



SCAN TEAM REPORT

Scan 07-05

Best Practices In Bridge Management Decision-Making

Supported by the
National Cooperative Highway Research Program

The information contained in this report was prepared as part of NCHRP Project 20-68A U.S. Domestic Scan, National Cooperative Highway Research Program.

SPECIAL NOTE: This report IS NOT an official publication of the National Cooperative Highway Research Program, Transportation Research Board, National Research Council, or The National Academies.

Executive Summary

Introduction/Overview

Scan 07-05 is a domestic scan focusing on practices among U.S. transportation departments (DOT) for identification, prioritization, and execution of programs for management of highway bridges. The scan includes reviews of DOT manuals, guidelines, and policy statements; a collection of responses to amplifying questions from DOTs; and travel to seven sites for meetings with DOT staff. The most detailed information was collected from 13 DOTs that participated in meetings with the scan team. Document review includes input from 11 other DOTs. All sources are state or local government agencies of the United States (see Table 1.1).

Materials collected from participating agencies during the scan include PowerPoint presentations, maintenance manuals, technical memoranda, coding guides, policy memos, and spreadsheets used in prioritizing and executing bridge maintenance work.

This scan collected policies and procedures only. Visits to bridge sites or other field sites were not part of the scan.

Key Findings/Observations

The scan team observed that certain practices in current use in bridge maintenance are effective in improving overall bridge conditions. These key observations/findings are divided into three main categories: the bridge management process, preventive maintenance, and agency support. The first of these categories, the bridge management process, further touches upon four elements of an effective process: identification of maintenance needs, performance measures, prioritization, and verification. Each of these is further described below. Following, the scan's key recommendations are presented.

Bridge Management Process

Bridge management is a process that combines information on the needs of bridges, the significance of bridge conditions and risks, the appropriate remedies and actions, the available means of execution, and the efficient programming and coordination of maintenance work. Bridge management, as a process, responds to limitations in available resources and yields appropriate work programs for specified planning periods.

■ Maintenance Needs

The identification of maintenance needs at bridges is most effective when it is uniform, specific, and repeatable. Needs should be identified at the bridge element level. Needs must be stated as standard work actions so that procedures, expected costs, and requirements in permitting and scheduling are identified. To make the most effective use of work needs at bridges, needs must be stored in a corporate database accessible to program managers.

■ Maintenance Performance Measures

At DOTs where the use of performance measures were effective in documenting improvements to bridge conditions, performance measures were matched to objectives in bridge maintenance. Performance measures that are focused on deficient bridges deliver programs for deficiencies. Performance measures that are focused on PM needs deliver programs for preventive maintenance. Performance measures must both identify work that will achieve maintenance objectives provide simple indications of the status of bridge conditions.

Performance measures are effective when upper management actively and consistently supports them and when they are used to monitor overall network conditions and progress in achieving network goals. Performance measures are less effective in selecting day-to-day work programs, which are best set by experienced, trained maintenance crew supervisors using easily available data and first-hand knowledge of bridges within their jurisdiction.

■ Prioritization

Prioritization of maintenance projects must integrate agency objectives for deficient bridges, for preventive maintenance of good bridges, for network performance, and for risk. The process for prioritization must recognize the effect that deferred maintenance will have on individual bridges and on the network of bridges.

For automated evaluation of priorities, multi-object approaches are needed to combine the benefits of least cost, risk reduction, and preventive maintenance. Inputs to automated evaluations must include bridge conditions; bridge vulnerabilities; indicators for PM needs, such as paint health index; and attributes of bridge inventory.

Procedures for prioritization must engage both central and regional DOT offices and must advance from network-level rankings of candidates to bridge-by-bridge selection of projects.

■ Verification

Bridge management processes that are reliable and useful in making decisions incorporate reports of completed maintenance work. Bridge management systems must also correlate the impact of the work on bridge condition measures through verification. Verification is needed to confirm that risk is reduced or that preventive maintenance needs are satisfied. Verification is most effective when it includes integration of DOT data systems so that bridge management applications can collect relevant information from crew- and contract-management applications.

Preventive Maintenance

A significant portion of bridge resources (i.e., funds and personnel) is being directed to preventive maintenance (PM) in some DOTs that have proactively sought to improve overall bridge condition measures. A strategy of emphasizing PM can succeed in improving or maintaining good bridge conditions.

To be effective, PM actions must be applied before bridge conditions become poor. DOTs must be able to recognize current needs for PM actions, anticipate near-term needs, and follow work-programming procedures that deliver PM actions promptly and at appropriate times. Successful programs target bridges that are in fair or good condition for PM actions.

To recognize and program preventive maintenance, DOTs must have trained staff, adequate funding, flexible allocation of funds, and clear plans of action for bridge components. These last two aspects, flexible allocation and clear plans, are key. Funding must be directed to preventive maintenance for bridges before bridges become deficient. DOT staff must recognize maintenance needs related to time in service, and not only to the defects.

Agency Support

The formal DOT organization must support the bridge management process at all levels. DOT bridge inspection teams, by training and experience, must be able to identify work needs and recommend actions. Bridge owners need to leverage their bridge site inspections for both the identification of needed work and the verification of completed work (from previous recommendations). Maintenance crews must take initiative in the execution of maintenance work and be guided, but not controlled, by lists of needs from bridge inspections. District maintenance engineers must collect information from inspectors and from crews, evaluate the continuing needs and trends in their bridges, and make appropriate applications to their central DOT office for funds and for projects. The central DOT office must operate with quantitative performance measures that are compatible with district operations and must recognize the first-hand knowledge that resides in DOT districts. DOT executives and government executives generally must accept that maintenance is not an episodic response to deficient bridges, but rather a continuing program of support for good bridges.

In its external aspects, agency-wide support for bridge management is seen in staff training, peer-exchange conferences, policies on preventive maintenance practices, Web-accessible guides and manuals and, in general, access of staff to technical knowledge and policy guidance for bridge maintenance.

Full explanations of these practices should be prepared and disseminated through documents, Web sites, webinars, presentations to AASHTO and TRB committees, and should be included as content in National Highway Institute courses for bridge maintenance and management. The effective practices are outlined below. An implementation plan begins on page 174. Information on practices at individual DOTs appears in the “Findings” sections in the body of this report.

Key Recommendations

The scan team’s key recommendations for bridge management decision-making are as follows:

- Adopt element-level bridge inspection programs and establish standard condition states, quantities, and recommended actions (i.e., maintenance, preservation, rehabilitation, and replacement) to match the operational characteristics of the agency maintenance and or

preservation program.

- Establish national performance measures for all highway bridges for comparisons among bridge owners.
- Use owner-specific performance measures to allocate funding levels for the full range of actions (i.e., maintenance, preservation, rehabilitation, and replacement) to optimize highway bridge conditions.
- Determine bridge needs and a proposed multiyear treatment program based on owner-specific objectives. Use the proposed program to develop a needs-based funding allocation, using all types of funding within the state's prerogative for each of the recommended action types (i.e., maintenance, preservation, rehabilitation, and replacement).
- Establish standards for preventive maintenance programs that are funded at levels set by analysis of performance measures. Programs must include the preservation needs of "cusp" bridges to keep them from becoming deficient bridges. In other words, do the right activity at the right time, keeping good bridges in good condition and moving away from the "worst first" approach. Experience in scan states has shown that preventive and minor maintenance must be a significant portion of bridge programs that optimize bridge conditions within limited budgets.
- Develop work programs for maintenance and preservation at the lowest level of management or supervision when supervisors with extensive field maintenance knowledge and experience staff those positions. Avoid blind use of work programs from bridge management systems (BMSs), and work programs dictated by goals to maximize performance measures (although both BMSs and performance measures do provide useful information to maintenance crews).

Scan Team Overall Recommendations

Based on the findings, the scan team also identified a larger set of overall recommendations in addition to the key recommendations. These overall recommendations, which are categorized into various bridge management areas, draw upon and expand the key recommendations to highlight effective bridge management practices that have broader program applicability. The overall recommendations are as follows:

Assessments: Element-Level Inventory and Inspection

- Identify work recommendations (set to match agency practices) and costs and store them in a database
- Continuously update accomplishments and unmet needs
- Create a feedback loop for validation to avoid re-reporting of resolved needs

Performance Measures

- Establish performance measures
- Include all bridges, in addition to those that are structurally deficient and functionally obsolete
- Ensure that the measures are suitable for establishing relative funding levels for crew or contract maintenance, capital program rehabilitation, and capital program replacement
- Ensure that the measures are suitable for national comparison

Funding/Resources

Develop for all highway bridges needs-based funding formulas that recognize the value of maintenance and repair at the appropriate time to improve bridge conditions and extend service life

Decision Tools

- Integrate project and network objectives, especially for program-level decision-making in asset management, to achieve single-asset optimization
- Use forecasting and modeling tools
- Use tools that are capable of evaluating maintenance scenarios that are consistent with agency maintenance practices

Programming

- Use priority indicators that integrate urgency, vulnerability, delays, cost, and other key factors
- Achieve the most effectiveness by coordinating work plans through local, district, and headquarter levels, incorporating local knowledge, and setting day-to-day work schedules at the lowest local level

Delivery Mechanisms

- Use a wide range of alternative design/contracting options for various types of maintenance and repairs, including state crews, contracted planned maintenance, on-call contracted as-needed repairs, and state specialty crews for specific repairs (e.g., spot painting, heat straightening, and corrosion mitigation)
- Continue efforts in performance-management type contracts
- Develop standardized item-based contracting for specific on-call projects

