



Guidelines for Historic Bridge Rehabilitation and Replacement

November 2008

AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS

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Acknowledgements

This study was requested by the American Association of State Highway and Transportation Officials (AASHTO), and conducted as part of the National Cooperative Highway Research Program (NCHRP) Project 25-25/Task 19. The NCHRP is supported by annual voluntary contributions from the state Departments of Transportation. Project 25-25 is intended to fund quick response studies on behalf of the AASHTO Standing Committee on the Environment. The report was prepared by Lichtenstein Consulting Engineers, Inc. in association with Parsons Brinckerhoff Quade & Douglas, Inc. Mary E. McCahon of Lichtenstein was principal investigator for this project and led the preparation of the report. The other authors and investigators were Joseph J. Pullaro, P.E., Steven A. Shaup, P.E. and senior historian J. Patrick Harshbarger, all of Lichtenstein. Eric DeLony provided review comments.

The work was guided by a task group chaired by Tim Hill which included Brent Bowen, Janet D'Ignazio, Susan Gasbarro, Paul Graham, William Hauser, Mary Ann Naber, Nancy Schamu, and Madeleine White. The project was managed by Christopher Hedges, NCHRP Senior Program Officer. The preparers would like to thank Ken Kobetsky and Kelley Rehm of AASHTO for their technical assistance and Lisa Zeimer of Parsons Brinckerhoff for administrative assistance during the project.

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The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsors. The information contained in this document was taken directly from the submission of the authors. This document is not a report of the Transportation Research Board or of the National Research Council.

Table of Contents

LIST OF FIGURES	v
LIST OF TABLES	v
ABSTRACT	vi
EXECUTIVE SUMMARY	1
CHAPTER 1 Introduction and Research Approach	3
Introduction	3
Research Approach	4
CHAPTER 2 Findings	5
Literature Search	5
Findings from Questionnaire on Current State of Decision Making Practice	6
CHAPTER 3 Historic Bridge Rehabilitation/Replacement Decision-Making Guidelines	9
The Need for Decision-Making Guidelines	9
How to Use the Decision-Making Guidelines	10
Step 1: Understanding What Makes a Bridge Historic	11
What Makes the Bridge Historic?	11
Is the Bridge of Average or High Historical Significance?	11
Can Members be Changed Without Adversely Affecting Historical Significance?	12
Completion of Step 1	19
Step 2: Applying Structural and Functional Considerations	20
Analysis of Structure Condition and Waterway Adequacy	20
Analysis of Load-Carrying Capacity	23
Analysis of Geometry and Safety Features	25
Completion of Step 2	29
Step 3: Historical and Environmental Considerations	29
Common Problems	30
Approaches for Addressing Historic and Environmental Considerations	30
Completion of Step 3	31
Step 4: Applying the Decision-Making Thresholds	31
Defining Feasible and Prudent	31
Application of Thresholds Based on Aspects of Adequacy	33
APPENDIX A Literature Search	A1
APPENDIX B Summary of Responses to Questionnaire	B1

List of Figures

Figure 3-1	Bankhead Highway over Proctor Creek Bridge in Atlanta, Georgia	14
Figure 3-2	Standard-Design Two-Span Continuous Bridge in Georgia.	14
Figure 3-3	Detail of Delaware River Bridge at Washington Crossing, New Jersey	15
Figure 3-4	Kansas Corral railings on John Mack Bridge at Wichita, Kansas	16
Figure 3-5a.	Partridge Bridge at Whitefield, Maine—Elevation.	16
Figure 3-5b.	Partridge Bridge at Whitefield, Maine—Through View Showing Modern Railings.	17
Figure 3-6a.	Walnut Street Bridge at Chattanooga, Tennessee—Post-Tension Diagonal. . .	18
Figure 3-6b.	Walnut Street Bridge at Chattanooga, Tennessee—Post-Tensioned Lower Chord.	19
Figure 3-7	Truss Bridge at Califon, New Jersey	26

List of Tables

Table 3-1	Condition rating descriptions. From <i>Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges</i> , Federal Highway Administration, Report No. FHWA-PD-96-001	21
Table 3-2a–c	Rehabilitation/Replacement Thresholds Based on Aspects of Adequacy . .	38–40

Abstract

This report presents a literature search, findings of a survey on the current state of historic bridge rehabilitation or replacement decision making by state and local transportation agencies, and nationally applicable decision-making guidelines for historic bridges. The guidelines are intended to be used as the protocol for defining when rehabilitation of historic bridges can be considered prudent and feasible and when it is not, based on engineering and environmental data and judgments. The guidelines include identification of various approaches to bringing historic bridges into conformance with current design and safety guidelines/standards, and the effect or implications of remedial action on historical significance.

There are currently no such nationally applicable decision-making guidelines, but there are a variety of state and local processes and policies for managing historic bridges. Effective practices for the various processes inform the nationally applicable guidelines. The guidelines are in narrative and matrix format.





Executive Summary

While the National Historic Preservation Act of 1966 (amended) and Section 4(f) U.S. Department of Transportation Act of 1966 specify nationally applicable processes for considering preservation or replacement of historic bridges, there is no corresponding protocol that ensures a nationally consistent approach to determining which bridges should be rehabilitated or replaced. State and local transportation agencies have developed a wide variety of approaches for addressing historic bridges with each reflecting the priorities and culture of the particular agency as well as the bias, knowledge, and expertise of the decision makers. Despite the federal legislation and proactive policies of many states, historic bridges continue to be lost for a variety of reasons. To ensure that rehabilitation versus replacement decision making is balanced and consistent among the states, nationally applicable guidance on historic bridge analysis is deemed by the American Association of State Highway and Transportation Officials Standing Committee on the Environment to be useful.

Research indicates that while many transportation agencies have processes for managing historic bridges, including some with well thought out treatments for preserving specific bridges, few have written protocols or guidelines that lead engineers and historians through the decision-making process. When is it not prudent to rehabilitate a substandard bridge? When is it prudent to upgrade the bridge to keep it in service? What work can be done without adversely affecting what makes the bridge historic? Has everything that could be done to preserve the bridge been considered? Research indicates that engineers believe that their agencies are proactive about historic bridge preservation while historians do not. So while there are stunning successes, like Vermont's metal truss bridge preservation program or Oregon's Coastal Highway bridge rehabilitations, the perception is that historic bridges that could be saved are not being saved because rehabilitation is not as consistently considered as it should be.

Guidelines have been developed based on effective practices, understanding of historic bridge types, and appropriate methodologies for addressing deficient load capacity, geometry, and safety features. These guidelines lead decision makers through considerations that define when rehabilitation is prudent and feasible and when it is not, based on engineering judgments balanced with consideration of environmental issues.





Chapter 1

Introduction and Research Approach

Introduction

While the National Historic Preservation Act of 1966 (amended) and Section 4(f) of the U.S. Department of Transportation Act of 1966 specify nationally applicable processes for considering preservation or replacement of historic bridges (defined as those that are listed in or have been determined eligible for inclusion in the National Register of Historic Places), there is no corresponding protocol that ensures a nationally consistent approach to determining when rehabilitation is the appropriate decision or when replacement is justified. State and local transportation agencies have developed a wide variety of approaches for managing historic bridges, and many of them proactively define treatments and uses after decisions about rehabilitation or replacement have been made. But few of the processes are founded on written protocols or guidelines that ensure balanced decision making that spells out to all stakeholders when rehabilitation is the prudent alternative.

When an engineer considers rehabilitation or replacement of a deficient, non-historic bridge, the engineer may not look very deeply into rehabilitation unless the bridge is of substantial length (at least a few hundred feet) or has multiple spans. For those bridges, whether they are historic or not, rehabilitation is nearly always considered because it is often less expensive than full replacement. This approach is sound and valid because ways to upgrade the bridge and keep it in service are fully considered. But the same approach is not consistently applied to shorter bridges. Owners and managers often decide to replace shorter bridges that have structural, functional, and/or safety problems rather than consider rehabilitation based on the proven long-term cost effectiveness of replacement for short and single-span bridges. With so many shorter and less complicated bridges now identified as historic, and thus worthy of preservation under federal policy and statutes, the engineering approach to decision making needs to acknowledge the value of these bridges and to take their historic value into account in the decision-making process.

Those concerned about preservation of historic bridges acknowledge that there is a need for nationally applicable guidance on analysis and decision making that balances engineering judgment and environmental issues. There is also a need for definitions of when rehabilitation can be considered

prudent and feasible and when it cannot. The guidelines need to address all of the issues associated with decision making, including thresholds that define such issues as when cost makes remedial work not prudent or when a context-based solution is appropriate.

Some deficiencies are easily corrected. Others may require so much effort to bring the bridge into conformance that rehabilitation may not be the prudent decision. Not all historic bridges can be saved, but many can. Preservability of a historic bridge, as with any bridge, is a factor of its ability to perform adequately, which is defined by engineers as meeting current minimum standards or guidelines in the areas of load capacity (structural), geometry (functional), and safety. The cost to achieve and maintain adequacy in these areas must also be factored into any definition of preservability.

Historical significance must also be a major factor in the decision-making process, including whether the bridge is of such significance that a higher level of effort to preserve it is warranted. If a bridge can be improved to an acceptable level in a prudent manner, within the limits of acceptable technology, and without adversely affecting what it is that makes it historic, then the bridge is likely a viable candidate for rehabilitation.

Research Approach

The approach to research was to use existing information to the greatest extent possible and then synthesize it (1) to identify effective practices, (2) to provide an accurate assessment of the state of the practice of historic bridge “rehabilitation-versus-replacement” decision making among state and local transportation agencies, (3) to identify approaches for consistent and balanced decision making, and (4) to understand if historic bridge “issues” delay projects. The research was conducted by doing a literature search (see Appendix A) and a targeted questionnaire (see Appendix B). Both efforts were structured to identify effective practices and the issues that prevent consistent consideration of rehabilitation potential of all historic bridges. A great deal of anecdotal and empirical data is provided by the research team based on their years of experience assessing the rehabilitation potential of all types of historic bridges.

A questionnaire was developed to determine the current state of practice and decision-making processes that are being used by the states. The questionnaire was sent to 49 engineers and environmental specialists, including historians, preservationists, archaeologists, and managers, with county, state, and federal transportation agencies and state historic preservation offices (SHPOs).

The guidelines for historic bridge rehabilitation or replacement decision making represent the synthesis of the literature search, questionnaire responses, and experience of the researchers.



Chapter 2

Findings

Literature Search

The literature search (Appendix A) revealed that very little has been published (including the web) that addresses specific evaluation criteria or guidelines for historic bridge rehabilitation or replacement decision making. Rather, much of the existing body of literature describes particular rehabilitation projects or general approaches to decision making, particularly methods for expediting or streamlining consultation under the National Environmental Policy Act (NEPA), Section 106, and Section 4(f).

The literature search identified two previous NCHRP syntheses by William Chamberlin (1983, 1999) that do an excellent job of summarizing the issues faced and methods used by state highway departments. Chamberlin concludes that approaches and levels of historic bridge rehabilitation expertise vary greatly from state to state. Some states start with the mindset that historic bridges should be preserved unless thorough analysis proves that rehabilitation and preservation is not prudent and feasible; others assume deficient bridges should be replaced. In many cases, decisions whether to rehabilitate or replace are made based on very general guidance and assumptions. A 2004 national historic bridge workshop (DeLony and Klein) concluded that historic bridges remain a heritage at risk despite local, state, and federal legislation to identify and protect historic bridges. The workshop recommended development of historic bridge management plans and a synthesis of rehabilitation-versus-replacement options.

Perhaps the most significant applicable guidance to appear in the past decade is the American Association of State Highway and Transportation Officials (AASHTO) *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT<400)*, 2001. That guidance, which is now part of AASHTO's *A Policy on Geometric Design of Highways and Streets*, offers flexibility when considering width and safety performance, and thus increases the likelihood that narrow bridges can remain in service on very low-volume local roads.

A number of state highway departments have preservation plans that are outgrowths of their historic bridge inventories, but the plans tend to be process-oriented and offer a menu of possible treatments

rather than a protocol or specific technical guidance for deciding when to rehabilitate and when to replace. Maine DOT's Historic Bridge Preservation Plan (2004) was the only one identified to have a specific quantifiable protocol for rehabilitation or replacement analysis and decision making.

The technical literature of journal articles, conference proceedings, and briefs from such organizations as the American Concrete Institute, American Society of Civil Engineers, Association for Preservation Technology, and the National Park Service's Technical Preservation Services offer many historic bridge rehabilitation case studies and scholarship on properties, testing, and conservation of materials, like reinforced concrete or steel, but again with little synthesis of this information in a format that would offer broadly applicable guidance when deciding whether to rehabilitate or replace historic bridges.

Findings from Questionnaire on Current State of Decision-Making Practice

A 16-question questionnaire was developed to research the current state of historic bridge rehabilitation-versus-replacement decision making. It was sent to 49 engineers, historians, archaeologists, and managers from state departments of transportation (DOTs), counties, SHPOs, and the Federal Highway Administration (FHWA). Twenty-one respondents from 17 states replied. The goal was to elicit responses that might help the research team to identify useful resources or specific problem areas.

About half of the respondents felt that their agencies were proactive in terms of rehabilitation decision making. Of these respondents, nine identified their agency as either having a written procedure that defines the process related to historic bridge treatments, or identified their agency as currently working on a written procedure. Of the nine, five of them have (or will have) a procedure/process that addresses all bridge types, whereas the rest have written processes that address specific bridge types, like metal or wood trusses. Three respondents indicated that their agency consistently follows an unwritten approach. However, only one of these three found their agency to be acting in a proactive manner regarding historic bridges.

Determining factors that affect rehabilitation versus replacement decision-making included cost, community input, Section 106 and Section 4(f) findings, engineering needs, future traffic, safety issues, historic significance, structural condition, and geometric issues such as roadway width, lane width, and vertical clearance. Only eight respondents, all of whom felt their agency to be proactive, also felt their agency achieved a balance between engineering and historic preservation issues. Only one of these eight respondents represents an agency that does not have an established written procedure or a consistent unwritten approach.

The respondents' suggestions on how to achieve a consistent national approach dealt with either including specific information in the analysis process, or accessing information to inform decision making. Information identified as useful to the decision-making process included clearer guidelines defining rehabilitation potential; design exceptions and options other than replacement, like relocation and bypassing; guidance on what makes a bridge historically significant and valuable; and consideration of rehabilitation occurring earlier in the decision-making process before replacement funds have been allocated.

The survey findings confirmed the dearth of general information about historic bridge analysis and decision making. Suggestions for disseminating useful information included setting up an easily accessible “permanent record” of related research and case studies that would include successes and failures, effective practices, and the latest technology used for bridge rehabilitation and preservation. Other suggestions included establishment of closer coordination between cultural resources staff, engineers, and owners and for more engineering expertise at the SHPO staff level. There was also a suggestion for information on how to address substandard features on low-volume roads, which to a large extent has already been accomplished with AASHTO’s *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT<400)*, but which may not have been known or useful enough to the respondent.

Over half of the respondents identified delays and other problems as common to projects involving historic bridges. These delays and problems typically arose from issues associated with completing the Section 106 and Section 4(f) processes and the additional public involvement necessary to accommodate all interested and consulting parties. Interestingly, the respondents who did not identify delays or problems felt that their agencies had a streamlined process already in place with FHWA and SHPO and/or that the “rehabilitation-versus-replacement” decision-making process was so well-established that all parties knew how to advance projects. One respondent stated that there was no delay or problem because their state agency was unwilling to accept rehabilitation as an option.

Issues identified as important in the decision-making process are functionality, public opinion, initial cost, life-cycle cost differences between rehabilitated and new bridges, concerns with safety, bridge location, historic significance, difficulty identifying parties to accept ownership and liability for a bypassed bridge, and traffic volumes. That engineers would rank achieving structural and geometric functionality as the highest priority is not surprising, nor is the finding that public opinion is a very strong factor in decision making or that initial and life-cycle costs matter greatly.

A detailed discussion of the questionnaire and responses is included in Appendix B.





Chapter 3

Historic Bridge Rehabilitation/ Replacement Decision-Making Guidelines

The Need for Decision-Making Guidelines

The National Historic Preservation Act (NHPA) of 1966, the U.S. Department of Transportation (U.S. DOT) Act of 1966, and the National Environmental Policy Act (NEPA) of 1969 specify nationally applicable processes for considering preservation of historic bridges, but there is no corresponding guidance to ensure a nationally consistent approach for determining when they should be rehabilitated or replaced. Many state and local transportation agencies have developed approaches for managing historic bridges, including some potential treatments for preserving specific bridges. Most of the approaches reflect the culture of each agency, as well as the knowledge and preferences of the individuals making decisions, rather than written step-by-step protocols that lead engineers, managers, and environmentalists, including historians and preservationists, through a process to achieve consistently balanced and well-founded decisions.

While there are stunning historic bridge preservation successes, like Vermont's metal truss bridge preservation program or Oregon's Coastal Highway bridge rehabilitations, the perception is that historic bridges that could be saved are not being saved because rehabilitation is not as fairly and consistently considered as it could be. Additionally, a need to better integrate historic bridge rehabilitation or replacement decision making into the NEPA process has been identified. To that end, step-by-step guidelines have been developed to address historic preservation and engineering issues in a manner that reflects the appropriate balance between the two seemingly divergent objectives—preserving old bridges and maintaining a safe, efficient transportation system. These guidelines will lead decision makers through considerations that will define when rehabilitation is feasible and prudent, and when it is not, based on engineering judgments balanced with consideration of environmental issues.