

# Guides to Preservation of Highway Bridges

by George Hearn, University of Colorado Boulder

Bridge preservation, as defined by the American Association of State Highway and Transportation Officials (AASHTO), is a program of actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good condition; and extend their life.<sup>1</sup> This concept can also be described as maintenance and repair applied to bridges that are currently in good or fair condition with the intention to keep them in good or fair condition. Preservation keeps bridges in service without modification to bridge capacity, design type, materials, or function.

Bridge preservation can be an important initiative to help agencies reduce costs over the service lives of their bridges. The National Cooperative Highway Research Program (NCHRP) has been working with AASHTO to develop guides to (a) the general preservation of highway bridges and (b) the preservation of highway bridge decks. This article explores some of the concepts and definitions used in the development of the forthcoming guides. Further information on the concept of bridge preservation and detailed information on the development of the two guides to preservation are available in NCHRP Report 950.<sup>2</sup>

## Candidates for Bridge Preservation

Candidates for preservation are bridges that meet criteria in condition, capacity, robustness, and durability. Bridge condition is indicated by general condition ratings of the U.S. Department of Transportation National Bridge Inventory and by element-level condition states defined in the AASHTO *Manual for Bridge Element Inspection*.<sup>3</sup> The capacity of a bridge is a combined assessment of deck width, roadway alignment, clearances, number of traffic lanes, live-load rating, and weight

restrictions in relation to desired service for a route. Robustness in a bridge is the absence of vulnerabilities to sudden failure by earthquake, flood, overload, fatigue, fracture, or attack. Durability is an assessment of resistance to deterioration of a bridge's construction materials, design details, and devices such as bearings and joints.

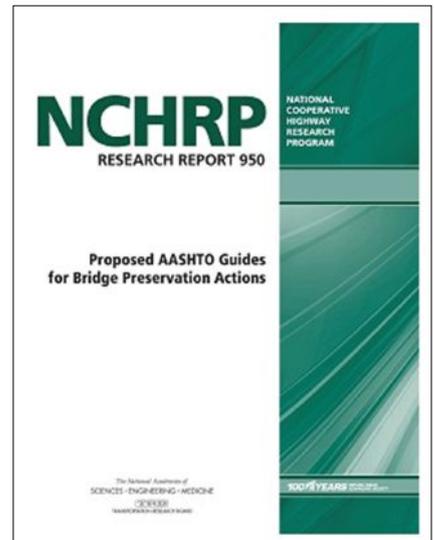
## Preservation Actions

Preservation actions maintain good or fair condition of a bridge and extend service life. These actions comprise maintenance and repair of major components of a bridge as well as maintenance, repair, or replacement of other components. Major components are decks, superstructures, substructures, and culverts; other components are joints, bearings, drains, railings, approach slabs, approach embankments, and channel protection.

Preservation is not intended to increase capacity of a bridge; for that reason, actions to replace or reconstruct major components of a bridge are not preservation. Preservation may, however, increase durability. Increased durability may result from new coatings, new overlays, or new joints, and, in general, from actions to repair or replace other nonmajor components.

## Benefits of Bridge Preservation

Bridge preservation can reduce agency costs for bridge service. Cost is evaluated using preservation-cycle cost analysis (PCCA). PCCA assumes that every bridge will be replaced eventually, that preservation actions can extend bridge service life, and that costs include the ongoing costs of preservation actions plus the cost of future replacement of a bridge. Longer service life is a reduction in the cost of replacement, and this reduction can



be great enough to offset the costs of ongoing actions in preservation. When preservation is applied to bridges in good or fair condition, there can be a net savings in agency costs.

PCCA can be applied to the overall preservation of a bridge, or to preservation of a bridge component. It can also be applied to a network of bridges. At a network level, PCCA yields annual quantities of preservation work and annual costs of preservation. Agencies can develop budgets for preservation and track the delivery of preservation programs using PCCA.

## Bridge Preservation Program

Preservation is one phase in overall management of bridges. The service life of a highway bridge is a progression of phases that include new construction, preservation in service, and eventual replacement. Bridge preservation complements existing programs for new construction, and for rehabilitation and replacement of bridges.

Preservation actions respond to defects in bridges and provide repairs. Preservation

programs emphasize cyclic actions that can be taken in advance of defects. The renewal of coatings, overlays, joint seals, and other features that protect major components of bridges can be performed at intervals based on the service life of protective features without waiting for defects to appear.

### Guides to Bridge Preservation and Bridge Deck Preservation

NCHRP Project 14-36 developed two AASHTO guides for highway bridge preservation: a general guide to bridge preservation and a guide to preservation of highway bridge decks. The general guide addresses all components of bridges, including bridge decks, whereas the deck guide provides greater detail on materials and methods for preservation of bridge decks. Both guides are based on comprehensive data collection, cost and benefit analyses, and development of catalogs of bridge

element preservation actions. Both provide the definition of preservation, criteria to identify candidates for preservation, listed preservation actions, measures of preservation effectiveness, and procedures to monitor and evaluate preservation programs. Examples of application of PCCA to bridges, bridge decks, and bridge networks are also provided.

NCHRP Project 14-36 was completed in 2020, and AASHTO Technical Committee T-9, Bridge Preservation, reviewed and edited both guides. The general guide to bridge preservation was approved by the AASHTO Committee on Bridges and Structures and will be published in 2021.<sup>4</sup> The guide to deck preservation will be considered for publication at the 2021 committee meeting. Detailed information on the development of both guides is available in NCHRP Report 950.<sup>2</sup>

### References

1. American Association of State Highway and Transportation Officials (AASHTO). 2011. *Adoption of an AASHTO Bridge Preservation Definition*. Policy Resolution PR-3-11. Washington, DC: AASHTO.
2. Hearn, G. 2020. *Proposed AASHTO Guides for Bridge Preservation Actions*. National Cooperative Highway Research Program Report 950. Washington, DC: National Academies Press. <https://doi.org/10.17226/26013>.
3. AASHTO. 2019. *Manual for Bridge Element Inspection*, 2nd ed. MBEI-2. Washington, DC: AASHTO.
4. AASHTO. Forthcoming. *Guide to Bridge Preservation Actions*. Washington, DC: AASHTO. 

*George Hearn is an associate professor of civil engineering at the University of Colorado Boulder.*



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