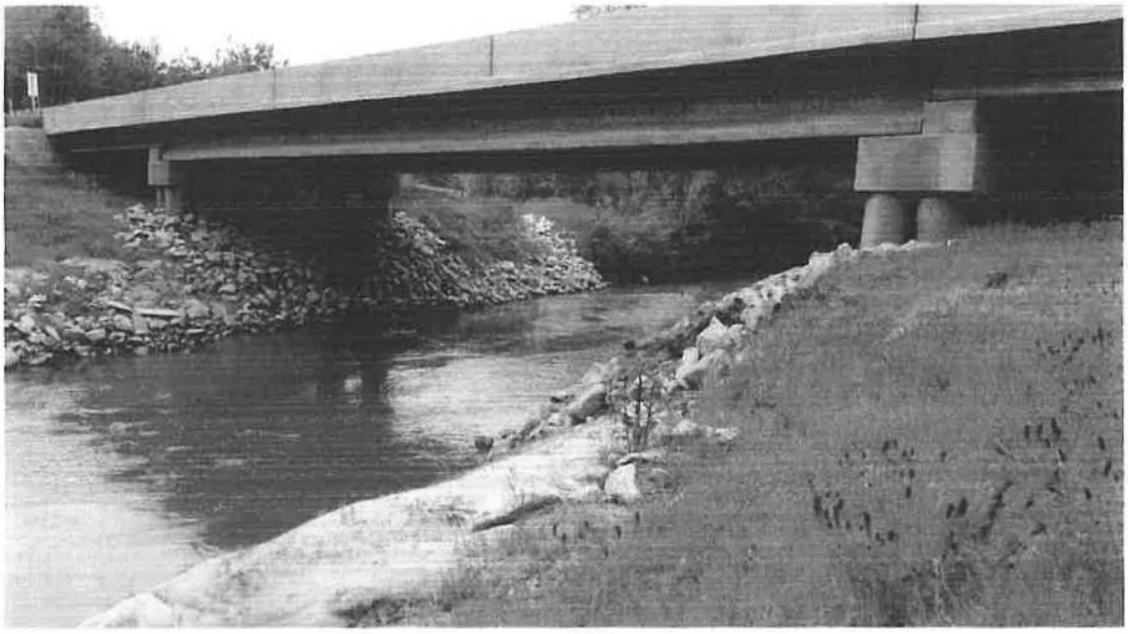
PRESERVATION

MDOT has established a preventive maintenance program aimed at delaying the deterioration of structures and maximizing their usability in an effort to extend the service life of state-owned bridges. Preventive maintenance falls into two categories: corrective and cyclical. The former are repairs to deteriorated elements of bridges that are otherwise in good structural condition and the latter are performed regularly as per a schedule. Examples of cyclical maintenance would be joint repair at five to ten years and painting at 20 to 25 years, if warranted and depending on the condition of these elements. This program includes a wide array of bridge items ranging from superstructure and substructure repairs to bridge painting and erosion control. Annually, each District is given a fixed amount of Federal funding, and recommendations from the Districts with concurrence from the Director of Structures, State Bridge Engineer are used to develop lists of bridges with specific deteriorated elements. As element level deterioration and life cycle cost optimization models become available, these tools will also be utilized in the development of preservation projects. This program has been in place since 2013 and is funded annually at approximately $3 million per year for preservation. The money is divided evenly among the Districts. Annually, an additional $3M is dedicated to bridge painting projects which are prioritized on a statewide basis.

LIFE-CYCLE MANAGEMENT

To aid in making further improvements to the prioritization process, MDOT is currently working to develop bridge element deterioration models and incorporate life-cycle cost optimization models. Deterioration modeling is designed to forecast the future conditions of bridges and aid in developing optimal actions to take on the bridge in a given period of time. This approach utilizes Element Level Bridge Inspection, which breaks down each structure into individual elements that provide a more detailed assessment of the bridge. By using element level data, structure performance can be more accurately analyzed by predicting structure deterioration based on the average condition ratings collected for each bridge component. Ultimately the final goal of optimized maintenance, rehabilitation, and repair is to use probability, cost data, and condition rating data to determine the most cost-effective option for extending the service-life of each structure.

OFFICE OF STATE AID ROAD CONSTRUCTION



Alcorn County 2015

Capturing Bridge Data

An introductory training session on capturing the data needed for load rating and input into InspectTech

Wednesday, August 8, 2018 from 8:30am to 3:30pm

McGowan Workforce Training Center, Holmes Community College, 412 W Ridgeland Ave, Ridgeland, MS

Presented in conjunction with:

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Michael Baker
INTERNATIONAL

U.S. Department of Transportation
Federal Highway Administration
MISSISSIPPI DIVISION

OFFICE OF
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November 9, 2018

James A Barber, Executive Director
PEER Committee
501 North West Street
Woolfolk Building, Suite 301-A
Jackson, Mississippi 39201

Dear Mr. Barber:

This letter is our follow-up to the PEER report entitled "*Selected Issues: Mississippi Department of Transportation and the Office of State Aid Road Construction*" (April 11, 2018). Subsequent to the release of the Committee's report, the Office of State Aid Road Construction (OSARC) has worked diligently with Federal Highway Administration (FHWA) and the Mississippi Department of Transportation (MDOT) to ensure federal guidelines are adhered to.

We have developed new agreements with the Boards of Supervisors of each county for bridge inspections and communicated with them the need to have these instruments in place so as to further assist them and their county engineer with subsequent bridge inspections. With the assistance of MDOT and FHWA, we are currently entering into labor- hour contracts for bridge inspection with the county engineers for over 5,000 bridges that will be inspected over the next 6 to 8 months. Each contract requires quality control/quality assurance reviews and monitoring by the county engineer as well as monitoring by OSARC and FHWA. It is important to OSARC that in the future as many of the bridge inspections as possible are performed at the local level.

Training programs for the performance of NBIS compliant inspections have been held and offered at no cost to the county engineers. Additional training for bridge inspection team leaders and bridge inspection personnel have been held and have been scheduled for 2019. OSARC will continue to schedule this training on a continual and ongoing basis to ensure that qualified personnel are performing the required bridge inspections.

We are currently in the second year of a two year bridge inspection cycle for timber bridges. The total amount paid to date under the contracts for these inspections is $11,263,969.66. Nine (9) consulting firms were utilized the first year and seven (7) are being used in this second year. This inspection cycle will look at approximately 1,600 bridges. Approximately 1,000 are being inspected again as a follow up from the inspections that were performed last year, while another 600 are being evaluated using NBIS compliant inspection procedures for the first time. As the inspection process is a fluid process we are constantly working with the inspection consultants to communicate the findings of an inspection and what actions may be required of the county as a result of an inspection.

As a part of the follow-up I reached out to FHWA for a response from their perspective on the actions taken subsequent to the Committee's report. While their comments have been incorporated into the OSARC response, a copy of their comments is included as an attachment to this correspondence.

While we have made progress, the issue of bridge closure enforcement and posting remains a local issue that has not been fully addressed. As stated in previous correspondence, OSARC is charged with the responsibility of administering, at the state level, the State Aid Program (SAP) and the Local System Bridge Replacement and Rehabilitation Program (LSBP) to benefit the Counties. As such, OSARC does not have ownership or operational authority on any road or bridge in the State, but administers funds as allocated to the Counties by State and Federal Law. OSARC is responsible for certain oversight through the SAP and LSBP programs, as well as federally required bridge inspections.

The powers of the State Aid Engineer are with reference to the expenditures of state funds and are not intended to interfere in any way with the constitutional jurisdiction of any County Board of Supervisors. OSARC provides oversight of the local bridge inspection program and based on inspection and load ratings performed by consultants, bridge postings and closure recommendations are recommended as necessary. County personnel are responsible for sign posting, bridge closures, and the subsequent monitoring and maintenance of bridge postings/closures. A requirement for a successful NBIS compliant local bridge inspection program must include appropriate communication and cooperation by the Board of Supervisors in each County.

I appreciate the opportunity to provide information on the actions we have taken in recent months. If I may be of any assistance to you and the committee, please do not hesitate to contact me.

Sincerely,

Harry Lee James, P.E.
State Aid Engineer

MDOT, Ms. McGrath
FHWA, Mr. Davis
98-01

Attachment

Response and Comments from MS Division FHWA Office

The Federal Highway Administration, the Mississippi Department of Transportation, and the Office of State Aid Road Construction has been diligently working together to strengthen the local bridge inspection program. Many actions have been implemented, such as:

- *The second inspection cycle for the locally owned bridges with timber substructure utilizing independent consultants began in September 2018. For this round, seven consulting firms are being utilized.*
- *A new process has been implemented to strengthen the inspection process for the locally owned non-complex bridges. These are the bridges that have remained within the traditional inspection process – those inspected through the respective County Engineer. New process changes include:*
    - *The County designates a qualified bridge inspection firm to inspect the bridges. The firm may or may not be the County Engineer. This is the county's decision as long as the designated firm is qualified per federal regulations. This designation is included in a board order provided to OSARC.*
    - *OSARC verifies the designated firm is qualified and subsequently enters into contract negotiations with the county designated firm to inspect the bridges within the county.*
    - *The contracts are between OSARC and the inspection firm – this maximizes OSARC's ability to oversee these contracts. FHWA, MDOT, and OSARC diligently worked to create a new contract scope and compensation method to help ensure a long term sustainable NBI compliant inspection process. For example:*
        - *The contracts are no longer lump sum. Instead, they are now labor hour contracts.*
        - *The contracts are for inspection work only – no load ratings. If a load rating is needed, OSARC will be notified by the County's inspection firm and OSARC will have the bridge load rated by a firm qualified and experienced in load ratings.*
    - *FHWA, MDOT, and OSARC worked together to establish a methodology to extend the inspection dates for the lower risk bridges. The time extension provides the inspection firms much needed flexibility to adjust their staffing levels and spread the inspections over a longer time period if needed. Based on parameters derived by FHWA, OSARC and MDOT - OSARC provided the inspection firms with the new inspection due dates for each bridge.*
    - *FHWA, MDOT, and OSARC held training sessions with the designated inspection firms to present the new contract scopes, method of compensation, and inspection expectations. Feedback was obtained to help establish an efficient and effective inspection program.*

All of the above items have been a monumental and time-consuming effort for FHWA, MDOT, and OSARC to achieve a long term sustainable NBI compliant local bridge inspection program. Extraordinary progress has been made. Now that the contracts and inspection process have been strengthened, the next step is to aggressively update OSARC's QA program. This effort is now underway and will be completed by the December 31, 2018. The focus of the QA program will be to ensure well documented NBI compliant inspections are performed, inspection due dates are met, and bridges are timely posted/closed.

PEER Committee Staff

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