275

National Cooperative Highway Research Program

NCHRP Synthesis 275

Historic Highway Bridge Preservation Practices

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

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Synthesis of Highway Practice 275

Historic Highway Bridge Preservation Practices

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis report will be of interest to state highway design engineers and structural engineers, as well as environmental and historic preservation personnel in transportation agencies. It will also be of interest to state historic preservation offices, federal historic preservation agencies, and engineering preservation consultants. It describes the current state of the practice and experience of state and local transportation agencies dealing with the preservation of historic bridges in their jurisdictions. Information for the synthesis was collected by surveying U.S. state and federal transportation agencies and by conducting a literature search. The synthesis is intended to compliment NCHRP Synthesis 101: *Historic Bridges—Criteria for Decision Making* published in 1983, and draws on that work by reference.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board provides information on the policies, decision criteria (or models), and administrative practices used to determine which historic bridges to preserve and the specific preservation option to be employed with

each. It also emphasizes the experience of highway agencies in administering these polices and practices, describes a number of successful examples, and identifies some unresolved issues. Several case studies are included to highlight the differences between the policies and practices of state transportation agencies and preservation agencies.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

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William P. Chamberlin, Schenectady, New York, collected the data and prepared the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Everett B. Barnard, Bridge Maintenance Engineer, Maine Department of Transportation; Curtis B. Cryer, Senior Electrical Design Engineer, Oregon Department of Transportation; Eric N. DeLony, Chief, Historic American Engineering Record, National Park Service; Bruce Eberle, Federal Historic Preservation Officer, U.S. Department of Transportation; Peter J. Frantz, Chief of Environment, Illinois Department of Transportation; Mary F. Ivey, Head of Cultural Resources, Environmental Analysis Bureau, New York Department of Transportation; Paul Daniel Marriott, Director, National Task Force for Historic Roads, National Trust of Historic Preservation; Robert McCullough, Historic Preservation Coordinator, Vermont Agency of Transportation; and Jon M. Williams, Senior Program Officer, Transportation Research Board.

This study was managed by Stephen F. Maher, P.E., Manager, Synthesis Studies, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Linda S. Mason was responsible for editing and production.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

HISTORIC HIGHWAY BRIDGE PRESERVATION PRACTICES

SUMMARY

Historic bridges present challenges to both transportation and preservation. Many of the features that render them marginally suitable for modern traffic and candidates for replacement or rehabilitation are the same features that distinguish them as having historic value and that elicit interest in preservation. While the need to identify and protect historic bridges is now widely recognized and supported by federal legislation, the determination of which bridges are historic, which of those judged to be historic should be preserved, and what manner of preservation is most appropriate for each is left to the individual states.

Yet, in spite of this disparity, progress has been made in both attitude and substance since publication of the first NCHRP synthesis on this topic, in 1983. Most states have completed an inventory of at least some of their historic bridges; the number protected by being listed in or eligibile for the National Register of Historic Places has increased dramatically, and patterns of preservation suggest a strong association between those bridges that are most valued and those that are being preserved with the greatest frequency. Beginning with the Surface Transportation and Uniform Relocation Assistance Act of 1987, the national congress has become increasingly sympathetic to the importance of historic bridges and has provided funding in increasing amounts for their preservation; and a small number of states have enacted laws on their own initiative that support preservation of their historic bridges.

This synthesis identifies and describes current practices of highway agencies that are addressing these issues effectively. It draws on information from the literature, from published and unpublished reports of highway agencies, and from engineers and others in the cultural resources field who shared their knowledge and experience through responses to a mailed questionnaire and through personal communications.

The methods employed by highway agencies to manage historic bridges occur in a variety of forms including: formal stand-alone documents referred to as preservation or management plans; memoranda of agreement or understanding among the agency, the State Historic Preservation Officer and the Federal Highway Administration; internal memoranda or statements of intent; and unwritten but spoken understandings of how decisions will be made. Of these different expressions, the preservation plan addresses the components of the decision process more thoroughly and has usually been the product of a broader base of input. Ten state highway agencies were identified that have developed preservation plans for their historic bridges and these include several different developmental approaches. Other states were identified in which such plans are either in progress or contemplated. The more novel of these plans include that of the Vermont Agency of Transportation, a plan that reflects that state's extraordinary commitment to preserving the rural and small community character of its roadscapes, and that of the Montana Department of Transportation, a plan that seeks to integrate preservation of its historic bridges with historic road segments, as components of the same cultural resource.

Several states have developed design criteria for rehabilitating historic bridges on public roads, other than those on the national or state highway systems, in response to recent encouragement by the FHWA to consider flexibility in applying the AASHTO guidelines where aesthetic or historic values can be preserved and where the rehabilitated facility is judged to be safe; and the legislature of at least one state has provided an independent funding stream for upgrading roads and bridges in instances where acceptance of federal assistance would require application of standards judged to be incompatible with local values. A few state highway agencies have also developed programs that recognize historic bridges as a distinct category of structure with distinct maintenance and rehabilitation needs; and, in at least one instance, a new organizational unit has been created with its own staff to manage these programs. This commitment has resulted in the identification of a number of innovative and cost-effective approaches to engineering the rehabilitation and to finding alternative uses for the bridges that are rehabilitated.

Efforts to market historic bridges removed from public highways, currently required by the 1987 federal transportation legislation, have not been particularly effective except where accompanied by aggressive proactive educational and promotional programs aimed at increasing awareness of the importance of historic bridges and the opportunities for their alternative use. Also, an argument is made for including in the National Register nominating process, to the extent possible, factors relating to the preservability of historic bridges. This is particularly applicable to metal truss bridges which represent about three-quarters of all NR-eligible or listed bridges that fail to be preserved when included in a replacement or rehabilitation project.

CHAPTER ONE

INTRODUCTION

PURPOSE AND SCOPE

The Federal-Aid Highway Bridge Replacement and Rehabilitation program (*1*) is, by far, the principal source of funds for replacement and rehabilitation of structurally deficient and functionally obsolete bridges, both on and off the federal-aid highway system. This program is intended to provide safe bridge structures for the traveling public, especially in regions where local governments may otherwise lack the funds to adequately address the safety of the bridges under their jurisdiction. The program has had broad political support since its inception in 1970 as the Special Bridge Replacement program (*2*), and its funding has been supplemented in 1982 (*3*), 1987 (*4*) and 1991 (*5*). Other public funding sources include construction programs administered directly by agencies of the federal government, such as the U.S. Forest Service (USFS) and the National Park Service (NPS) and non-federally assisted programs of local jurisdictions.

Historic bridges, that is, those that are listed or determined to be eligible for listing in the National Register of Historic Places *(4)*, often present both transportation and preservation challenges. This is because characteristics that may render them no longer suitable for currently anticipated traffic are the same characteristics that distinguish them as representations of important developments in engineering technology, or as essential components of the fabric of historic districts or routes. There are no absolute standards for deciding which bridges are historic, which of those that are judged to be historic should be preserved, or what manner of preservation is most appropriate for each. For federal-aid projects, those decisions are negotiated by the individual state highway agencies in cooperation with their State Historic Preservation Officer (SHPO) and the Federal Highway Administration (FHWA), typically within the framework of agreed upon criteria (*6*). Where regional, local, or other considerations are also relevant, other persons or agencies might be included in the decision process as well. All decisions of National Register eligibility are made within the general framework specified by the Keeper of the RHP, as set forth in 36 CFR Part 60.4 (*7*).

Preservation in this context has generally been taken to mean the physical retention of the structure at its original or an alternate location with particular attention to protecting those elements of design, materials, and workmanship that support the quality of historic importance. Thus, preservation may include continued use for vehicular purposes at the same or a less demanding site, or use for non-vehicular purposes such as pedestrian or bicycle crossings, architectural adaptations, and historical ruins or monuments. In the present context, elements of cultural resource management such as dismantling and storing for future use, salvage of structural or decorative elements for reuse, display or research; and documentation to Historic American Engineering Record (HAER) or other standards are not considered forms of preservation.

The purpose of this synthesis is to identify and describe the current practices and experience of state and some local transportation agencies in dealing with the preservation of historic bridges in their jurisdiction. It emphasizes policies, decision criteria (or models), and administrative practices used to determine which bridges to preserve and the specific preservation option to be employed with each. It also emphasizes the experience of highway agencies in administering these policies and practices, describes a number of successful examples and identifies some unresolved issues. The synthesis will be useful to those in the highway transportation and preservation communities who influence and execute decisions involving historic bridges.

The synthesis is intended to complement *NCHRP Synthesis 101: Historic Bridges—Criteria for Decision Making*, published in 1983 (*6*), drawing on that work by reference. The earlier document was written at a time (1982–1983) when highway and transportation agencies, as a group, had been involved with the "historic bridge issue" for less than a decade and were only in the earliest stages of developing strategies for arriving at decisions regarding those structures. Money designated for bridge replacement and rehabilitation was being made available to highway agencies in annually increasing amounts in response to heightened concern over safety, and the preservation community was becoming increasingly alarmed at the rate at which this new emphasis was destroying or irrevocably altering some of the best examples of the nation's rich bridge building heritage. As a result, historic bridge investigations were becoming an increasingly larger factor in the management of cultural resources and there was concern that failure to deal with this issue skillfully risked unnecessary and costly delays to needed bridge projects. *NCHRP Synthesis 101* reviewed the background of that issue and discussed progress in developing workable solutions that could be supported by proponents of these often competing interests. The present work gives an overview

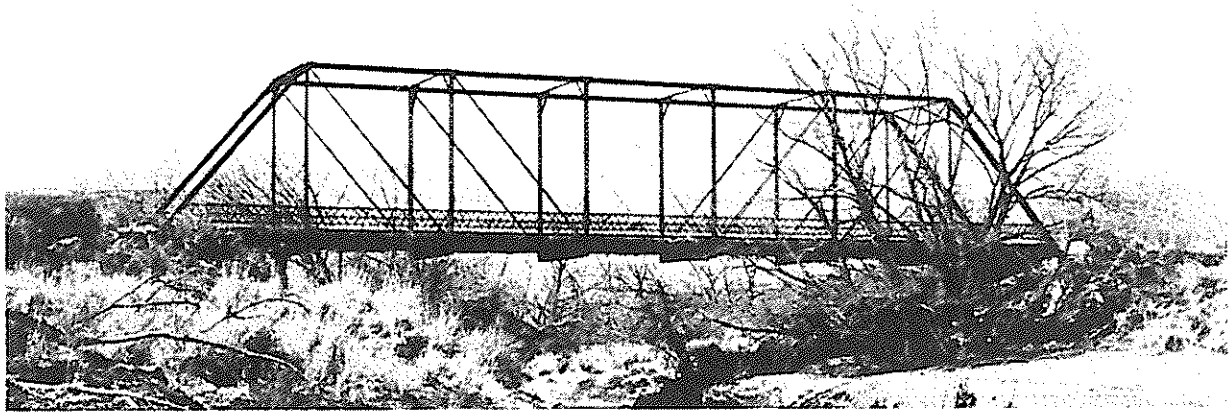

FIGURE 1 Rio Hondo Bridge at Picacho.

of *NCHRP Synthesis 101* and summarizes current issues in historic bridge preservation (chapter 1), seeks to identify preservation trends and the reasons for those trends (chapter 2), focuses on the policies and practices that have evolved within highway agencies during the intervening decade and one-half since *NCHRP Synthesis 101* was published and highlights those that have been particularly effective (chapter 3). The present work also complements a current project sponsored by FHWA to synthesize existing information and practice regarding the technical aspects of evaluating, rehabilitating, and preserving historic bridges; and to recommend standards and guidelines appropriate for such work (*8*).

This synthesis draws on published and unpublished documents of state highway and transportation agencies, interviews with persons currently involved with historic bridge issues, and responses to a questionnaire mailed to the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. Local jurisdictions (counties and municipalities) identified by the respondents to the survey as having been unusually successful in managing their historic bridges were also contacted by telephone, as were representatives of the FHWA, NPS, and USFS. The survey questionnaire itself is included as Appendix A. Individual responses to all of the questions were tabulated and although not presented here, are drawn on at appropriate points in the text and the 38 responding agencies are listed in Appendix B.

BACKGROUND

Thirty-five miles west of Roswell, New Mexico, where U.S. 70 traverses the rural Hondo Valley at Picacho, a modest sign erected by that state's transportation agency describes a seven-panel, pin-connected, metal truss bridge that carries a recently abandoned segment of an unpaved county road over the Hondo River (*9*):

> RIO HONDO BRIDGE
>
> ORIGINALLY BUILT IN 1902 OVER THE PECOS RIVER, AND LATER MOVED TO THIS SITE, THIS PRATT TRUSS BRIDGE IS THE LONGEST AND OLDEST OF ITS KIND REMAINING IN NEW MEXICO

The Rio Hondo Bridge (Figure 1), barricaded and left standing on its original alignment, has been replaced by a modern structure of reinforced concrete on a parallel alignment, and now serves as a historical monument to the technology of an earlier time. That the structure survives at all is due, in the first instance, to the ease with which these early truss bridges could be disassembled and re-erected at alternate locations and, in the second, to the accommodation that has been forged between highway agencies and preservation interests. It is reasonable to speculate that had the Rio Hondo Bridge been replaced in the early 1980s, when *NCHRP Synthesis 101* was published, it would have been salvaged for its value in the scrap metals market, as would most bridges of its age and style in other parts of the country. In fact, in 1981, an FHWA survey reported only 13 states as having completed an inventory of any of their historic bridges (*10*) and 2 years later only five of those had identified candidates for RHP listing (*6*). New Mexico was then in the preliminary stages only of developing its own inventory (*6*).

NCHRP Synthesis 101

The issues addressed in *NCHRP Synthesis 101* in the early 1980s were relatively uncomplicated and dealt mainly with the need to increase awareness of the historic bridge "problem." They included:

- Promoting a clearer understanding within both the transportation and the preservation communities of the concerns of the other with regard to historic bridges;

- Clearly setting forth in one place the federal legislation and other actions that give legitimacy to both sets of those concerns; and
- Identifying the processes that were being developed within some highway agencies to assure that reasoned and consistent decisions would be made on historic bridges in a manner that did not needlessly delay projects.

An unstated assumption of the synthesis was that it was in the best interest of highway agencies to acknowledge that historic bridges would become an increasingly larger factor in cultural resource considerations and to begin developing strategies that could be used to address that issue in ways that cause as little interruption to needed bridge replacement and rehabilitation projects as possible.

The synthesis traced development of the then-current federal Highway Bridge Replacement and Rehabilitation Program (*3*) from the December 1967 collapse of the Point Pleasant Bridge over the Ohio River (*11*), as well as national preservation policy from its inception in the Historic Sites and Buildings Act of 1953 (*12*), and emphasized the conflicting values embodied in those legislative streams as they relate to historic bridges. Particular attention was given to the provisions of Section 4(f) of the U.S. Department of Transportation Act of 1966 (*13*) and Section 106 of the National Historic Preservation Act of 1966 (*14*) and their subsequent amendments. It reviewed the rationale, methods, and status of historic bridge inventories as well as methodologies then being used to rank individual bridges for National Register eligibility. It also discussed technical, legal, and financial constraints on the preservation of historic bridges, and it presented a hierarchy of preservation alternatives for affected bridges.

The synthesis also included a generalized decision model for treating historic bridges. The model, Figure 2, was less an original construct than a logical outgrowth of patterns that were already emerging in various highway and transportation agencies around the country, notable in Virginia (*6,15–17*), North Carolina (*6*) and Frederick County, Maryland (*6,18,19*). The findings suggested that such decisions evolve from at least four sets of considerations: preservation warrants, preservation feasibility, preservation alternatives, and preservation policy.

1. *Preservation Warrants*—Assessments of National Register eligibility. For a cultural resource as numerous and diverse as bridges, this is best done after surveying the properties within the jurisdiction and then ranking their relative importance against national criteria as well as criteria specific to that jurisdiction.
2. *Preservation Feasibility*—The practical feasibility of preserving each bridge eligible for the RHP. This can be done by assessing the importance of a variety of technical, legal, and financial considerations that may constrain one or more of the desirable preservation alternatives.
3. *Preservation Alternatives*—Viable preservation alternatives identified after consideration of input

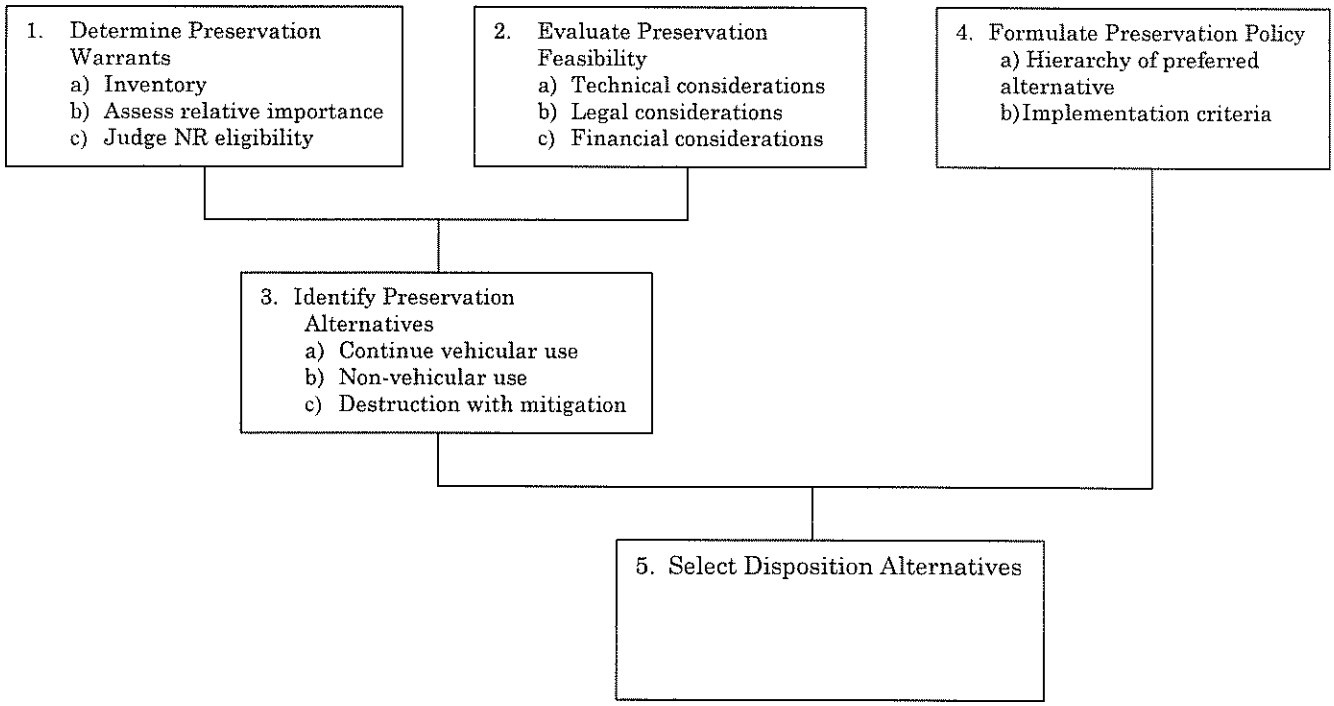

FIGURE 2 A model for decisions regarding historic bridges.

from 1 and 2, above. These may include alternatives that permit the bridge to continue in service for vehicular purposes at the same or at an alternate site, that remove it from vehicular service but permit continued use either as a bridge or in some adaptive mode, or that incorporate some form of mitigation such as recordation, if the bridge is destroyed.

4) *Preservation Policy*—An ordering of generic preservation alternatives from most to least desirable, together with a statement of the conditions that need to be met in order for each alternative to be implemented. This will provide a checklist against which to weigh specific alternatives identified for each bridge to assure that the best use possible is made of each of the historic structures.

The issues addressed by *NCHRP Synthesis 101* have for the most part been resolved. Highway and transportation agencies are now well aware of the status given to historic bridges by the preservation community and the statutory legitimacy of that recognition. The staffs of many of these agencies, particularly at the state level, now include cultural resource specialists trained in architectural and/or industrial history and many have taken commendable initiatives to develop and interpret the history of surface transportation within their own jurisdiction as a context for evaluating the importance of their historic bridges. This process has been aided by the emergence of consulting firms and joint venture efforts that have fielded teams of engineers and historians working together with the agencies to assess not only the technological and historical importance of the bridges but preservation feasibility and alternatives, as well.

Since the publication of *NCHRP Synthesis 101*, most states have completed an inventory of at least some of their historic bridges. A number have updated their original inventory to reflect a more recent inventory "cut-off" date or to include bridge types or jurisdictions not included in their original inventory, such as bridges on local systems (*20–23*). Others, including Delaware, Georgia, Indiana, Massachusetts, Michigan, New York, Ohio, Pennsylvania, Tennessee, Washington, Wisconsin, and Virginia are in the process of updating or extending their original inventory. Montana (*24*), New Jersey (*25*), and Washington (*26*) are three states whose agencies have included or are including railroad bridges, even though most of these structures are privately owned and their inventory does not qualify for federal funding. Largely as a result of these efforts, bridges listed or eligible for listing in the National Register have increased from about 650 in 1980 (*6*) to more than 8,000 as of this writing (extrapolated from Question 3 of the study questionnaire). While this dramatic increase was undoubtedly accelerated by a provision of the Surface Transportation and Uniform Relocation Assistance Act of 1987 that required states to inventory their historic highway bridges, most state highway agencies now enthusiastically acknowledge the value of these inventories to the planning process. Seventy-five percent of those responding to Question 6 of the study questionnaire indicated that such inventories have proven to be an extremely useful planning tool (Table 1).

TABLE 1

STATES SATISFACTION WITH HISTORIC BRIDGE INVENTORIES

		Percent
5	Extremely useful	75.0
4		13.9
3	Moderately useful	8.3
2		0.0
1	Not at all useful	2.8
Total		100.0

Based on questionnaire responses from 36 states.

Current Issues

About 90 percent of the issues cited by respondents to the study questionnaire, when asked to identify the "three most important issues with regard to managing historic bridges" (Question 20), can be grouped under one of six general headings: *financial, public awareness and interest, alternative uses, safety and liability, historic integrity and historic significance*. These issues are not new. However, the specific focus within each category has changed over time as the sensitivity to historic bridges at all levels of government has increased, as new technical and financial resources have been brought to bear, and as knowledge and experience in dealing with this particular cultural resource has become more widespread. The experiences of highway agencies that have had noteworthy success in dealing with these issues are presented in chapter 3.

Financial

Financial issues continue to be a major constraint on the preservation of historic bridges. Even when preservation is seen as a desirable outcome by all parties and the technical and legal problems can be overcome, the issue often comes down to whether or not some agency or organization is willing or able to spend the money required to restore and maintain the structure, either with or without vehicular traffic. If the bridge must be moved to an alternate location, the cost of dismantling, transporting, and re-erecting it on a new foundation prepared for the purpose represents a substantial expenditure that may exceed the cost of a new structure. However, most of the interests that seek preservation are usually modestly funded and most highway agencies do not have the authority to maintain properties that are no longer part of or support the highway system *(6)*.

Recent federal legislation (*4*) has helped but not solved the problem. Reasonable costs of preserving or protecting historic integrity are now eligible for reimbursement under rehabilitation projects as long as the load capacity and safety features of the rehabilitated bridge are adequate for the structure's intended use. Also, the law provides that preservation costs, up to the estimated cost of demolition are now eligible when the bridge is proposed for demolition or removal from vehicular service within the system. An important deterrent to the use of federal funds for this purpose is that such activities do not generate new monies but must compete with other replacement and rehabilitation needs of the state's highway system. However, even when federal funds are used for such purposes, there is reluctance on behalf of local jurisdictions and private recipients to assume additional preservation costs beyond those estimated for demolition as well as the costs of continued maintenance, neither of which qualifies for additional federal funds. Preservationists argue that these additional costs can be significant because the cost of actual preservation can exceed the estimated cost of demolition. Also, once funded, the bridge is henceforth disqualified under present law for other sources of federal monies (*4*), though pending federal legislation may alter that situation.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) set aside $2.64 billion over the 6-year life of the act for the states to fund "transportation enhancement activities." Applicants for enhancement funds need not use the monies for specific transportation projects but may use them for projects in areas served by a road or facility receiving federal funding, including several categories under which historic bridges qualify. Notwithstanding such assistance, many local jurisdictions and preservation organizations that are otherwise logical trustees of historic properties still lack the funds to match their share of the cost or to maintain the structure once it is preserved. A case in point is the rural town of Hadley, New York, a community of modest tax base located in an economically depressed region of the southeastern Adirondack Mountains. Hadley's town council hired a consultant to prepare its application for an enhancement grant to rehabilitate and convert to a pedestrian crossing an abandoned bridge (*27*). The truss bridge dated from 1885 and was one of the most unusual and esthetically pleasing structures surviving anywhere from the last quarter of the 19th century (Figure 3) (*28*). The application was successful but, by the time the $349,000 grant was awarded, the community's finances were so tenuous that a newly elected town council was unwilling to fund the $67,800 local share and to obligate itself for the continuing cost of the structure's maintenance (*Thomas Mason, Supervisor, Town of Hadley, NY, personal communication*).

Public Awareness and Interest

While the options for treating historic bridges continue to be contested, some vigorously, there now exists a broad base of awareness and acceptance, at least at the federal and state levels, that bridges can be legitimate subjects of preservation interest and there is a general willingness to

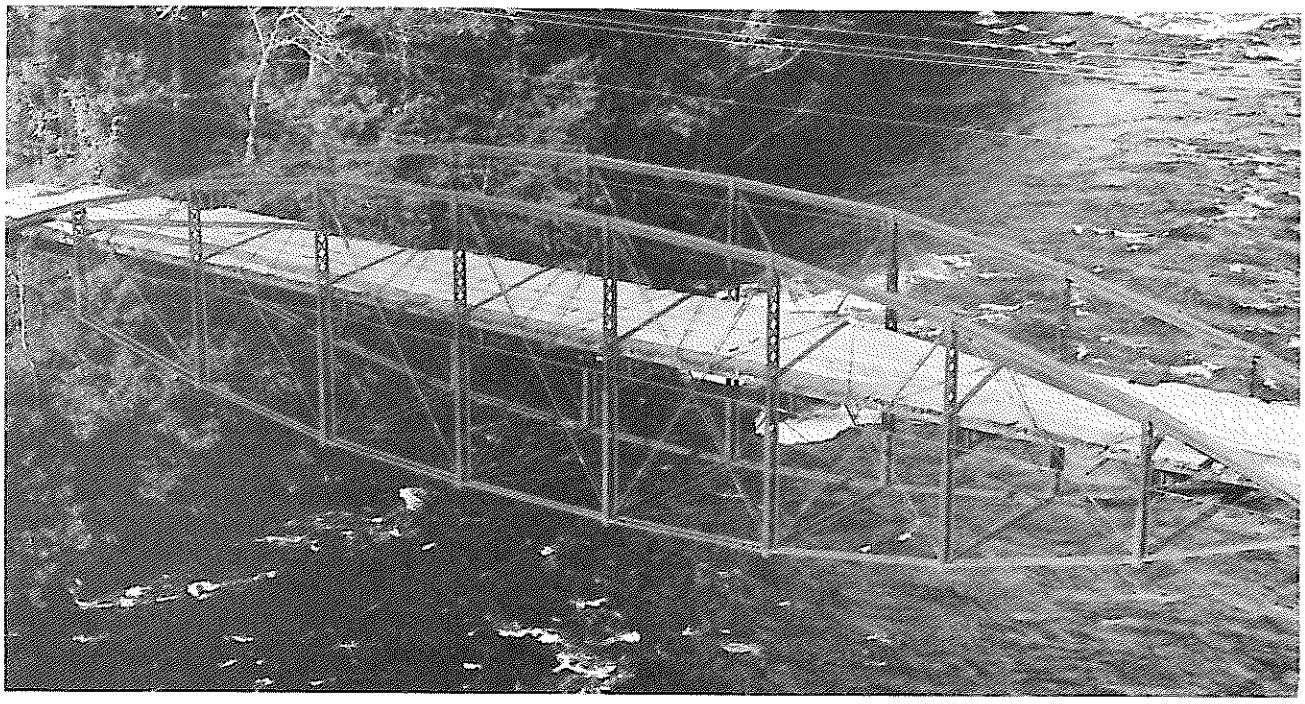

FIGURE 3 Old Corinth Road Bridge over the East Branch of the Sacandaga River, Hadley, New York *(photo credit: Jet Lowe).*

make good faith efforts to seek resolutions that satisfy preservation values. In contrast, questionnaire respondents indicated that there is a perception, at least among state agencies, that local jurisdictions and their constituents, as a group, are less sensitive to the importance of historic bridges, less familiar with regulations that apply to them, less knowledgeable with regard to the options for their use and interpretation, and less willing to commit scarce resources to their preservation than at the state and federal levels. Of course, there are notable exceptions, such as the often-cited example of Frederick County, Maryland (*6,18,19*). According to *Preserving Historic Bridges* (*29*), a recent publication of the National Trust for Historic Preservation (NTHP), the most important element in the successful, long-term preservation of historic bridges is strong local support. The NTHP argues further that, "Public understanding of the importance (of bridges) . . . as well as a familiarity with federal programs to encourage (their) preservation, is key to their successful rehabilitation and reuse . . ." (*29*).

TABLE 2

STATES' SUCCESS IN MOVING HISTORIC BRIDGES TO ALTERNATIVE IN-STATE TRANSPORTATION LOCATIONS

		Percent
5	Extremely successful	10.8
4		2.7
3	Moderately successful	37.8
2		27.0
1	Not at all successful	21.6
Total		99.9

Based on questionnaire responses from 37 states

TABLE 3

STATES' SUCCESS IN MARKETING HISTORIC BRIDGES THROUGH ADVERTISING

		Percent
5	Extremely successful	5.9
4		8.8
3	Moderately successful	23.5
2		44.1
1	Not at all successful	17.6
Total		99.9

Based on questionnaire responses from 34 states

Alternative Uses

Closely related to issues of public awareness and interest are those that address the difficulty of finding alternative uses, either vehicular or non-vehicular, for historic bridges that are removed from their original location. The subject is discussed at greater length in chapter 3, but suffice it to say here that most states have not been overly successful in moving historic bridges to alternate transportation locations within their states. Only 13.5 percent of study questionnaire respondents indicated more than moderate success in such efforts; and 48.6 percent, less than moderate success (Table 2). Also, it does not appear that the anticipated benefit of publicly advertising the availability of such bridges, as now required by the 1987 Act, has materialized (Table 3). Some believe that this situation can be improved if local political jurisdictions and historical groups become better acquainted than they now are with the value and potential use of historic bridges. Others suggest that the highway agencies themselves need to become more aggressive in identifying innovative uses for their historic bridges (Question 17).

Safety and Liability

The driving force behind the Highway Bridge Replacement and Rehabilitation Program has been concern for the public's safety. The older a bridge is the more likely that it has been weakened by one or more time-related mechanisms of alteration such as corrosion or freeze-thaw damage, the less likely it is to have been designed for modern traffic loads, and the less likely that its width, overhead clearance, approach alignments and/or hydraulic clearance are consistent with current design standards. Such deficiencies are categorized by bridge engineers as either structural or functional (*30, 31*). A structural deficiency is one that affects the capacity of the bridge to carry the desired traffic without collapsing or without undue deflection or vibration. A functional deficiency is one that affects the capacity of the bridge to allow efficient and safe movement of the intended traffic and to maintain adequate clearance beneath the bridge. While deficiencies in these two categories generally arise from different sets of conditions and require different approaches to remediation, both do impact safety. Further, a structural deficiency may have functional implications and a functional deficiency, structural implications.

With concern heightened by several recent catastrophic bridge failures, bridge engineers take safety issues extremely seriously and tend to act cautiously when faced with replacement and rehabilitation decisions. They are concerned that the desire to maintain historic integrity of on-system bridges can be incompatible with maintaining safe crossings and that, when structures are removed from the system, regular inspection and maintenance can no longer be assured. One team of legal investigators has suggested that the focus of federal legislation on historic preservation places the importance of the continued existence of old bridges above safe travel for the public (*32*). Preservationists, on the other hand, respond that highway engineers sometimes use safety and liability concerns as an excuse for their failure to seek creative solutions that do not endanger the public.

Historic Integrity

Closely related to safety and liability is the question of historic integrity, that is, how to rehabilitate a historic bridge so that it can be kept in service with the assurance of safety, but without significantly altering those elements that are important to its historic character. The regulations implementing the Highway Bridge Replacement and Rehabilitation Program define rehabilitation as, "The major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects" (*1*). In order for HBBRP funds to be applied to a bridge, its sufficiency rating, a numerical measure (from 0 to 100) of the structure's sufficiency to remain in service at its present location (*30,31*), must be less than a value of 80 and the rehabilitation must remove the bridge from the eligibility list (*1*). Highway engineers have typically interpreted this to mean that rehabilitation requires the structure to be brought up to the current AASHTO guidelines. These guidelines, which deal primarily with design of new structures, set conditions on load capacity, deck geometry, overhead and waterway clearance, and approach roadway alignment that often cannot be met without seriously altering historic integrity.

Yet, the HBRRP now allows bridge engineers flexibility in applying those conditions to the rehabilitation of historic bridges where safety can be assured (*5*). However, in the absence of a national consensus document or guidance manual that better integrates safety practices with historic preservation needs, engineers continue to be concerned with exposing the traveling public to what may be an increased risk of injury or, secondarily, themselves or their agency to an increased liability risk. The issue is complicated by reports that FHWA division administrators have been inconsistent in their approval of exceptions to the AASHTO guidelines.

Historic Significance

In spite of the major efforts of the last 25 years to inventory historic bridges and to identify NR-eligible properties, questionnaire respondents indicated frustration over what they see as the arbitrary nature of many of these designations. Because the NR criteria themselves are so broad and because bridges exist in such great numbers and diversity, decisions of eligibility have been left to the discretion of the interested parties in the individual states working within their particular contextual framework, and often in the absence of complete information. Even though significant progress had been made in negotiating the criteria for such decisions with SHPOs, and in managing the designation process itself, such decisions are sometimes "second guessed" because original inventory "cut-off" dates were thought to be too conservative, because new information becomes available, or because local interest in preservation materializes only after the prospect of replacement or closure becomes known.

Federal and State Legislative Requirements

The current federal program that provides most of the funding for highway bridge replacement and rehabilitation and that has had, by far, the greatest impact on historic bridges, is the result of a stream of legislation that began with the Federal-Aid Highway Act of 1968 (*33*). That act established the National Bridge Inspection Program (*34,35*), the first of a series of legislative initiatives in response to the heightened concern for bridge safety that was precipitated by the 1966 collapse of the Point Pleasant bridge (*11*). The bridge inspection program was followed closely by the Special Bridge Replacement Program, established by the Federal-Aid Highway Act of 1970 to inspect and classify all federal-aid bridges, to rank them numerically for their sufficiency for remaining in service at their present locations, and to set priorities for their replacement (*30,31*). That act also authorized $250 million for demolition and replacement of substandard and unsafe bridges, funding that was renewed in increasing amounts in the Federal-Aid Highway Acts of 1973 and 1976.

It was during the mid-1970s that the preservation community became fully alerted to the potential threat of these programs to historic bridges, due in large measure to the efforts of the newly organized Historic American Engineering Record (*38–41*). The Surface Transportation Assistance Act of 1978 increased that threat by extending the program to include bridges off the federal-aid system (where many of the important early bridges were to be found) and at a greatly increased level of funding. It did offer modest relief by permitting rehabilitation rather than complete replacement, provided the sufficiency rating could be raised to a specified minimum value. This new initiative, called the Highway Bridge Replacement and Rehabilitation Program, was refunded in the Surface Transportation Assistance Act of 1982. However, it was not until the Surface Transportation and Uniform Relocation Assistance Act of 1987 that historic bridges were specifically identified for any special consideration in the federal program. By that act, the Congress decided it to be:

> . . . in the national interest to encourage the rehabilitation, reuse and preservation of bridges significant in American history, architecture, engineering and culture. Historic bridges are important links to our past, serve as safe and vital transportation routes in the present, and can represent significant resources for the future (*4*).

It also lent major support to preservation interests by charging the Secretary of Transportation to: " . . . encourage the inventory, retention, rehabilitation, adaptive

use, and future study of historic bridges" and " . . . require each state to complete an inventory of all bridges on and off the Federal-aid system to determine their historic significance." The Act also required any state proposing to demolish a historic bridge as part of a federally funded replacement project to first make the bridge available for donation to a public or responsible private entity, provided the recipient would agree to maintain the bridge and its historic elements and assume all legal and financial responsibilities. It also, for the first time, permitted reasonable costs for preserving or protecting historical integrity to be eligible for reimbursement as long as load capacity and safety features of the rehabilitated bridge could be judged adequate for the structure's intended use; and it allowed preservation costs, up to the estimated cost of demolition, to be eligible when the bridge was proposed for demolition or removed from active service within the system.

Further, support for preservation of historic bridges was included in the Intermodal Surface Transportation Efficiency Act of 1991 (*5*), which provided more flexible standards for rehabilitation projects, including bridges, by encouraging approval in cases where AASHTO guidelines may not be met but where the rehabilitated facility was judged to be safe. It also strengthened planning requirements to assure consideration of historic preservation earlier in project planning and established a program of "transportation enhancements" by setting aside a pool of money for projects in one of 10 specific categories typically considered beyond the usual mandate of highway agencies, several of which include bridges:

1) Facilities for pedestrians and bicycles;
2) Acquisition of scenic easements or historic sites;
3) Scenic or historic highway programs;
4) Landscaping and other scenic beautification;
5) Historic preservation;
6) Rehabilitation and operation of historic transportation buildings, structures, or facilities;
7) Preservation of abandoned railway corridors for pedestrian and bicycle trails;
8) Control and removal of outdoor advertising;
9) Archeological planning and research; and
10) Mitigation of water pollution from highway runoff.

The most recent federal legislation to affect historic bridges was passed in the summer of 1998. The Transportation Equity Act for the 21st Century (TEA-21) (*42*) adds three new "stand alone" enhancement categories:

11) Provision of Safety and Educational Activities for Pedestrians and Bicyclists;
12) Establishment of Transportation Museums; and
13) Mitigate or Reduce Vehicle Caused Wildlife Mortality While Maintaining Habitat Connectivity.

It also modifies Category 3 by adding the phrase, " . . . including the addition of tourist and welcome center facilities" (that are linked to scenic or historic sites). The extent to which any of these provisions will affect historic bridges depends on interpretation by the FHWA. The act also included a substantial increase in funding for the Enhancement Program, $630 million for the 6-year life of the act and a new program for historic covered timber bridges. Funding in the amount of $10 million for each of the fiscal years 1999 through 2003 will be available to the states on a project-by-project basis and may be used for repair, rehabilitation, relocation, or protection of eligible structures. The act also directs the Secretary of Transportation to: 1) research and disseminate information on the history of historic covered bridges and the techniques of their construction; and 2) research methods for protecting historic covered bridges from rot, fire, natural disasters and traffic loads.

Even though historic bridges were not identified for specific consideration within the federal bridge program until the 1987 act, they have been afforded the same protection as all historic and cultural resources since the mid-1960s. Federal legislation protecting historic bridges, as well as attendant policies and regulations, have been reviewed by a number of writers (*6,29,32,43-46*), the most recent and most thorough being that of Eilers and Vedder (*32*).

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (16 USC par. 470 et seq. [1992] requires federal agencies to take into account the effect of their proposed undertakings on properties listed or eligible for listing in the National Register before the expenditure of federal funds or the issuance of any licenses. While very few bridges have been designated as National Historic Landmarks, Section 106 does afford such properties additional protection in that agencies whose actions may directly and adversely affect them must make every effort to minimize that harm (*29*). The federal agency must also allow the Advisory Council on Historic Preservation, a 19-member body established by the NHPA to advise the President and Congress on matters relating to historic preservation, a reasonable opportunity to comment on the effects of these undertakings on the historic properties. In practice, agreements to mitigate potential damage to historic properties are negotiated at the state (or other jurisdictional) level and submitted to the Council for Advisory comment.

Section 4(f) of the U.S. Department of Transportation Act (DOTA) of 1966, as amended (49 USC par.1653(f) and par.18(a) of the Federal-Aid Highway Act of 1968, 23 USC par.138) (hereinafter referred to jointly as Section 4(f)), provides that the Secretary of Transportation shall not approve any program or project that requires the use of any land from a historic site of national, state, or local

significance unless there is no feasible and prudent alternative to the use of such land and all possible efforts are made to minimize harm to the historic site. By allowing conditional approval of projects designed to preserve historic value even though they may not meet AASHTO standards, Section 109q of ISTEA, the 1991 Transportation Act, encourages a more flexible interpretation of what is "feasible and prudent" (*29*).

While Section 106 of the NHPA, Section 4(f) of the DOTA and the bridge programs collectively, exert the greatest legislative influence on transportation projects that include historic bridges, other federal laws impose requirements as well. Principal among these is the National Environmental Policy Act (42 USC par.4321-70d, 1994) (NEPA). NEPA is best known for its requirement of an Environmental Impact Statement (EIS) as a full-disclosure document on proposed federal actions that will significantly affect environmental quality, including important historical and cultural resources. Such resources need not be National Register-listed or eligible in order to trigger the requirement for an impact statement, however, in the practice of state highway agencies, they usually are (*29*). The EIS must describe the impact of the proposed action, potential adverse effects, and possible alternative actions; and the agency must inform the public of the findings of the review and demonstrate that the impact was considered (*29,32*). However, the requirements of NEPA are procedural and do not impose an obligation on agencies to implement the most environmentally favorable alternatives (*32*). Even outside of the context of preparing an EIS, NEPA requires that every federal agency's policies, regulations, and public laws be interpreted and administered to the fullest extent possible in accordance with NEPA's substantive goals, including historic preservation (*29*).

In addition to federal legislation, many states have passed omnibus environmental quality and/or historical preservation acts that impose requirements on public works projects that impact historic properties or archeological resources. Without specifically identifying them, such acts are generally taken to include bridges, particularly those that have been determined eligible for listing with the National Register or that are listed in the state's own register of historic places. Bridges have also been protected as contributing components of scenic or historic highways identified at the state level. Oregon, for instance, has been particularly aggressive in this regard, establishing in 1983 a historic and scenic highway program (*47*) that provided limited protection for 11 of Oregon's historic bridges and 26 other structures included in the Historic Columbia River Highway District (*48*) nominated that same year for the National Register. The Oregon program is discussed in greater detail in chapter 3. More recently, some states have restricted the flexibility of their own agencies when disposing of or altering properties under their jurisdiction that have historical value, and these of course include bridges. An example of the latter is California which, in 1980, amended its Public Resources Code to require all state-owned structures over 50 years of age to be inventoried and their eligibility for NRHP or state landmark listing to be determined. It also invoked protections against arbitrary demolition or rehabilitation similar in substance to those of Section 4(f) of DOTA. The California legislation defines a structure as any immovable man-made work used to shelter or promote a form of human activity (*49*). Tennessee has sought similar protection for its state-owned historic properties but through a different, and possibly less enforceable, approach. In 1988, its legislature required that all state agencies elicit comment from the state's historical commission prior to demolishing, altering or transferring any property that is or may be of historical, architectural, or cultural significance. Tennessee's building commission must consider but is not bound by the historical commission's comments (*50*).

The above examples notwithstanding, very few states have passed laws that target bridges specifically. One exception is New Hampshire, which, as early as 1963, enacted legislation requiring a public hearing by the state's Historical Commission whenever one of its remaining covered bridges was being considered for demolition. Apparently responding to the capacity of these picturesque structures to attract tourists and to the fact that state financial aid was already available for their rehabilitation, New Hampshire declared the retention of its remaining wooden covered bridges to be public policy (*51*). In 1985, the state legislature of Maine found it to be in that state's best interest to maintain and, where necessary, improve its historically important bridges. In so doing, it identified 11 such bridges by name (*52*), a list that was expanded to 13 in 1987 (*53*). In 1986, the Indiana legislature authorized the dedication of $500 per bridge per year from its motor vehicle highway account for maintenance of each of its approximately 92 publicly owned, covered timber bridges, the monies to be paid directly to the counties in which the bridges were located (*54*); and, in 1991, Oregon legislated a maintenance and rehabilitation program under the auspices of a covered bridge advisory committee with a biennial allocation of $220,000 to be shared on a 50/50 matching basis with city and county jurisdictions that owned the bridges (*55*).

The most comprehensive and fully elaborated legislative initiative yet to deal at the state level with historic bridges is that enacted by Vermont in 1993 (*56*). Vermont, in effect, has given its historic bridge preservation policy the status of law, including: a hierarchy of preferred methods of protection for all historic bridges, funding mechanisms, and the assignment of administrative responsibility between the state's agencies of transportation and historic

preservation. Perhaps more than any other state, Vermont's economy is dependent on the attraction to tourists of its rural character, and that character is perceived to be related as much to the visual impact of its roadscapes as it is to the viability of its small farms and communities. Accordingly, in 1996 Vermont took additional legislative action to provide funding from non-federal sources for improvements to its secondary highways in order, among other reasons, to allow more flexibility in the design of treatments for its roads and its historic bridges (*57*). This important program is also discussed in greater detail in chapter 3.

CHAPTER TWO

PRESERVATION PATTERNS

Historic bridges have been a prominent focus of preservation interest for nearly a quarter century, long enough that preservation patterns should be discernible. It is useful to identify these patterns because they are the result of the policies and practices that are the subjects of this synthesis. If these patterns are not what was expected or intended by those who have been promoting historic bridge preservation, then the policies and practices may need to be reexamined. Unlike many endeavors, where policies and practices evolve from stated or implied goals, goals for preserving historic bridges have never been stated at either the national or the state level. That is, nowhere does there exist a statement of what the final mix of preserved bridge structures should be composed or what specifically it should represent. All we have are criteria for determining historic value (i.e., National Register eligibility and state ranking systems) and procedures to assure that those values are considered when rehabilitation or replacement decisions are made. This is not to argue that stated goals for historic bridge preservation are necessarily desirable or even possible, but that in their absence, preservation patterns may be interpreted as de facto goals, and that anyone concerned about historic bridge preservation should be aware of those patterns.

This chapter includes a summary of national preservation patterns that could be inferred from responses to the study questionnaire. That summary is preceded by a brief discussion of regional variations in both the mix of bridge types that survive and the criteria that are used to assess their historical importance. These variations, plus the fact that usable data were available from only 29 of the 38 responding states, caution against interpreting these patterns as anything but tentative and certainly against applying them to any specific region or state.

REGIONAL CONSIDERATIONS

The factors that contribute to the historic importance of a bridge and support its eligibility for listing in the National Register derive from the physical attributes of the bridge itself, from its association with historical events and/or persons, and from the characteristics of the particular population of bridges from which it was selected, that is, its context. These factors are discussed in detail in chapter 4 of *NCHRP Synthesis 101*, and they have been used in various combinations and weights by most state highway agencies to rank the relative importance of their historic bridges. These rankings have become a primary factor in judging eligibility for the National Register, which is what warrants preservation consideration when highway agencies make decisions about bridge replacement and rehabilitation. However, whether a particular eligible bridge is, in fact, preserved or demolished is determined by a variety of other factors that come under the general headings of preservation feasibility, preservation alternatives, and preservation policy. These other factors are diagrammed in Figure 2.

Determining preservation patterns for historic bridges, that is, what types of bridges are being preserved and in what proportions, is complicated by the fact that criteria for judging historic importance vary from one region to another and even among states within the same region. These criteria reflect variations in the mix of bridges that survive, regional variations in the development of transportation that influenced what bridge types were built, and the perceptions of those making the judgments as to what weight should be given to each of the contributing elements. For example, the Rio Hondo Bridge of Figure 1 (*9*) was one of the 14 highest ranked of about 750 bridges built before 1945 that were evaluated for their historic importance by the New Mexico State Highway and Transportation Department. It was assigned a score of 70 points out of a possible of 108, and was judged on that basis to be NR-eligible (Table 4). Yet, had that same bridge been located in one of the states of the industrial Northeast or Midwest where the population of surviving metal truss bridges is vastly different in terms of design diversity, age distribution, and frequency of occurrence, it most certainly would not have been ranked as highly as it was in New Mexico and may, in fact, not have been judged NR-eligible at all.

Other examples of these regional differences that can be expected to influence the pattern of bridge preservation can be cited. For example, because bridges are generally less common in the less densely populated states, any bridge is apt to be of more interest there than it is elsewhere. Uncovered timber bridges, in particular, have been more important to the development of transportation in such areas that are also arid, and thus constitute a greater proportion of the mix of survivors there than elsewhere. Because transportation developed later in the western states than in the East and Midwest, few of the very early cast- and wrought-iron trusses are found west of the Mississippi. Concrete bridges of all types, as well as stone masonry arches, are more common in areas where the natural materials of which they are constructed are abundant.

Thus, any attempt to describe general preservation patterns for historic bridges must acknowledge that the patterns in specific states or regions may deviate significantly from those found in the nation as a whole.

TABLE 4

SCORING THE HISTORICAL IMPORTANCE OF NEW MEXICO'S RIO HONDO BRIDGE *(9)*

Evaluation Factors	Awarded
Physical Attributes	
Type of bridge (truss, suspension or arch)	6
Rarity of design in state in its time (common)	2
Overall length (100–199 feet)	4
Length of longest span for multi-span bridges	NA
Presence of special design or decorative features (none)	0
Original design elements unaltered	2
Materials consistent with original	2
Elements of original workmanship present	2
Integrity of location and setting (moved)	0
Historicity	
Fabrication company known	4
Date of construction (pre-1912)	20
Historical importance (of state significance)	6
Feeling and association with the past (excellent)	10
Context	
Number of type surviving in New Mexico	(4–5)
Rarity (oldest known example of type in state)	4
Unique features (longest known in state)	4
Total Points	70

QUESTIONNAIRE RESPONSES

The two following questions were included in the study questionnaire to elicit data on the frequency of determinations of eligibility for the National Register and preservation decisions for broad general structural groups:

1. For each of the bridge types inventoried, how many of the total were determined to be NR-eligible? (Question 3)
2. Among those NR-eligible bridges that have been included in bridge replacement or rehabilitation projects since the inventory was completed, how many of each type have been preserved and how many have not been preserved? (Question 4)

Responses to these questions were not universally rigorous, probably because to do so would, in many instances, have required an inordinate effort on the part of the responder. In the absence of any federal requirement that these kinds of data be tracked, few agencies were found to have done so. Thus, the responses were supplemented by data extracted from those state historic bridge inventories that have been published and that are in the collection of the Historic American Engineering Record in Washington, D.C. (*Eric DeLony, HAER, personal communication*) and by telephone follow-up with some of the agencies themselves. Data on at least some of the bridge categories were ultimately obtained from 29 states, as summarized in Tables 5-7.

Table 5 shows which of the general bridge types are most commonly represented among those inventoried and which of those inventoried are most commonly represented among those determined to be NR-eligible or listed. It includes all of the data that were collected from the 29 contributing states. The most interesting observation is that metal trusses, for which 26 of the 29 states included data, appear to be the most commonly inventoried structural form, accounting for more than one-third of those reported (35.6 percent). The only other structural forms that approach metal trusses in their inventory frequency are concrete beams, stringers and girders (25.7 percent) and steel beams, stringers and girders (20.8 percent). Metal trusses also account for more than one-half of those found to be NR-eligible or listed, about 5 to 6 times the frequency reported for the next highest types, respectively concrete arches (11.1 percent), concrete beams, stringers and girders (9.4 percent), and steel beams, stringers and girders (8.5 percent).

Table 6 reports the number of NR-eligible/listed bridges expressed as a percent of the bridges inventoried for each of the general bridge types, arranged in order of decreasing NR-eligibility/listing frequency. Because only 28 of the 29 contributing states provided data that could be used in Table 6, the total numbers given for inventoried and NR-eligible/listed bridges are less than those given for the same categories in Table 5. Table 6 indicates clearly that the preservation interest in certain types of bridges, as judged by their eligibility frequency, is substantially higher than it is for others. For instance, the long-span forms (suspension bridges, steel arches and cantilevered trusses), which have the highest NR-eligibility rate, are distinctive because they are relatively uncommon in most areas, can be visually spectacular, tend to have strong associative values, and are more costly to replace than other forms. Bascule, swing, and lift bridges, which have the second highest eligibility rate, are typically less visually appealing than the long spans but share their other attributes, although perhaps to a lesser extent. Timber trusses score high because they include a large number of covered bridges, which have been part of the national nostalgia for decades and which have their own advocacy communities. Most of the rigid frames are reinforced concrete and many are contributing elements of parkways or parks that are, in themselves, identified as historical resources. Stone (and brick) masonry arches, which are among the oldest of our structural forms, evoke the same sense of a rural past as do covered bridges but many of them have not been well

TABLE 5

INVENTORY AND NATIONAL REGISTER ELIGIBILITY FREQUENCIES FOR HISTORIC BRIDGES

General Structural Group	Inventoried			NR-Eligible & Listed		
	Number of States Reporting	Number	Percent of Total	Number of States Reporting	Number	Percent of Total
Metal Trusses	26	10,996	35.6	28	2,064	52.2
Concrete Arches	20	1,737	5.6	21	441	11.1
Concrete Beam, Stringer and Girder	16	7,928	25.7	17	374	9.4
Steel Beam, Stringer and Girder	16	6,414	20.8	17	338	8.5
Masonry Arches	14	459	1.5	16	218	5.5
Timber Trusses	12	332	1.1	12	155	3.9
Movable (bascule, swing, lift)	13	277	0.9	15	134	3.4
Long Span (suspension, metal arch, cantilevered truss)	14	145	0.5	14	94	2.4
Rigid Frame (concrete and steel)	8	162	0.5	11	85	2.1
Timber Stringer	8	1,773	5.7	8	44	1.1
Trestle (timber and steel)	3	11	0.0	5	6	0.2
Aluminum Stringer	1	1	0.0	1	1	0.0
Concrete Culverts	4	602	2.0	4	1	0.0
Tunnels and Snowsheds	1	1	0.0	1	1	0.0
Totals		30,838	99.9		3,956	99.8

Based on Questionnaire responses from 29 states.

TABLE 6

NATIONAL REGISTER ELIGIBILITY PATTERNS FOR HISTORIC BRIDGES

General Structural Group	States Reporting	Number Inventoried	NR-Eligible & Listed	
			Number	Percent
Long span (suspension, metal arch, cantilevered truss)	14	145	94	64.8
Movable (bascule, swing, lift)	13	277	132	47.6
Timber Truss	12	332	155	46.7
Rigid Frame (concrete and steel)	8	162	63	38.9
Masonry Arch	14	459	165	36.0
Concrete Arch	20	1,737	426	24.5
Metal Truss	26	10,996	1,999	18.2
Steel Beam, Stringer and Girder	15	6,414	316	4.9
Concrete Beam, Stringer and Girder	16	7,928	352	4.1
Timber Stringer	8	1,773	44	2.5
Culvert (concrete, steel, and stone masonry)	4	602	1	0.2
Totals		30,825	3,747	

Based on Questionnaire responses from 28 states that provided information on both the numbers inventoried and the numbers determined NR-eligible or listed.

maintained and are in poor condition. Others have been subsumed by additions or altered by grouting of their exposed surfaces to the point where the original material or form is hardly detectable. Concrete arches, which occur in both through and deck forms, and with either open or closed spandrels, can be visually striking but many of them are badly damaged by reinforcement corrosion and by freezing and thawing, progressive conditions that are difficult and costly to arrest and repair. Also, one of the most important technological elements contributing to the significance of these bridges is their metal reinforcing system and that cannot be seen. Metal trusses have probably received more attention by the preservation community than the other types because they exist in such large numbers and in such an interesting array of variants. Yet, few are without damage either from corrosion of their metal parts or from collision. Bridges supported by steel, concrete or timber beams, stringers, or girders exist in very large numbers in most parts of the country but, because they tend to be structurally simple and visually unremarkable, they have not attracted wide preservation interest. They are also shorter lived due to the ease with which they can be replaced. Culverts have been omitted from most inventories, although one in Arkansas has been declared to be NR-eligible (*20*).

The foregoing discussion, supported by the statistics of Table 6, suggests that preservation interest, as measured by the frequency of NR-eligibility, is greatest for those structural forms that have the greatest visual impact by virtue of their size and structural complexity. It is minimal for those forms that are smaller and structurally simpler,

TABLE 7

PRESERVATION PATTERNS FOR HISTORIC BRIDGES THAT HAVE BEEN INCLUDED IN REPLACEMENT OR REHABILITATION PROJECTS

General Structural Group	States Reporting	Number NR Eligible	Preserved		Destroyed		Preservation Success Rates (%)
			Number	Percent	Number	Percent	
Long Span	10	41	23	56.1	3	7.3	88.4
Masonry Arch	11	134	52	38.8	0	0.0	–
Movable	8	76	29	38.2	5	6.6	85.3
Concrete Arch	15	236	85	36.0	19	8.0	81.7
Rigid Frame	7	63	21	33.3	3	4.8	87.5
Metal Truss	19	895	213	23.8	181	20.2	54.1
Timber Truss	12	140	29	20.7	6	4.3	82.8
Timber Stringer	4	42	6	14.3	0	0.0	–
Steel Beam, Stringer and Girder	10	83	10	12.0	10	12.0	50.0
Concrete Beam, Stringer and Girder	12	205	23	11.2	9	4.4	71.9
Culvert	1	1	0	0.0	0	0.0	–
Totals		1,916	491		236		67.5

Based on Questionnaire responses from 22 states that provided information on both the numbers of NR-eligible bridges and the numbers preserved and not preserved.

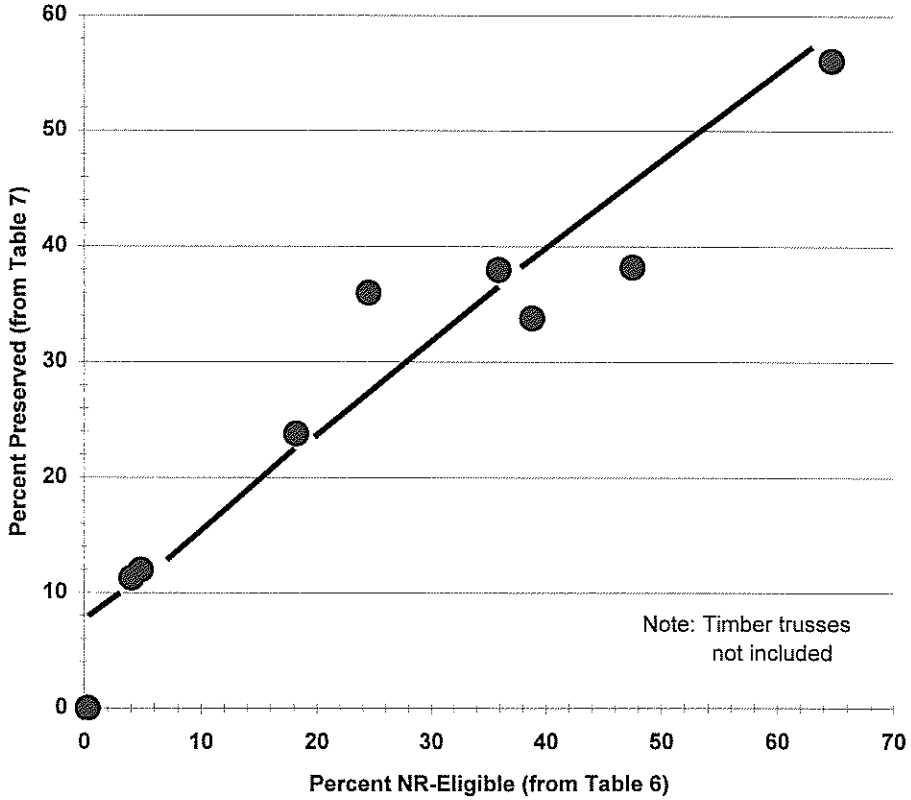

FIGURE 4 Eligibility for National Register of Historic Places versus preservation success.

Table 7 presents the results of preservation decisions for NR-eligible and listed bridges that have actually been included in replacement or rehabilitation projects. For each of the general structural types, the number and percent of bridges preserved, according to the definition on page 4, is given in the fourth and fifth columns. Corresponding values for those bridges not preserved (i.e., destroyed) is given in the sixth and seventh columns. Also, preservation success rates, defined as the number of bridges destroyed divided by the sum of the number destroyed plus the number preserved, have been calculated and these are given in the eighth column. The most interesting observation to be made from Table 7 is the relationship between the pattern of preservation success, represented by the fifth column of Table 7, and the pattern of NR-eligibility, represented by the fifth column of Table 6. This relationship, described graphically in Figure 4, indicates that those general bridge types that are more frequently the object of

preservation interest, as measured by their frequency of NR-eligibility and listing, are also the types for which the greatest preservation success is being experienced. This inference is important because it reveals an underlying consistency between what is valued and what is being preserved. While the high degree of correlation between the two variables lends support to this conclusion, it should nevertheless be viewed as tentative in consideration of the modest data base from which it is drawn and in view of the preceding discussion about the effect of regional differences on preservation patterns. Even so, Figure 4 offers an appealing working hypothesis to explain present patterns of bridge preservation.

Another interesting observation to be made from Table 7 derives from the pattern of preservation failure represented by the eighth column. The preservation success rate for all structural forms combined is estimated by this sample to be 67.5 percent, which means that about one of every three NR-eligible or listed bridges fails to be preserved once it is included in a replacement or rehabilitation project. The relatively low preservation success rate for metal truss bridges (54.1 percent), when combined with the earlier observation that that form constitutes about one-half of all NR-eligible or listed bridges (Table 5), suggest that three-quarters of the bridges that fail to be preserved are metal trusses. In other words, for every twelve NR-eligible or listed bridges that have come up for replacement or rehabilitation, four have failed to be preserved and three of those that have failed have been metal trusses. While these data are silent as to the reasons why one out every three bridges chosen for NR listing fails to be preserved, it is clear that NR selection processes should be scrutinized to assure that factors relating to preservability are being identified during the inventory process, at least to the extent possible, and that this information is being used when assessing NR eligibility. This admonition is particularly appropriate for metal truss bridges because of their disproportionate representation among those bridges not preserved. Not to do so, may place an unnecessary burden on highway agencies to administer Section 106 and 4(f) compliance proceedings for structures that have little ultimate chance of being preserved.

CHAPTER THREE

POLICIES, PRACTICES, AND EXPERIENCE

The elements that must be included in any coherent approach to the treatment of historic bridges have been described as:

1) Identified resources to be preserved or protected,
2) A comprehensive plan for managing the resources, and
3) A methodology for applying appropriate treatments, including standards and guidelines (*58*).

The first of these elements constitutes the inventory and evaluation functions described in Box 1 of the Figure 2 model. As noted in chapter 1, substantial progress has been made nationwide in identifying publicly owned historic bridges; most states have surveyed their bridges and applied criteria for judging their significance. The cumulative result of these activities, in terms of the bridge types inventoried and determined to be NR-eligible or listed, has been estimated and is described in Tables 5 and 6. The third element represents the technologies applied to evaluating, rehabilitating, and protecting the historic structures. This element is the subject of a current FHWA project to develop technical guidelines (*8*) and is beyond the scope of this synthesis. The second element, which is the subject of this chapter, includes the functions described in Boxes 2-5 of Figure 2, that is, the combination of policies and practices that together determine which historic bridges are, in fact, preserved and in what manner.

In contrast to the national bridge programs, in which the policies and practices (inventory, inspection, evaluation, rehabilitation, replacement) have been promulgated from the federal government, methods employed by state and local transportation agencies to manage historic bridges have, in large measure, evolved from the experience of the agencies themselves. As a result, they differ widely, reflecting the needs, priorities, and organizational culture of the agencies, as well as the knowledge and experience of the persons managing the decisions. Such policies and practices occur in a variety of forms, including: 1) formal documents, generally referred to as preservation or management plans, 2) memoranda of agreement or understanding, typically among the transportation agency, the SHPO, and the FHWA, 3) internal memoranda or statements of intent that guide agency staff, and 4) unwritten but spoken understandings of how decisions will be made. Of these different expressions, the written preservation plan carries the greatest weight because it typically addresses the components of the decision process more thoroughly and has usually been the product of a broader base of input.

PRESERVATION PLANS

In its simplest form, a preservation plan for historic bridges has been described as ". . . a plan that identifies specific actions to be taken with regard to specific bridges that have a warrant for preservation consideration, typically by virtue of a determination of National Register eligibility" (*6*). The purpose of such a plan is to have in place a list of acceptable and agreed upon options for each of the bridges included in the plan so that Section 106 and Section 4(f) regulatory processes are not unduly delayed, and so that preservation interests are protected when a historic bridge must be replaced or rehabilitated. In that sense, the process of developing the plan may facilitate changes in attitude and behavior. The plan may also serve as the basis for a Programmatic Agreement, under Section 106, that will satisfy the regulatory requirements for all of the protected bridges, as a group, rather than individually as they come up for treatment. However, in common practice, the term "preservation plan" is being used to include almost any statement of intent that includes some or all of the following elements (study questionnaire, Question 7):

1) A statement of agency policy,
2) A hierarchy of treatment alternatives,
3) Specific treatment recommendations for specific bridges,
4) Identification of roles and responsibilities for implementing the policy,
5) Administrative protocols, and
6) Provisions for updating the historic bridge inventory.

The statutory basis for preservation plans is found in Section 110 of the National Historic Preservation Act of 1966 (*14*) which, along with Section 106 discussed earlier, defines the procedures by which federal agencies and their designates must take into account the effect of their actions on historic properties. Section 110(a)(1) par. © states that "Preservation plans should be developed for historic property types that the agency knows it has under its jurisdiction or control." Section 110 regulations also specify

TABLE 8

VIRGINIA'S "PRINCIPLES" FOR REHABILITATING HISTORIC BRIDGES (*58*)

1.	Every reasonable effort should be made to continue the historic bridge in some form of useful transportation service. Primary consideration should be given to rehabilitation of the bridge on site. Only when this option has been fully exhausted should other alternatives be explored.
2.	The original character-defining qualities or elements of a bridge, its site, and its environment should be respected. The removal, concealment, or alteration of any historic material or distinctive engineering or architectural features should be avoided when possible.
3.	All bridges should be recognized as products of their own times. Proposed alterations that have no historical basis and which seek to create a false historical appearance should be discouraged.
4.	Changes which have taken place in the course of time may be evidence of the history and development of a bridge, its site, and its environment. These changes may have acquired significance in their own right, and this significance should be recognized, be carefully evaluated, and respected.
5.	Distinctive engineering and stylistic features or examples of skilled craftsmanship which characterize a bridge should be treated with sensitivity.
6.	Deteriorated structural members and architectural details should be retained rather than replaced, and repaired whenever possible. In the event replacement is necessary, the new material should match the material being replaced in design, color, texture, and other visual qualities.
7.	The surface cleaning and treatments of bridges should be done with processes that will not damage the historic materials.
8.	Every reasonable effort should be made to protect and preserve significant archeological and other cultural and environmental resources by or adjacent to any bridge.
9.	Contemporary designs for new bridges located in historic districts, should not be discouraged. Contemporary designs for proposed alterations and additions to historic bridges, should not be discouraged. These designs should be compatible with the size, scale, visual quality, and character of the historic district, or of the bridge and its environment, and any alterations or additions should not destroy or conceal significant structural, architectural or historical materials.
10.	Wherever possible, additions or alterations to bridges should be made in such a manner that their subsequent removal would not impair the essential form and integrity of the bridge.

TABLE 9

DIGEST OF VIRGINIA'S "PRIORITIES" FOR TREATMENT OF HISTORIC BRIDGES" (*58*)

I.	*Continued Use for Vehicular Purposes* which may require removal to a less demanding site.
II.	*Continued Use for Nonvehicular Purposes* at the existing or at a new site, including: 1) pedestrian and bicycle uses, 2) architectural adaptation for residential, commercial or educational space, and 3) as a historical ruin or monument. Preference shall be given to transportation related uses.
III.	*Replacement with Mitigation,* including: 1) recordation and documentation of the bridge at its site, 2) match marking, dismantling, and storage for future use, or 3) salvage of specific elements for display, research or reuse.
IV.	*Special Consideration for Bridges Located in Historic Districts* any treatment of an existing historic bridge, a replacement bridge or a new bridge within a historic district should take into consideration the character of the historic district. In addition, the design of new or replacement bridges should be compatible with the character of the historic district.

that if the historic property is to be modified that the modifications be consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (*59*) (Secretary's Standards). In its present form, this latter document consists of four sets of standards with expanded guidelines, one each for evaluating proposals for preservation, rehabilitation, restoration, and reconstruction treatments. Although developed for buildings, the Secretary's Standards have been interpreted broadly to include bridges and have, in fact, become one of the resource documents used by highway agencies to assess the extent to which a bridge can be modified without compromising its historic integrity (study questionnaire, Question 14). In 1987, Spero, et al. (*58*) proposed sets of "principles," "priorities," and "guidelines" for evaluating preservation options and treatments that were specific to historic bridges. Patterned after the Secretary's Standards, and building on a limited number of precedents (*16,19,60,*), this document was developed to provide a planning tool for the Virginia Department of Transportation that would be consistent with the Secretary's Standards and still recognize that agency's mandated responsibility to considerations of economy, safety, and transportation utility. The document is important because it was the first, and remains the only, comprehensive treatment of this subject devoted exclusively to bridges, and has been used by other agencies as a model for their own efforts (study questionnaire, Question 14). The principles and priorities recommended for Virginia's historic bridges are given in Tables 8 and 9.

Extrapolation of the responses to the study questionnaire suggest that 35 to 60 percent of state transportation agencies have either a written document they consider to be a preservation plan (study questionnaire, Question 7) or other written policies and/or practices for making preservation decisions regarding historic bridges (study questionnaire,

TABLE 10
COMPONENTS OF HISTORIC BRIDGE PRESERVATION PLANS

State*	Year	Status**	Stated Agency Policy	Treatment Alternatives Hierarchy	Bridge Specific Recommendations	Roles and Responsibilities	Administravtive Protocols	Provisions for Updating
Arkansas (*20*)	1987	Report	No	No	No	Yes	Yes	Yes
Connecticut (*61*)	1991	Report	Yes	Yes	Yes	No	No	No
Montana (*62*)	1997	Report	No	Yes	Yes	Yes	Yes	No
Nebraska (*63*)	1991	Report	No	Yes	No	Yes	Yes	Yes
Ohio (*64*)	1993	Inven.	No	Yes	No	Yes	Yes	Yes
Oklahoma (*65*)	1993	Report	No	Yes	No	No	No	No
Rhode Island [++]	1990	Report	Yes	Yes	Yes	No	No	No
Tennessee (*64*)	1997[+]	Invent.	Yes	Yes	No	No	No	Yes
Vermont (*68*)	1997[+]	Report	Yes	Yes	Yes	Yes	Yes	No
Wisconsin (*69*)	1996	PA	No	Yes	Yes	Yes	Yes	Yes

[*] Plans in development were indicated by Georgia, Iowa, Minnesota, Nevada, New Jersey, Texas and Virginia.
[**] Report = stand alone report; Inven. = part of historic bridge inventory report; PA = programmatic agreement.
[+] Indicated preservation plan was in draft form in August 1997.
[++] Rhode Island Historic Bridge Inventory, Part III, Preservation Plan.

Question 9). Those that have published such plans as stand-alone documents or as part of a bridge inventory report are identified in Table 10, with the elements that their plans include. The most fully developed of these plans are, by definition, those that have been carried to the point of including specific treatment alternatives for specific bridges. Such development was found in the plans of only four transportation agencies, those of the states of Connecticut, Rhode Island, Vermont, and Wisconsin. Because the plans developed by these agencies represent at least three distinctly different approaches, they are presented below as case studies.

Among the four, the Connecticut and Rhode Island plans are similar and, in fact, were developed in cooperation with the same cultural resources consultant. Both are based on inventories of all publicly owned highway bridges in these states and their development follows closely the model anticipated in Figure 2 of this synthesis. Both include notable innovations but because of their similarity, only the Connecticut plan is presented below. In contrast to the Connecticut and Rhode Island plans, the Vermont plan addresses only one of its state's historic bridge groups, albeit a large one—metal trusses. What is particularly noteworthy about Vermont's plan is that it reflects that state's extraordinary commitment to preserving the rural and small community character of its roadscapes, a commitment that has elevated historic bridges in Vermont to a status probably unlike that in any other state. Like Vermont, Wisconsin is also developing its preservation plan for historic bridges incrementally but has started with a much smaller structural group, bascule bridges, none of which is owned by the state itself, but by three of its municipalities. This approach has allowed Wisconsin to evolve a planning process with a small group of relatively homogenous bridges before addressing larger and more diverse groups.

The preservation plans developed by state highway agencies in Montana and Oregon are also presented here as case studies. While these plans may not have been developed to the degree of specificity of the other four, each includes distinctive features worth noting. The Montana plan, which addresses all of that state's historic bridges, is interesting because it was developed as one of several conditions of a programmatic agreement that seeks to integrate the preservation and use of the state's historic bridges with historic segments of its highways, that is, to treat them as parts of the same cultural resource. Like Wisconsin's, Oregon's plan treats only a subset of its historic bridges. However, rather than being selected for their common structural form, they were chosen because of their association with segments of Oregon's historic and scenic highways, including the visually spectacular Columbia River Gorge and Oregon Coastal Highways.

Connecticut: An Inclusive Plan for All Bridge Types

The Connecticut preservation plan (*61*) addresses 120 structures considered the most historically important publicly owned bridges in that state by virtue of being listed, or determined eligible for listing, in the National Register, or by contributing to NR-eligible districts. The bridges were selected because they were either unique in the state, possessed exceptional architectural or technological significance, had strong claims for local significance, or were significant components of historic districts or important thematic groupings, such as reservoir systems (*70*). The plan also addresses 65 bridges on the Merritt Parkway which, while not technologically significant in themselves, are contributing elements to the visual impact of the Parkway, itself an NR-listed resource (*71*). The Connecticut plan was developed to comply with the state's Environmental Policy Act (*72*) under which the Connecticut Historical Commission reviews state-spon-sored undertakings that may disrupt or alter historic resources, as well as

another provision of the state's General Statutes that requires notification of intent to demolish, transfer, or dispose of any structures more than 50 years old.

A distinctive feature of the Connecticut plan is the application of a two-layered approach to valuing its historic bridges when they are considered for replacement or rehabilitation. Each of the 120 bridges is considered individually on its own merits, that is, in terms of the factors that were used in the first instance to assess its NR eligibility; each is also considered as a member of one or more groups of bridges that are related in part by their structural form but also by their role in the development of transportation in the state. As an example, the "Black Road Bridge," which is a 1936 steel Warren pony truss, would not only be valued as a good extant example of 20th century riveted truss technology, the only factor that may have been considered in its original selection, but also as:

1) One of 11 post-1920 trusses employing heavy rolled (rather than lighter built-up) sections that reflect new design standards developed by state engineers after 1920 to meet the growing use of motorized vehicles; and
2) One of three post-1920 trusses fabricated by the Berlin Construction Company, Connecticut's only significant bridge fabricator.

The use of both intrinsic and associative values in assessing the importance of Connecticut's historic bridges is not unique among highway agencies, but it has been applied in Connecticut in an unusually visible and thoughtful way. The intent is not to add layers of significance to each bridge but to identify important historical groupings to which each belongs so that extra effort and expense to retain some of the examples within a group may be justified as compensation for the loss of other examples within the same group. The categories identified in the Connecticut plan are given in Table 11.

TABLE 11

CONNECTICUT'S BRIDGE PRESERVATION PLANNING CATEGORIES (*61*)

Berlin Iron Bridge Company Lenticular Trusses
New Haven Railroad Early Pony Trusses
Timber Trusses
Early 20th-Century Town-Highway Trusses (1901–1920)
Early 20th-Century Highway Trusses over Railroads
Trusses Built after 1920
19th-Century Simple Masonry Highway Arches
19th-Century Large or Decorative Highway Stone Arches
19th-Century Rail-Carrying Stone Arches
Simple 20th-Century Stone Arches
Decorative 20th-Century Stone Arches
Stone Arch Factory Passages
Simple Highway Concrete Arches, 1920 and Before
Decorative Concrete Arches, 1920 and Before
Decorative Concrete Arches, 1921 and Later
Open-Spandrel Concrete Arches
Park Bridges
Simple Bascule Bridges
Swing Bridges
Unique Structures

The plan also outlines a hierarchy of preservation options that is generally consistent with Virginia's priorities for treatment of historic bridges (Table 9). They are grouped into three categories: no action strategies, selective rehabilitation, and major structural rehabilitation.

1. *No Action Strategies*, in which the historic bridge itself is virtually unchanged ("no effect" in Section 106 terms), including:
   a) Retention in service as a functioning part of the transportation system,
   b) Posting for weight limits and/or restricted use, and/or
   c) Bypassing, including use as a parallel span for one-way traffic.
2. *Selective Rehabilitation*, in which the bridge is upgraded without damage to its historic qualities ("no adverse effect" in Section 106 terms).
3. *Major Structural Rehabilitation*, which substantially changes the bridge, but is done with its historic qualities in mind so as to retain most of its distinguishing characteristics ("mitigation of adverse effects" in Section 106 terms), including:
   a) Widening, and/or
   b) Substituting new structural systems.

Relocation, substantial alteration, and demolition are considered to be "adverse effects" and trigger efforts to preserve the historical information embodied in the bridge by documentation according to standards of the Historic American Engineering Record (HAER) (*73–75*). Special considerations apply to the replacement of bridges in historic districts that are contributing elements in those districts. Specifically, caution is given to ensure that the replacement bridge is as visually compatible as possible in scale and material with its surroundings.

The operative component of the Connecticut plan is a set of narratives that set forth preservation planning considerations for each of the bridges that are NR-listed or eligible, or that contribute to NR-listed or eligible districts. The purpose of these narratives is to adapt the general preservation options discussed above to the specific condition of each of the protected bridges and to assure a degree of consistency in their treatment that might not occur were they to be dealt with on a case-by-case basis. Each narrative includes a summary of the bridge's important historical features, identification of other bridges within the same contextual group(s), discussion of particular preservation options that have implications for the bridge, and

any other relevant considerations such as planned nearby construction. These narratives are intended to be used with the bridge's original inventory forms as planning tools when the protected structures are considered for replacement or rehabilitation. The write-up for the Black Road Bridge, cited above, is included as an example in Appendix C to this synthesis.

Vermont: Bridges as Historic Resources to be Exploited

The State of Vermont has taken unusual steps to overcome many of the issues associated with the management of its historic bridges. These innovations have occurred within a legislative framework that recognizes historic bridges as an important visual component of the state's rural and urban roadscapes, in addition to their significance as examples of engineering technology. Because the quality of its roadscapes, as well as its landscapes, is so closely related to its attraction for tourists, historic bridges in Vermont have come to be viewed as resources to be preserved and exploited. Vermont's preservation plan (*68*) is being used with the inventory of its historic bridges (*76*) to develop programs for managing these resources.

In 1993, the Vermont legislature took the uncommon action of recognizing that some of the state's bridges qualified for consideration as historic, and defined a general hierarchy of preservation alternatives that gave preference to retaining historic bridges in vehicular use, preferably as functioning elements of the state and local highway systems (*56*). By providing new options for funding and management, the legislation also sought to create an alternative for historic bridges that could not be retained in highway use and for which another acceptable preservation alternative could not be identified. While the bridge preservation program now evolving in Vermont obviates the need for those new funding and management options, they are nonetheless worthy of describing for their novelty and innovation.

The most radical element of the 1993 Act was to authorize Vermont's Division of Historic Preservation (VDHP) of its Agency of Development and Community Affairs to accept transfer of bridges deemed appropriate for preservation, along with land necessary to preserve the sites or to ensure public access. Such bridges could be transferred from Vermont's Agency of Transportation (VAOT) to towns and municipalities, railroads, or other public and private entities. Significantly, bridges need not have been removed from active service in order to affect a transfer to the VDHP as use of the right-of-way for highway or railroad purposes could be retained by the original owner. Further, the VDHP was authorized to sell or lease historic bridges to sympathetic owners, to acquire facilities for storage or dismantling pending their sale or lease, and to prescribe covenants on their transfer to assure preservation of historic integrity. The legislature also authorized transfer of funds from the VAOT to VDHP to support a range of traditional bridge management functions including maintenance, repair and rehabilitation, as well as some that were less traditional, such as moving, storage, and restoration. The funds could also be used to support grants to other entities to perform these functions, as well as planning and engineering studies to further preservation interests. The transferred monies could include appropriations from the state's transportation fund, or monies from other public or private sources. However, because of staffing and budget constraints within the VDHP, and subsequent legislation and actions within the VAOT that provided new incentives to retain historic bridges in highway use (described below) the operative portions of the 1993 Act were never fully implemented. Only one metal truss bridge has been transferred to the VDHP under the program.

In 1996, the Vermont legislature enacted a new law that, in effect, established a policy favoring rehabilitation over replacement for bridges on local systems, in order to "ensure compatibility with the Vermont setting and context and to reduce costs and environmental impacts." That act provided a new financial incentive by modifying the traditional allocation model for federal, state, and local participation from 80:10:10 to 80:15:5, thus, reducing by 50 percent the financial burden on local governments. The new law also encouraged the VAOT to pursue exceptions to national geometric standards for on-system highways and bridges when those standards were incompatible with state or regional plans and when the exceptions did not jeopardize safety (*57*).

Thus, the programs now being implemented to manage Vermont's historic bridges are considerably different from what was conceived by the 1993 legislation. They are based on a preservation plan developed for 97 of the state's metal truss bridges that had been determined earlier to be NR-eligible or listed (*68*). That plan was, in turn, based on engineering judgments of the structural capacity and geometric properties of each of the historic bridges, studies of present and future traffic needs of the crossings, feasibility analyses of preservation alternatives, and a cost estimate for each of the recommended alternatives. As a result of these studies, the VAOT and the VDHP have agreed on the following dispositions for Vermont's historic metal truss bridges (*Personal communication: Robert McCullough, VAOT*):

Alternative A—Preserve for Limited Highway Use at Existing Site (51 bridges). This option is limited to structures on local highways and presumes that the bridge will be posted for appropriate weight limits and that heavier traffic will be diverted to an alternative route.

Alternative B—Preserve and Reinforce for Full Highway Use at Existing Site (5 bridges). This option presumes that the bridge can be upgraded to maximum weight limits applicable to its site and that its geometrics are safe.

Alternative C—Preserve and Adapt to Alternative Transportation Use at Existing Site (9 bridges). This option presumes that the bridge will be adapted for pedestrian, bicycle, or other alternative purpose and that all motor traffic will be diverted to another route.

Alternative D—Relocate and Preserve for Limited Highway or Alternative Transportation Use (20 bridges). This option presumes restoration, rehabilitation, or reinforcement for continued use as part of the public highway system or for adaptive use on an alternative transportation system. Temporary storage under this option is possible.

Alternative E—Modify for Continued Limited or Unlimited Highway Use at Another Site (3 bridges). This option presumes some innovative preservation alternative not included above and not specifically anticipated in this plan.

Alternative F—Demolition Accompanied by Appropriate Documentation (9 bridges).

If carried out, these plans will result in about 60 percent of Vermont's 97 historic metal truss bridges remaining in highway service, about 30 percent in some adaptive use, and about 10 percent documented and destroyed. VAOT has also completed a survey and study of its timber bridges and the consultant has recommended preservation alternatives. That work has not yet progressed to the stage of a written preservation plan.

While the details of Vermont's historic bridge program have yet to take final shape, one alternative being considered is to establish and fund within VAOT an administrative unit that would manage such a program. In effect, such action would transfer the responsibility for bridge preservation activities from the state's historic preservation agency, where such responsibility has traditionally resided, to its transportation agency. Those who favor this approach argue that historic bridges represent a distinct class of bridges with particular problems, but ones that also contribute particular economic, aesthetic, and educational benefits. They argue further that rehabilitating metal truss bridges that are capable of serving continued highway use can result in significant savings over the cost of new bridges; and that adapting those no longer capable of continued highway use to alternative transportation or other purposes can produce other long-term benefits (77). One structure proposed for such a unit would include:

1) *A Bridge Maintenance and Rehabilitation Subprogram* to provide accelerated maintenance for those bridges that will remain in highway use to assure appropriate and timely attention to maintenance needs.
2) *A Town Participation Subprogram* to provide cost incentives for towns and municipalities that own historic bridges to bring them into the program with its higher maintenance standards.
3) *A Relocation and Adaptive Use Subprogram* to rehabilitate and relocate bridges that can no longer serve a highway use at their existing location, including limited highway use at another location or adaptive use for another transportation function such a bicycle, pedestrian, or snow-mobile path (Figure 5). This subprogram is, in fact, already functioning with funding support within the existing organizational structure of VAOT; its program prospectus is included as Appendix D to this synthesis.

FIGURE 5 A low Warren truss bridge removed from a town highway in Hinsberg, Vermont, restored and adaptively reused as a pedestrian bridge at another location in Hinsberg. *(Vermont Agency of Transportation photo)*

The significance of Vermont's approach to preserving its historic bridges resides largely in the assumption that the state makes about the status of historic bridges in the fabric of its transportation infrastructure. Most highway agencies approach their historic bridges as they approach other cultural resource issues, that is, as objects encountered during the progress of their work that are protected by external regulatory requirements that must be complied with. Understandably, the typical response is to develop strategies that enable those requirements to be met in ways that are least disruptive and costly to the rehabilitation and reconstruction programs to which they are primarily committed. Vermont, on the other hand, has chosen to operate from the premise that its historic bridges are an important aesthetic component of its roadways and that they have educational and economic value as well. As a result, they are treating them as resources to be exploited. In 1997, the Vermont Agency of Transportation received the Trustee's Award for Outstanding Achievement in Public Policy from the National Trust for Historic Preservation for its innovative work on design standards for historic bridges (*78*).

Wisconsin: A Pilot Plan for Bascule Bridges

The Wisconsin plan is included here because, unlike the other two, it addresses a single structural form only—the bascule bridge. The plan was developed as the basis for a Programmatic Agreement (PA) among FHWA, the Wisconsin State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation and the Wisconsin Department of Transportation (WisDOT) to satisfy FHWA's Section 106 responsibility for bascule bridges in Wisconsin. The six NR-eligible bridges included in the agreement, all of which are owned by municipalities, were identified from among 13 that met the NR's 50-year minimum age criterion (*79*). It is WisDOT's intent to develop preservation plans for each of its prominent bridge types and to negotiate a separate PA for each type. The approach was piloted on bascule bridges because that group includes a small number for which the issues were expected to be relatively manageable. Wisconsin has also completed inventories of stone and concrete arch bridges (*81*) and metal truss bridges (*80*) and a similar PA on the latter was pending as of the summer of 1997 (*Personal communication: Robert S. Newbery, WisDOT*).

The Wisconsin plan proposes to encourage rehabilitation of the protected bridges where that option is economically and structurally viable, and to support that encouragement with an offer of technical advice and assistance to the owners to protect historically sensitive elements. Where an adverse effect on the bridge's historical integrity is anticipated or where the bridge is to be destroyed, WisDOT will initiate documentation to HAER standards. Where rehabilitation and/or reconstruction are not feasible, WisDOT will also encourage salvage of portions of the structure and its use in connection with public displays or other educational endeavors. Portions of one Strauss trunnion bascule bridge that was destroyed have already been used and interpreted in a museum display, and some of the operator's houses from another such bridge were restored and adaptively reused for educational purposes, one as a small museum. The Wisconsin plan includes very specific actions to be taken in support of each of the plan's five management options:

1) Provision of technical assistance for rehabilitation efforts,
2) Documentation,
3) Salvage,
4) Educational outreach, and
5) Adaptive use.

While the WisDOT document does not include the specific preservation planning considerations for each bridge that are part of the Connecticut and Vermont plans, it does include a fairly extensive narrative description of each bridge, an assessment of the bridge's present condition including important elements that may have been replaced or modified, and a summary of the factors that support the bridge's historical importance.

An important element in identifying those bascule bridges that were sufficiently important to merit NR-eligibility, and in developing the Wisconsin preservation plan, was the inclusion of representatives of the various parties that would later be expected to oversee implementation of the plan. These included representatives of WisDOT's central engineering, environmental, and district offices; the engineering departments of the cities in which the bridges are located; the FHWA; and the SHPO. This team constitutes the "Bascule Bridge Committee" and it is available on an as-needed basis to address preservation issues that may arise with these bridges.

Montana: Integrating Historic Roads and Bridges

The Montana preservation plan (*62*) was one of several products of a 1991 Programmatic Agreement (PA) between the Montana Department of Transportation (MDT), the Montana Division of the FHWA, the Advisory Council on Historic Preservation (ACHP) and the Montana SHPO to identify and manage the state's historic roads and bridges (Appendix E) (*82*). The PA was entered into as an alternative to what had become a frustrating process of making decisions regarding these resources on a case-by-case basis. A 1982 inventory of metal truss bridges was proving to be inadequate because it was limited to only that one structural form and because not all bridges were considered (*83*). Also, the NR-eligibility assessments

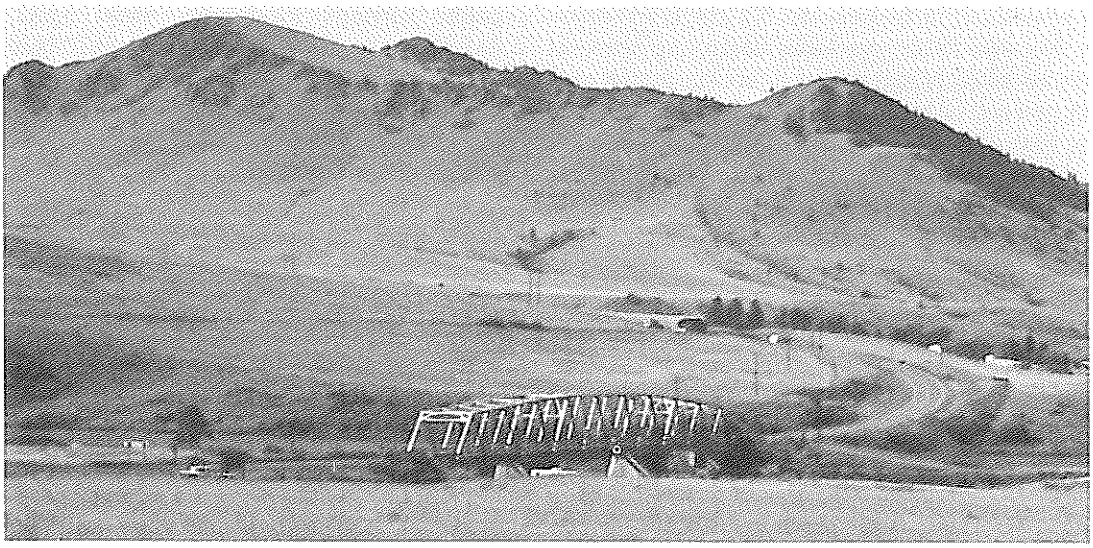

FIGURE 6 Sheep Creek Bridge, one of four metal truss bridges preserved as part of Montana's historic Frontage/Recreation Road *(courtesy of Montana Department of Transportation).*

based on that inventory had been made in the absence of any historical context specific to Montana, and were also considered to be unrealistically small in number (*Personal communication: Jon Axline, Montana DOT*).

The Montana PA stipulated that the MDT inventory its historic roads and bridges and place them in context by completing narrative histories of roads, road construction, and bridge building in the state. It further stipulated that the MDT develop a public information and education program on the state's historic roads and bridges as well as their construction and significance; and, finally, that it prepare a plan for the preservation of significant and representative road segments and bridge types identified during the inventory phase. The purpose of the preservation plan was ". . . to establish processes for integrating the preservation and use of historic roads and bridges with the mission and programs of the FHWA in a manner appropriate to the nature of the historic properties involved, the nature of the roads and bridges in Montana, and the nature of the FHWA's mission to provide safe, durable and economical transportation" (*82*). The first of these stipulations was satisfied in 1993 with publication of two books: *Roads to Romance: The Origin and Development of the Road and Trail System in Montana* and *Monuments Above the Water: Montana's Historic Highway Bridges, 1862–1956.*

The preservation plan, developed to satisfy another stipulation of the PA, was published in 1997 (*62*). It identified 17 historic road and trail segments, nominated by MDT in consultation with local historical societies and museums, as well as 101 bridges determined to be eligible for NR listing. By including roads and bridges in the same planning process, Montana has taken the logical but uncommon action of treating them as parts of the same cultural resource. Linking the two in this way assures that bridges that may be historically important only, or primarily, because they are a contributing element of an important road, are not overlooked. One example is a group of four through metal truss bridges that will be protected because they were identified as a feature of Montana's historic Frontage/Recreation Road. Built in the early 1930s, this road was determined to be historically important because it is part of the original alignment of U.S. 91 and retains all of its original design features, including the four bridges (Figure 6). Another advantage of linking the two elements, at least in Montana, is that the ambitious public information and education program developed as part of the preservation plan is materially enhanced, and that program helps to increase awareness of the importance of historic bridges among local highway jurisdictions and other organizations that are potential recipients of salvaged bridges.

The Montana preservation plan attempts to provide for the rehabilitation and continued use of as many of its NR-eligible bridges as possible, to give others to responsible alternative owners, to record and photograph yet others that are bypassed or abandoned, and to develop and promote a public information and education program to address historic bridge issues. Rather than seeking to preserve all bridges that have historical merit, based on the usual criteria, the Montana plan attempts to protect a representative number of the best examples. In selecting those examples, preservation objectives were integrated with the mission and program needs of the MDT and the FHWA to provide safe, durable, and economic highway transportation. Thus, such factors as anticipated traffic needs, rehabilitation feasibility, and estimated rehabilitation costs

were also considered in making the NR-eligibility determinations. Because these sometimes competing interests were addressed in the bridge selection process, a high proportion (88 percent) of Montana's 101 NR-eligible bridges have been placed in its Historic Bridge Rehabilitation Program, that is, they have been identified in the first instance as candidates for rehabilitation and continued in-place use, rather than as candidates for replacement. The preservation plan requires adherence to the Secretary of the Interior's *Standards for Rehabilitation* (*59*) but exceptions are permitted for modern guardrails and deck surfaces. Also, by implication, the plan encourages flexibility in applying the AASHTO guidelines, and the FHWA has been receptive to such exceptions where public safety is not compromised (*Jon Axline, MDT, personal communication*). Both on- and off-system bridges included in the program are eligible for HBRRP funding, except for off-system bridges that have been closed to traffic and are now under county jurisdiction or private ownership. However, the latter group does qualify for funding under the Community Transportation Enhancement Program of ISTEA (*5*) and state encouragement and assistance are provided in applying for such funds. All bridges improved under the Rehabilitation Program are identified for the public by historical markers that describe the bridges' history and their rehabilitation as part of Montana's Roads and Bridges Historic Preservation Plan.

Any bridge selected initially for the Historic Bridge Rehabilitation Program that ultimately proves to be unsuitable, for either financial or technical reasons (as well as the 13 bridges eligible for the National Register not selected in the first instance) must then be considered for Montana's Adopt-A-Bridge Program, and a suitable replacement chosen for it. Similarly, any bridge in the program that is inadvertently destroyed becomes a candidate for replacement. This replacement practice is a variation on the "reserve pool", first introduced in Ohio (*64*), wherein a backup group of bridges "possibly eligible" for the National Register was identified from which to draw alternates when eligible bridges were destroyed or otherwise became unavailable. Replacement bridges must meet the same criteria used initially to determine eligibility for the National Register and the Rehabilitation Program.

The objective of Montana's Adopt-A-Bridge Program is to "find new homes for old bridges" that have been identified for replacement. All truss and steel girder bridges with a structural sufficiency rating (*31*) of 3 or above are considered for the program, as are reinforced concrete and timber-stringer bridges that can be preserved in-place. Recommendations for inclusion in the program are made jointly by the MDT's Bridge Bureau and its staff historian, in consultation with the SHPO. Availability of bridges deemed suitable for the program is advertised (with information about the Adopt-A-Bridge Program) through public hearings, local press, radio public service announcements, and the MDT's Internet home page. New owners are selected from among applicants based on proposed use and location, ability and willingness to assume maintenance and preservation responsibility, and willingness to assume legal liability. MDT funds the cost of removing the bridges and transporting them to new locations, up to the estimated demolition costs, and assumes responsibility for cleanup of the sites. For bridges that are adapted to new uses in place, the MDT will fund costs of restoration and rehabilitation, also up to the estimated costs of demolition. Although designed as a preservation program for historic bridges, the Adopt-A-Bridge Program has been expanded to include all bridges that are suitable for moving to an alternate location or for an alternate use in-place (*Jon Axline, MDT, personal communication*).

The Preservation Plan also requires that an earlier program of recording, photographing, and mapping of any bridges that are bypassed, abandoned, or demolished be continued and that the resulting documents be archived as part of a historic road database developed under another element of the Preservation Plan. As the agency primarily responsible for the design, construction, and maintenance of the state's roads and bridges, MDT has also accepted responsibility for accumulating, interpreting, and disseminating information regarding the history of its highway transportation system.

Oregon: Protecting Scenic Highways and their Bridges

In 1983, the Oregon legislature established a historic and scenic highway program in recognition of the role that preserving historic and scenic resources plays in enhancing the economic base of the state and in maintaining citizen pride and respect for its cultural and natural heritage (*86*). An eight-person volunteer citizen committee working with the state's department of transportation (ODOT) invited local governments, interested federal and state agencies, and historical associations to nominate highway segments and structures that met a set of eligibility guidelines developed for the purpose (Table 12). Twenty-five sites that met the guidelines were identified and designated as historic and scenic highway sections. They included 11 bridges, a variety of long-span types built between 1926 and 1973 (Figure 7), plus a 73.8-mile segment of the Historic Columbia River Highway which, in itself, included 24 of the highway's original bridges and viaducts, all dating from the 1913–1922 construction period (*47*).

The management plan for these highway segments provides limited protection for the bridges by stipulating that ODOT not dismantle, destroy, abandon, significantly transform, or sell any of the structures, or any portion

TABLE 12

ELIGIBILITY GUIDELINES FOR OREGON'S HISTORIC AND SCENIC HIGHWAYS AND STRUCTURES (*47*)

1. The highway segment provides an outstanding view or vista.
2. The highway segment or structure contains outstanding or particularly unusual historic values which illustrate the development of Oregon.
3. The highway segment provides for historic or scenic values which promote use of the facility as a destination or preferred route.
4. Historic or scenic values provided by the highway segment or structure appear in local or regional travel promotional literature.
5. The highway segment or structure contains unique design or construction features.
6. The highway segment or structure contains significant features that are connected with a notable designer or architect.
7. The significant views or vistas provided by the highway segment contain unique examples of landform, vegetation, or scenic values of the geographic region.
8. The significant historic or scenic values are recognized by the local population.

thereof, or take any other action that would adversely affect their preservation as historic objects, when it is prudent or feasible not to take such action. It also recommends that ODOT consult with Oregon's SHPO and other appropriate organizations regarding how to best rehabilitate, restore, maintain, and preserve the significant historical features of the structures (*47*). Five of the largest and most visually striking of the bridges, those that span major coastal estuaries traversed by Oregon's scenic Coastal Highway, are particularly vulnerable to corrosion damage because of their exposure to salt spray and high humidity.

Because of the exceedingly high cost to replace these structures, their contribution to the visual impact of the highway, and their association with Conde B. McCullough, Oregon's most prominent bridge builder, ODOT has committed itself to the considerable expense of installing cathodic protection systems on these bridges.

Those bridges that are a part of the Historic Columbia River Highway were given additional administrative protection, also in 1983, when 55 of the extant miles of the original highway and its structures were nominated for the National Register as a historic district (*85*). They were protected further in 1987, when the Oregon legislature established a permanent advisory committee to assist ODOT and other agencies in managing the historic district (*86*) and in 1986, when the U.S. Congress established the Columbia River Gorge National Scenic Area in Oregon and Washington State. The management requirements for historic bridges in the scenic area are very stringent and allow no adverse effects.

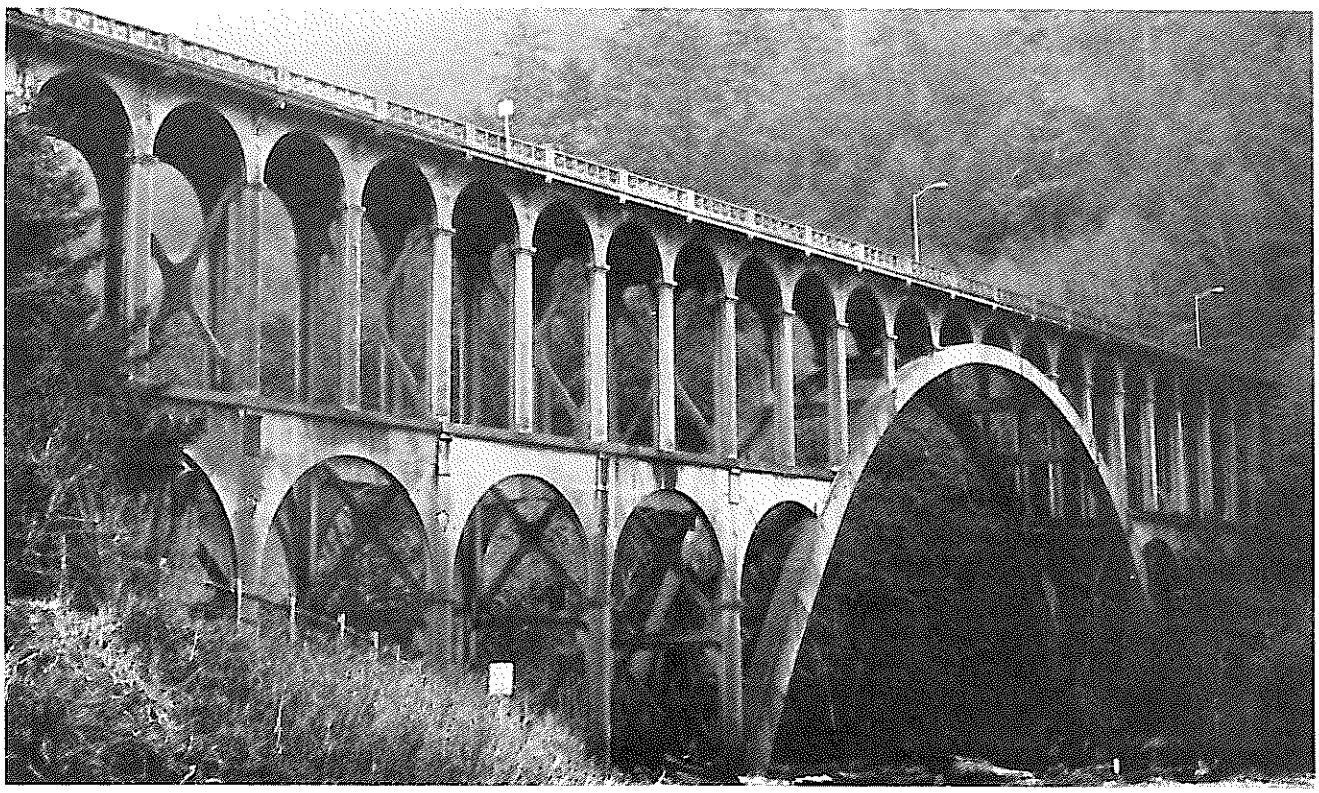

FIGURE 7 Oregon's Cape Creek Bridge, designed by Conde B. McCullough, and constructed in 1931 *(courtesy of Oregon Department of Transportation).*

OTHER INNOVATIVE POLICIES AND PRACTICES

As noted elsewhere, methods employed by highway agencies to manage their historic bridges vary widely. Some, while not employed universally, are now common enough to no longer warrant being considered innovative. Clearly, inventorying the resource, which most highway agencies have either completed or on which they have made substantial progress, has proven beneficial, as have efforts to assign individual bridges a measure of their relative value as historical artifacts. The need to develop preservation plans is gaining general acceptance. Similarly, the need to update earlier inventories, limited by unacceptably narrow scopes, is now commonly recognized, as is the wisdom of including a broad base of participation in the decision-making elements of these planning processes. The following sections identify some more recent and less well-known innovations that are either proving to be successful or that have the potential to succeed. Each addresses one or more of the six general issues identified in chapter 1: *financial, public awareness and interest, alternative uses, safety and liability, historic integrity,* and *historic significance.*

Financial issues tend to drive many of the decisions that are made with regard to preserving historic bridges, and there may be scant opportunity for significant relief in this regard outside of new funds becoming available through federal or state legislation. One popular proposal would have modified the federal transportation legislation to increase the funds available for preserving a historic bridge scheduled for demolition if the bridge were put to an alternative public use, such as on a bicycle path or hiking trail. Presently, such funds are limited in federal law to the estimated cost of demolition with the prohibition that a structure so funded is henceforth disqualified from other funding under the bridge program (*4*). The proposal, had it been included in the most recent transportation reauthorization bill (*42*), would have removed the prohibition but would not have provided new money, and the bridge would still have had to compete with other projects for funding, say, through the transportation enhancement grant program. Advocates for this proposal are optimistic that it will be enacted under proposed legislation *(personal communication, Daniel Costello, National Trust for Historic Preservation).* New funds now available under TEA-21 (*42*) for preserving historic timber covered bridges have been discussed earlier.

Several states have taken initiatives to remove some of the financial burden from local jurisdictions, where many historic bridges are found. Unfortunately most of these initiatives seem to have been limited to covered timber bridges (*51,54,55*), the earlier-cited example from Vermont being an exception. Vermont altered its federal/state/local apportionment model from 80/20/20 to 80/15/5, thereby reducing the financial burden to its cities and counties by one-half (*57*).

Efforts to permit and/or encourage the private sector to raise or contribute to the local share of such projects are not common but have, in some instances, achieved spectacular results. A case in point is Chattanooga's 1891 Walnut Street Bridge, a six-span, pin-connected camelback Pratt truss, that was restored to pedestrian and bicycle use with funds that included $400,000 raised by local citizens. The primary community funding vehicle was a "Bridging the Generations" campaign in which citizens were encouraged to purchase memorial brass plaques engraved with the name of a family member from another generation (grandchild, parent, uncle, etc.) to be set permanently in the truss lines of the restored deck. Innovative engineering enabled the cost of the restoration to be kept low enough that the citizens' contribution was a significant portion of the total cost, approximately 10 percent. The restored Walnut Street Bridge (Figure 8) is the oldest surviving bridge across the 1,500-mile long Tennessee River and has been an important element in the development of the city (*87* and *personal communication, Garnett Chapin).*

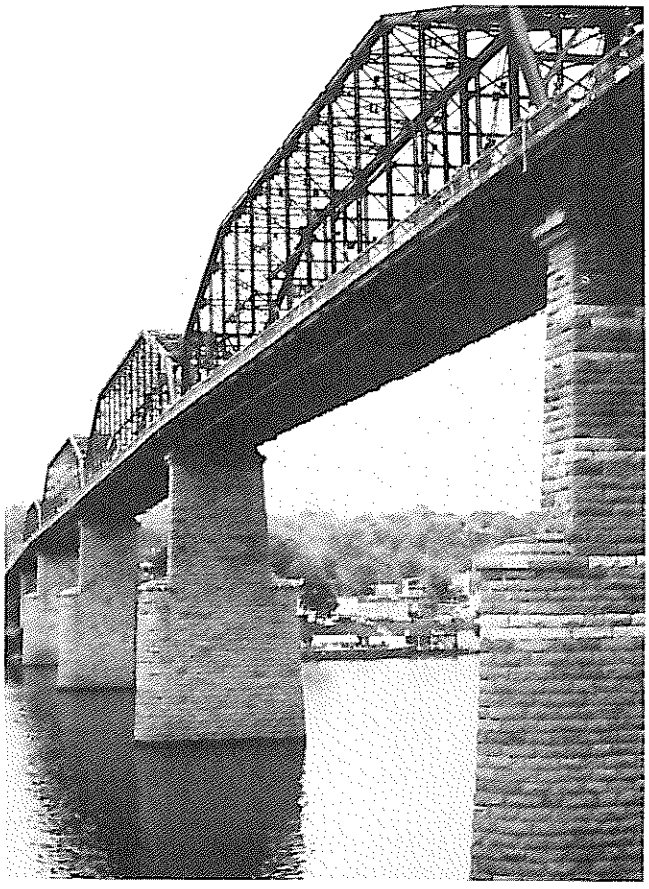

FIGURE 8 Chattanooga's Walnut Street Bridge dates from 1891 (courtesy, City of Chattanooga).

Under its Bridge Relocation and Adaptive Use Program (Appendix D), the Vermont Agency of Transportation has been seeking ways to reduce costs, including partnering arrangements with the state's Corrections Division to provide both labor and materials to rehabilitation projects. Arrangements have been made with the Division's sawmill to provide dimensioned lumber for deck planking and its machine shop to fabricate steel components. Labor from the Correction Division's Community Restitution Program may also be used to perform repairs on site, paint superstructure and assemble decking materials. Under this program, VAOT is also actively seeking qualified volunteers and retired engineers, with low overhead expenses, to design rehabilitation projects.

The issues of *public awareness and interest* and *alternative uses* for historic bridges are closely related. Without the awareness, interest, and support of local communities and organizations, many of the opportunities for alternative use never materialize. In response to the recognition received in 1984 by the Tennessee Department of Transportation for its historic bridge marketing program (*88*) and to the requirement of the 1987 Surface Transportation and Uniform Relocation Assistance Act requiring that any agency proposing to demolish a historic bridge with federal funds must first make the bridge available for donation (*4*), a number of other state highway agencies have developed advertising and marketing programs. Typically, these programs are triggered by the decision that one or more historic bridges is to be demolished and the marketing effort is often stipulated in the memorandum of agreement that controls the demolition project. The more effective of these programs include advertisements in their state's major newspapers; notices mailed to local governments, recreation departments, parks, natural resource districts, historical groups, and any others that have been identified as potential recipients; and in response to written expressions of interest, information packets that can include a variety of information relating to the description, technology, history, condition, rehabilitation feasibility and estimated cost, as well as proposal submission and acquisition requirements (*personal communication, Elizabeth Merritt, National Trust for Historic Preservation*). A 1985 assessment of these marketing programs indicated about a 40 percent success rate nationally, but also reported indications of early market saturation (*89*).

By 1997, as reported in Table 3, only 14.7 percent of the states (Illinois, Montana, North Carolina, Texas and Wisconsin) responding to the study questionnaire reported more than moderate success in marketing historic bridges through such advertising efforts. Of the two states that expressed the most satisfaction, Texas and North Carolina, both have aggressive proactive campaigns that seek to identify potential recipients independent of the periodic flurries of activity that can be associated with individual bridges or groups of bridges that become available.

Texas, for example, maintains a data base of people and agencies that have expressed interest in obtaining a bridge, and these potential recipients are approached first when one becomes available. However, Texas' most effective device, by far, has been press releases that include both a photograph and a history of the available bridge. Small local newspapers in the counties in the immediate vicinity of the bridge are strongly encouraged to run such releases and they are generally quite receptive. Texas has marketed about 30 truss bridges in this way, mostly small Warren and Pratt pony trusses, but an encouraging number of larger trusses, as well *(personal communication, Thomas P. Eisenhour)*. A copy of TxDOT's Internet home page describing the Texas Historic Bridge Marketing Program and a brief description of NCDOT's Bridge Preservation Program, which includes a marketing component, are included in Appendix F.

While a number of historic bridges, nationwide, have been successfully preserved by relocating them to less demanding sites, the details of these projects have not been widely published despite their obvious usefulness to potential recipients who must assess the logistics and the costs associated with such an undertaking. In this regard, the Rhode Island Department of Transportation has contributed a useful case study of the relocation of a three-panel, lenticular, pony-truss bridge from a highway site, where it had been scheduled for demolition, to a pedestrian crossing in a nearby town park. The case study is particularly rich in details of the bridge's protective bracing, dismantling, transport and rehabilitation, as well as the costs of the various activities (*90*).

Another approach to increasing public awareness of the importance of historic bridges and of stimulating interest in their preservation and alternative use is through continuing education, a more subtle form of marketing. This can take a variety of forms from promoting activities and preparing materials that inform citizens about the nature and history of bridge technology and its cultural significance, to actively publicizing bridges that have already been preserved in some form. One of the most comprehensive of such public education programs is that proposed by the Montana Department of Transportation (*62,82*), one of the five state agencies reporting more than moderate success in finding alternative uses for its historic bridges (Table 2).

As noted earlier, Montana's preservation plan is broader in scope than most in that it considers historic bridges within the more general framework of the state's highway transportation history. The educational component of MDT's preservation plan includes technical documentation of the history of roads and road construction, and of

bridge building, in the state and preparation of illustrated narratives suitable for publication and public distribution. Two documents already completed (*Roads to Romance: The Origin and Development of the Road* and *Trail System in Montana* and *Monuments Above the Water: Montana's Historic Highway Bridges, 1862–1956*), have been distributed to field offices of MDOH, County Commissioners, county road and bridge departments, county historical societies, owners of significant roads and bridges identified in the documents, the Montana Historical Society Library and the Montana State Library. They are also available to the general public. Currently, MDT is updating and expanding these books with the intent of republishing them.

Montana's preservation plan also includes: a traveling exhibit to interpret the history and significance of the state's roads and bridges; a biennial workshop on the rehabilitation of historic bridges for employees, students, county commissioners and road supervisors, and interested members of the general public; publication of informational brochures on MDOH's Historic Bridge Rehabilitation and Adopt-A-Bridge programs; an offering of articles, professional papers, and news releases on related topics; and aug-mentation of the state's historic sign program to include interpretative information for the traveling public at rest areas and pullovers, as well as on-site interpretation of significant roads and bridges.

Since the mid-1980s, several states have convened regional conferences and workshops on the topic of historic bridges. The longest running and best known of these are the biennial Historic Bridge Conferences sponsored jointly by the Department of Civil Engineering, The Ohio State University and the Historical Preservation Division, Ohio Historical Society (*91*).

The issue of *safety and liability* is also closely related to the issue of *historic integrity*. The problem is how to economically upgrade a historic bridge in a manner that assures the public's right to safe transportation without destroying or significantly altering those elements that make the bridge historic. The perception that the AASHTO design guidelines for such factors as roadway width, load carrying capacity and traffic railing are inflexible has inhibited rehabilitation options that might otherwise have been applied. However, in recent years, federal agencies have acted to encourage flexibility in the application of these guidelines where the aesthetic or historic value of a bridge can be retained or enhanced without compromising public safety (*5,92*), and some state highway agencies have developed standards to guide their own designers in such situations. One such standard, that of the Texas Department of Transportation, is included here as Appendix G (*93*).

With regard to the issues that surround the question of which bridges have sufficient *historic significance* to elevate them to National Register eligibility and which do not, the experience of the Vermont Agency of Transportation, discussed earlier in this chapter, has had an interesting, and possibly unintended, outcome. In effect, by electing to treat all bridges on local systems, and many on state highways, as contributing elements to the rural and small community character of its roadscapes, and therefore worthy of preservation on that account, Vermont has bypassed much of the historic significance question. Thus, discussions of whether particular bridges should be afforded protection as historic artifacts when highway improvements are considered has largely been replaced by discussions of whether they can be preserved and, if so, how best to accomplish that objective.

CHAPTER FOUR

CONCLUSIONS

This synthesis identifies and describes current practices of highway agencies with regard to preserving their historic bridges and highlights practices that may be useful to others. As background, *NCHRP Synthesis 101: Historic Bridges—Criteria for Decision Making* was reviewed, current issues that impact historic bridges were identified from questionnaire responses, and relevant federal and state legislation was summarized. Patterns of historic bridge preservation were inferred from available data, preservation plans representing different approaches to the management of historic bridges described, and innovative approaches to resolving current issues discussed.

The conclusions that follow are drawn from the open literature, from published and unpublished reports of highway agencies, and from engineers and others in the cultural resources field who shared their knowledge and experience through responses to a mailed questionnaire and through personal communications.

With regard to the background information:

- *NCHRP Synthesis 101: Historic Bridges—Criteria for Decision Making*, published in 1983, dealt largely with increasing awareness in both the transportation and preservation communities of issues relating to the management of historic bridges, and with emerging strategies to address those issues. Those awareness needs have largely been satisfied during the intervening years.

- Most current issues can be grouped into one of six categories: financial, public awareness and interest, alternative uses, safety and liability, historic integrity, and historic significance. As broad categories of concern, these issues are not new but the focus within each changes with time.

- Most state highway agencies have completed an inventory of at least some of their historic bridges and there is broad consensus that these inventories have been a useful planning tool. They are estimated to have contributed to an increase in the number of U.S. bridges eligible for and listed in the National Register to more than 8,000.

- In terms of legislation, historic bridges have for the most part been given the same consideration as other cultural resources, primarily under Section 4(f) of U.S. Department of Transportation Act, Section 106 of the National Historic Preservation Act and the National Environmental Protection Act, as well as under various omnibus preservation and environmental quality acts promulgated by the individual states. It was not until the Surface Transportation and Uniform Relocation Assistance Act of 1987 that historic bridges were specifically identified for any special consideration, and few states have passed laws that address historic bridges as a special category of cultural resource.

With regard to preservation patterns:

- Metal truss bridges are the most commonly inventoried structural form, accounting for about one-third of the total number. Among those inventoried, about one-half are eligible for or listed in the National Register.

- Preservation interest, as measured by the proportion of each structural form determined to be NR-eligible or listed, is greatest for those forms with the greatest visual impact by virtue of their size and structural complexity (i.e., long-span and movable bridges) and least for forms that are smaller and structurally simpler (i.e., beam, stringer, and girder bridges).

- There is a strong positive correlation between preservation interest, as defined above, and preservation success, defined by the proportion of NR-eligible and listed bridges actually preserved once they are included in a rehabilitation or replacement project. This relationship is taken as evidence of an underlying consistency between what is valued and what is preserved.

- About one of every three NR-eligible or listed bridges fails to be preserved once it is included in a replacement or rehabilitation project. This suggests that closer attention during the National Register selection process to the condition of candidate bridges, to their location, and to other factors that affect preservation could reduce staff time spent on processing NR nominations, and on complying with Section 4(f) and Section 106 requirements for structures that have little ultimate chance of being preserved.

With respect to policies and practices:

Because the procedures for managing historic bridges are left to the states, there is wide variation in the approaches taken. Ten state highway agencies were identified as having completed formal preservation plans; another seven are developing such plans. Several different developmental approaches were identified: 1) Plans that address only bridges but that include all structural forms within the same planning document. Examples include those of the Rhode Island and Connecticut departments of transportation. 2) Plans that address only bridges but that proceed incrementally, completing one structural form at a time. Examples include those of the Wisconsin Department of Transportation and the Vermont Agency of Transportation. 3) Plans that evolve from a broader concern for protecting historic and/or scenic roads, and roadscapes, or segments thereof, in which bridges are considered as only one of a number of contributing elements. Examples include those of the Montana and Oregon departments of transportation and the Vermont Agency of Transportation.

- The Vermont state legislature has acted to give historic bridges a status and level of protection that exceeds that of any other state including, among others, the following provisions: 1) a policy of favoring rehabilitation over replacement for bridges on local systems; 2) modification of the traditional allocation model for federal, state, and local participation from 80/10/10 to 80/15/5; 3) authorization for VAOT to pursue exceptions to national geometric design standards for bridges on the National Highway System where site conditions, environmental factors, or engineering factors so dictate; 4) instructions to VAOT to develop state geometric design standards for bridges not on the National Highway System, and 5) guidelines for protecting the historic integrity of bridges that are rehabilitated.

- Efforts by state legislatures to provide financial incentives to preserve historic bridges are limited mostly to subsidies for covered timber bridges. The one exception found was the Vermont Agency of Transportation which, as noted above, has altered the federal/state/local allocation model to reduce the local share by 50 percent.

- The level of volunteer public participation in raising funds for preserving historic bridges is hard to assess. Known examples are typically associcated with prominent bridges in urban or community settings.

- Historic bridge marketing programs are rated by most state highway agencies as having been less than "moderately successful." Of the few rated more than "moderately successful," many are associated with aggressive proactive educational and promotional programs aimed at increasing awareness of the importance of historic bridges and the opportunities for alternative use.

- Several state highway agencies have prepared design guidelines or standards that can be used to develop rehabilitation designs that include exceptions to AASHTO guidelines for historic bridges that are not on the national or state highway systems.

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
DOT	Department of Transportation
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
HAER	Historic American Engineering Record
HBRRP	Highway Bridge Replacement and Rehabilitation Program
ISTEA	Intermodal Surface Transportation Efficiency Act
MTD	Montana Department of Transportation
NEPA	National Environmental Policy Act of 1969
NCHRP	National Cooperative Highway Research Program
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	Nation Register of Historic Places
NTHP	National Trust for Historic Preservation
ODOT	Oregon Department of Transportation
PA	Programmatic Agreement
SHPO	State Historic Preservation Officer
TxDOT	Texas Department of Transportation
USFS	United States Forest Service
VAOT	Vermont Agency of Transportation
VDHP	Vermont Department of Historic Preservation
WisDOT	Wisconsin Department of Transportation

APPENDIX A

Study Questionnaire

National Cooperative Highway Research Project 20-5, Topic 28-08

Historic Highway Bridge Preservation Practices

The National Cooperative Highway Research Program (NCHRP) has convened a panel of experts from around the country to prepare a synthesis of information on the policies and practices of state and other agencies for dealing with historic bridges when they become candidates for rehabilitation or replacement. Historic bridges are understood to be those that are listed, or determined to be eligible for listing, in the National Register of Historic Places. The synthesis will focus on policies and decision-making procedures that have been employed by the agencies to determine which bridges to preserve and which not to preserve. The synthesis will compliment a current study of the Federal Highway Administration (FHWA) focused on the technical aspects of preserving historic bridges, and will supplement NCHRP Synthesis 101, "Historic Bridges - Criteria for Decision Making", published in 1983.

If ample space has not been provided for responding to specific questions, please feel free to write on the back side of any page or to add pages. A supplemental sheet has already been included for responses to Questions 3-5. Also, please feel free to add any additional comments that you believe would be helpful. Your responses will be carefully evaluated and incorporated into the synthesis report, copies of which will be furnished to your agency as a participant in this important program.

Schedule: We ask that you complete and return the survey form by April 1, 1997.

Returns: Please return the completed survey forms to:
William P. Chamberlin
1046 Shave Court
Schenectady, N.Y. 12303

Questions: In the event that you have any questions about the survey, please call Mr. Chamberlin at (518) 356-1090.

THANK YOU FOR YOUR COOPERATION
AND ASSISTANCE IN COMPLETING THIS QUESTIONNAIRE

QUESTIONNAIRE / INTERVIEW DOCUMENT

Name of Agency: _____
Name of Respondent: _____
Title of Respondent: _____
Telephone Number: _____ ; FX Number _____
Date of Response: _____

Definition of Preservation: For the purpose of this questionnaire, you should consider the term "preservation" to mean continued use of a bridge for a vehicular or non-vehicular transportation function, at either its present location or at an alternate location, even when structurally or geometrically modified. Its use as a display or monument, or for any other non-vehicular function at any location, should also be considered a form of preservation even though it may no longer serve a transportation function. Similarly, match-marking, dismantling and storage for future use should be considered a form of preservation. For the purpose of this questionnaire, neither salvage of specific structural or decorative elements for display, research or reuse nor recordation/documentation followed by destruction should be considered forms of preservation.

* * * * * * *

State or Local Legislative Requirements Please identify any legislation enacted within your jurisdiction that either clarifies, interprets or adds to the requirements of existing Federal legislation (ISTEA and its predecessors) regarding the treatment of historic bridges.

None enacted ___
If enacted, please, please enclose a copy.

Status of Historic Bridge Inventories:

1. Please check the types of historic bridges that have been inventoried in your jurisdiction.

Metal truss ____, Timber truss (incl. covered) ____, Concrete arch ____,
Stone or brick arch ____, Non-arched concrete ____, Metal beam/girder ____,
Moveable ____, Rigid frame ____, Trestle ____,
Long span (suspension, cantilevered truss, metal arch) ____, Other (please identify)
_____

2. If any of these inventories have been published, either as an internal agency document or for broader distribution, please give the appropriate citation(s).

_____
_____
_____

Historic Bridge Preservation Patterns: The purpose of the four questions that follow is to identify patterns of preservation within specific historic bridge types in your jurisdiction, and to identify those factors that have been the principle determinants of whether or not preservation was successful. While the questions are posed in sequence, you may wish to record your responses in the table on the following page. Please review carefully the definition of "preservation" given above.

3. For each of the bridge types inventoried, how many of the total number inventoried were determined to be National Register eligible?

4. Among those NO eligible bridges that have been included in bridge rehabilitation or replacement projects since the inventory was completed, how many of each type have been preserved, according to the above definition; how many have not been preserved?

5. For each bridge type, can you identify the factors that have contributed most strongly to the decision to preserve or to not preserve (e.g., historic importance, safety, cost, tort liability, local support, etc.)?

6. Based on your experience, how would you describe the usefulness of the historic bridge inventory as a planning tool in your jurisdiction?

Extremely Useful ___	___	Moderately Useful ___	___	Not at all Useful ___

Please give the reason(s) for your response. _____

_____

_____

_____

Historic Bridge Preservation Plans: The purpose of the next two questions is to determine whether or not your agency has developed a preservation plan for historic bridges and, if so, the nature of that plan. For this purpose, a "preservation plan" is defined as a document that identifies preservation warrants, preservation constraints and feasible preservation alternatives for each NO eligible bridge. Preservation warrants are typically judgments of NO eligibility. Whether eligibility is based on national, state or local significance may also be a consideration, as may be the relative historic importance among the eligible bridges. Preservation constraints are technical, legal and financial considerations that may mitigate against one or more preservation alternative. Feasible preservation alternatives are those for which the constraints do not impose unacceptable conditions. Where no feasible alternatives exist, the plan would identify acceptable mitigations such as document/destroy or dismantle/store. Some agencies have developed preservation plans in conjunction with their historic bridge inventory; others under a separate project; still others not at all.

Tabulation of Responses to Questions 3-5

Type of Bridge Inventoried	Number Inventoried	Number NO Eligible	From those Considered for Rehabilitation or Replacement		Principal Contributing Factors
			Number Preserved	Number Not Preserved	

7. Does your agency have a written preservation plan, as defined above, for the historic bridges identified in you jurisdiction?
   ___ Yes (please enclose a copy)
   ___ No (please skip to question 9) ___ No, but one is being developed.

8. If your agency has a written preservation plan for historic bridges how would you describe the usefulness of that document as a planning tool for your agency?

Extremely Useful		Moderately Useful		Not at all Useful
___	___		___	___

   Please give the reason(s) for your response. _____
   _____
   _____

Decision Models for Preserving Historic Bridges: The purpose of the next eleven questions is to identify and describe policies and practices used by your agency in making decisions to preserve or not to preserve historic bridges. Typically, such policies and practices would be used to determine the disposition of an historic bridge at the time that the bridge became the object of rehabilitation/replacement interest and, ideally, would be used to select a course of action from among feasible preservation alternatives already identified (e.g., in your preservation plan); or to select an acceptable mitigations where no preservation alternative was feasible. Such policies and practices may be written or unwritten.

9. Does your agency have <u>written</u> policies and/or practices for making preservation decisions regarding historic bridges?
   ___ Yes (please enclose a copy)
   ___ No ___ No, but they are being developed.

10. What offices of your agency and what outside agencies participated in developing these <u>written</u> policies and/or practices?
    _____
    _____
    _____

11. Whether your agency has written policies and/or practices or not, what are the criteria used for making preservation decisions? Please list them in order from most important to least important. If it is not possible to put these criteria in rank order, mark out the words "most important" and "least important". Insert additional lines, if needed.
    _____ (most) _____
    _____ _____
    _____ _____
    _____ _____ (least)

12. What in-house offices of your agency participate in preservation decisions regarding individual historic bridges? Examples of in-house offices might include cultural affairs, environmental affairs, legal services, bridge engineering, planning, etc.

_____
_____
_____

13. What agencies other than yours participate in these decisions? Examples of other agencies might include the SHPO, state historical services, state environmental conservation (stream protection, water quality), local jurisdictions, etc.

_____
_____
_____

14. What standards or guidelines does your agency use to decide the extent to which a bridge can be modified before its historical integrity is unacceptibility altered?

_____
_____
_____

15. Does your agency have a viable plan for dismantling and storing historic bridges for re-erection at some future date?

No viable plan ___
If yes, plese describe. _____
_____
_____

16. How successful has your agency been in moving historic bridges to alternative transportation systems within your state?

Extremely Successful ___	___	Modereately Successful ___	___	Not at all Successful ___

Please give reason(s) for your response. _____
_____
_____

17. How successful has your agency been in finding recipients for historic bridges scheduled for demolition when availability of the bridges for donation has been advertized as currently required by Federal law?

Extremely Successful ___	___	Moderately Successful	___	Not at all Successful

(Question 17 continued)

Please give reason(s) for your response. _____
_____
_____

18. Based on your experience, how would you assess the adequacy of the decision process of your agency with regard to the disposition of historic bridges?

Extremely Successful		Moderately Successful		Not at all Successful
___	___	___	___	___

Please give the reason(s) for your response. _____
_____
_____

19. Do you have any recommendations on how the decision process with regard to the disposition of historic bridges in your jurisdiction could be improved? If so, please elaborate. _____
_____
_____
_____

Miscellaneous:

20. In your experience, what are the three most important issues with regard to managing historic bridges?
    1) _____
    2) _____
    3) _____

21. Please identify any local jurisdictions within your state (counties or towns) that, in your opinion, have been unusually successful in managing decisions regarding disposition of historic bridges and that could contribute to this synthesis.
_____
_____

22. Can you recommend any literature that might be helpful in preparing this synthesis?
_____
_____

APPENDIX B

Agencies Responding to the Study Questionnaire

Alaska Department of Transportation and Public Facilities
Arizona Department of Transportation
Arkansas State Highway and Transportation Department
California Department of Transportation
Colorado Department of Transportation
Connecticut Department of Transportation
Georgia Department of Transportation
Illinois Department of Transportation
Indiana Department of Transportation
Iowa Department of Transportation
Maine Department of Transportation
Maryland Department of Transportation
Massachusetts Highway Department
Minnesota Department of Transportation
Mississippi Department of Transportation
Missouri Department of Transportation
Montana Department of Transportation
Nebraska Department of Roads
Nevada Department of Transportation
New Hampshire Department of Transportation
New Jersey Department of Transportation
New Mexico State Highway and Transportation Department
New York State Department of Transportation
North Carolina Department of Transportation
North Dakota Department of Transportation
Ohio Department of Transportation
Oklahoma Department of Transportation
Oregon Department of Transportation
Rhode Island Department of Transportation
South Carolina Department of Transportation
Tennessee Department of Transportation
Texas Department of Transportation
Vermont Agency of Transportation
Virginia Department of Transportation
Washington State Department of Transportation
West Virginia Department of Transportation
Wisconsin Department of Transportation
Wyoming Department of Transportation

APPENDIX C

Connecticut DOT's Preservation Plan for the Black Road Bridge

BRIDGE NO. 4434

Black Bridge Road over West Branch Farmington River, New Hartford

Description: 1936, steel Warren pony truss, 2 spans; fabricated by Berlin Construction Co.

Similar Structures in Preservation Plan:

Trusses, 1921 and Later: 1496, 3788, 562, 1649, 1524, 1487, 1561, 507, 1415, 349

Warren Trusses, 1921 and Later: 562, 1487, 1524

Berlin Construction Co. Trusses, 1921 and Later: 1524, 1561

Historical Significance: Typifies truss bridge construction of the automotive age; built by the town after the flood of 1936 destroyed the prior bridge, and paid for by the U.S. Works Progress Administration. Berlin Construction was the state's only significant bridge fabricator in the 20th century.

Preservation Planning:

General Considerations: The bridge is closed to vehicular traffic. Alternative crossings are available approximately three-quarter mile upstream and two miles downstream. Roadway width is 17'.

Structural Rehabilitation: Selective patching and in-kind replacement of members would not compromise the structure's historic integrity.

Bypass: Lack of adjacent buildings makes total bypass or lane division possible. Total bypass should be accompanied by some provision for maintenance of the historic bridge.

Widening/Secondary Structure: If a new structural system were inserted below the deck, the historic trusses can remain in place at the sides; the outer portion (one to two feet) of the floor beams, including the floor joints, should be retained both to preserve the historic fabric and to hide the new material.

Relocation: The spans are each 84' long, allowing relocation to park or trail use. The local historical context would be lost, but the intrinsic significance of the bridge, both as a typical structure of its time and the work of Berlin Construction, would outweigh that consideration.

APPENDIX D

Prospectus for Vermont AOT's Program for Adaptive Use of Historic Bridges

Mission

We will establish a comprehensive and viable program for adaptive use of historic bridges for pedestrian, bikepath, or other alternative public transportation uses, at a cost competitive with new, prefabricated pedestrian bridges. Vermont's historic bridges will thus remain in public use and will continue to serve transportation, educational, aesthetic, and economic functions. We will avoid the need to purchase new bridges manufactured in other states and, at the same time, will employ Vermont labor.

Purpose and Need

1. **Anticipate Adaptive Use Recommendations Under Lichtenstein Study.** The Lichtenstein study will recommend that certain bridges can no longer function on the state's highway systems and should be adapted to alternative transportation use. We should be prepared to implement those recommendations. The factors influencing any successful adaptive use are diverse and complex, and we should strive to manage these factors efficiently.

2. **Adapt Bridges Currently in Storage.** We currently have stockpiled ten historic truss bridges and have agreed to use our best efforts in placing them at new locations. This goal is attainable, and we should pursue it diligently. A formal program for adaptive use will allow us to pursue these opportunities far more efficiently and far less expensively than our current approach.

4. **Historic Preservation.** Vermont's historic bridges are a resource that eventually will generate an economic return far beyond the current costs associated with their preservation. The goal of bridge preservation is a worthy one.

Components

1. **Partnership with Corrections Division.** A working agreement with Corrections Division to provide materials and labor to rehabilitate historic bridges is a key part of this program. Corrections Division's sawmill in Windsor will provide high quality timber to be used on bridge decks, and their machine shop can produce steel components. Labor from their Community Restitution Program can conduct repair work, painting, and assembly of deck materials.

2. We can also explore the possibility of gaining certification for Corrections Division to conduct lead paint abatement.

3. **Partnership with Bikepath Programs.** Complete coordination with bikepath programs will be vital and would be aided by policy that requires adaptive use of historic bridges on bikepaths whenever feasible. In addition, we should probably develop standard guidelines for bridge rating and width. H10 loading is recommended.

4. **Partnership with Federal and State Agencies.** We might also encourage the development of a joint federal/state program to identify sites on federal or state lands where bridges could be relocated. Such a program would involve coordination among the various federal agencies (e.g. National Park Service, National Forest Service, Army Corps of Engineers) and state agencies that own the sites where bridges could be placed.

   We have already communicated with the Vermont Forest Service and have provided a list of available bridges.

5. **Disadvantaged Business Enterprises.** It may be useful to explore possible contracts with DBE's for lead paint abatement on steel truss bridges.

6. **Lichtenstein Study.** Logically, the program would continue to manage the truss bridge study currently being conducted by A.G. Lichtenstein & Assoc.

7. **Experimental Partnerships.** We might also develop partnerships with engineering programs at Dartmouth, Norwich, and University of Vermont.

8. **Publications.** The publication of a book discussing Vermont's historic bridges would be a logical outgrowth of this program.

9. **Interpretation.** Interpreting and promoting historic bridges as part of heritage tourism, and the mapping of specific tour routes, should be a part of this program.

Functions

1. **Engineering Services.** The program should be staffed by (or have the services of) an engineer who can provide the functions listed below. Creating a permanent position would be one alternative. Another would be to establish a pool of engineers interested in volunteering for these projects. Selection would be conducted equitably, and those chosen would be permitted to work additional hours.

a) Survey and document the historic bridge and evaluate its structural integrity.
b) Assess the suitability of proposed new sites.
c) Prepare rehabilitation plans. These should satisfy required load capacity, address any hydraulics concerns, include a materials list, and provide a cost estimate. Plans should also address the matter of any required lead paint abatement.
d) Complete final design and plans following coordination with Department of Corrections.
e) Provide inspection during construction phase.

2. **Administrative Services.** The program should be staffed by an administrator who can provide the following services:

a) Work with communities and members of the public to identify appropriate sites for the relocation of historic bridges and to obtain adequate funding.
b) Coordinate with Department of Corrections, Federal Highway Administration, Vermont Agency of Transportation, Regional Planning Commissions, communities, and other involved parties to prepare contracts and draft any required documents.
c) Evaluate rehabilitation plans to insure that the historic integrity of bridges is preserved.
d) Obtain all required permits and approvals from resource agencies.
e) Provide inspection during construction phase.
f) Draft and lobby for any federal or state legislative amendments required to implement such a program.

Funding

1. **Transportation Costs.** Costs of transporting bridges to the new locations should be considered part of the project costs for construction of new bridges.

2. **Rehabilitation Costs.** Costs of repair, must also be funded. If bridges are adapted to bikepath or other alternative transportation uses, a large portion of the rehabilitation costs would be paid by federal funding. Under current law, however, FHWA will participate in the relocation and rehabilitation of bridges removed from highway systems only up to the costs of demolition. For the time being, then, it may be necessary to arrange additional funding sources for rehabilitation.

> We will need to clarify and, if necessary change, federal law that limits FHWA participation in the rehabilitation of bridges being removed from highway systems to the costs of demolition. See 23 U.S.C. 144 (o)(4)(B).

3. Special Projects. A portion of the costs for construction of new bridges might be assigned to the costs of rehabilitation of bridges possessing exceptional historic significance.

HISTORIC BRIDGE ADAPTIVE USE PROGRAM

	PROJECTS CURRENTLY UNDERWAY					
	BRIDGE	OWNER	USE	LENGTH	EST. COST	FUNDING SOURCES
1.	Hardwick, No. 27	VAST	Snowmobiles	55	12000	VAST
			Pedestrians			Preservation Trust .
2.	Hinesburg, No. 30	Town	Pedestrians	41	24000	Enhancements
			Bicycles			VAOT Planning Div.
3.	Springfield, No. 81	Town	Motor Vehicles	160	200000	VAOT Bike & Ped
			Bicycles			
			Pedestrians			
4.	Westfield, No. 17	VAST	Snowmobiles	52	12000	VAST
			Pedestrians			
	PROJECTS PROPOSED					
	BRIDGE	OWNER	USE	LENGTH	EST. COST	FUNDING SOURCES
1.	Hardwick, No. 27	VAST	Snowmobiles		3000	Enhancements
	Prototype Railing Only					
2.	Bethel, No. 4	Town of Brandon	Pedestrians	56	70000	VAOT Structures Div.
			Bicycles			Enhancements
3.	Richmond, No. 10	Town	Pedestrians	200	75000	VAOT Structures Div.
		VDHP	Bicycles			Enhancements
		Cross Vt Trail				
4.	Berlin, No. 72	City of Montpelier	Pedestrians	90	35000	Enhancements
			Bicycles			
5.	Montpelier, No. 6	City of Montpelier	Pedestrians	141	65000	VAOT Structures Div.
			Bicycles			Enhancements
6.	Morristown, No. 53	Town of Morristown	Pedestrians	83	60000	VAOT Structures Div.
		VDHP	Bicycles			Enhancements
7.	Berlin, No. 4	Town of Charlotte	Vehicles	60	60000	Private
			Pedestrians			Enhancements
			Bicycles			
8.	Rochester, No. 36	Peavine Rail Trail	Bicycles	111	60000	VAOT Bike & Ped.
		VDHP	Pedestrians			Enhancements
9.	Rutland, No. 17	City of Rutland	Bicycles	127	40000	VAOT Bike & Ped
			Pedestrians	80	22000	Enhancements
10.	Wallingford, No. 50	Town of Stowe	Pedestrians	70	20000	Enhancements
			Bicycles			Preservation Trust
				TOTAL	510000	
	ALTERNATE PROJECTS					
	BRIDGE	OWNER	USE	LENGTH	EST. COST	FUNDING SOURCES
1.	Arlington, No. 25	TBA		85		
2.	Arlington, No. 22	TBA		58		
3.	Shoreham, No. 24	TBA		54		
4.	Middletown Springs, No. 21	TBA		49		
5.	Thetford, No. 25	TBA		70		

APPENDIX E

Montana DOT's Programmatic Agreement of Historic Roads and Bridges

PROGRAMMATIC AGREEMENT

Among the Federal Highway Administration (FHWA), the Montana State Historic Preservation Office (MSHPO), and the Advisory Council on Historic Preservation (ACHP), to develop a historic preservation plan to establish processes for integrating the preservation and use of historic roads and bridges with the mission and programs of the FHWA in a manner appropriate to the nature of the historic properties involved, the nature of the roads and bridges in Montana, and the nature of the FHWA's mission to provide safe, durable and economical transportation.

WHEREAS, Congress has mandated that highway bridges be evaluated, and where found substandard, be rehabilitated or replaced and has provided funding for these purposes, to insure the safety of the traveling public (through the Highway Bridge Replacement and Rehabilitation Program); and

WHEREAS, the American Association of State Highway and Transportation Officials (AASHTO) has standards regulating the construction and the rehabilitation of highways and bridges that must be met by the FHWA to insure the safety of the traveling public; and

WHEREAS, Congress declares it to be in the national interest to encourage the rehabilitation, reuse and preservation of bridges significant in American history, architecture, engineering and culture; and

WHEREAS, the FHWA proposes to make Federal funding available to the Montana Department of Highways (MDOH) for its ongoing program to construct and rehabilitate roads and bridges, and MDOH concurs in and accepts responsibilities for compliance with this Agreement; and

WHEREAS, the FHWA has determined that the construction and improvement of highways may have an effect on historic roads and bridges that are listed in the National Register of Historic Places, or may be determined eligible for listing, and have consulted with the ACHP and the MSHPO pursuant to Section 800.13 of the regulations (36CFR800) implementing Section 106 of the National Historic Preservation Act (16U.S.C. 470f); and

WHEREAS, the parties understand that not all historic roads and bridges fall under the jurisdiction of sphere of influence of the FHWA, and that to encourage other parties to participate in preservation efforts, an education to foster a preservation ethic is needed; and

NOW THEREFORE, FHWA, MSHPO, and ACHP agree, and MDOH concurs, that the following program to enhance the preservation potential of historic roads and bridges, and to promote management and public understanding of and appreciation for these cultural resources will be enacted in lieu of regular Section 106 procedures as applied to historic roads and bridges only.

Stipulations

The Federal Highway Administration will ensure that the following program is carried out:

The Federal Highway Administration, in cooperation with the Montana Department of Highways, will develop a preservation plan to ensure the preservation and rehabilitation of the states [sic] significant historic roads and bridges, and will develop and on-going educational program to interpret significant historic roads and bridges that illustrate the engineering, economic, and political development of roads in Montana. Specifically:

A. For Public Education

1. MDOH will prepare technical documentation of the history of roads and road construction, and of the history of bridge building in the state, according to a format developed by MDOH in consultation with the MSHPO and in compliance with the Secretary of the Interior's Standards for Preservation Planning. From this documentation, MDOH will prepare narrative histories suitable for publication for the general public. Draft copies of the documentation and the narrative histories will be submitted to the FHWA, MSHPO and a list of qualified reviewers to be determined by FHWA, MDOH and MSHPO by December 1, 1990, and 45 days will be allowed for reviewers to comment. MDOH will prepare final documentation and histories by May 1, 1991. Final copies will be distributed to the district, area, and field offices of the MDOH, to the County Commissioners, county road and bridge departments, and county historical societies, to the owners of significant roads and bridges identified in the documentation, to the Montana Historical Society Library and the Montana State Library, and to the general public as requested.

2. MDOH will develop and make available to newspapers and publishers of historical and of engineering journals articles suitable for public information on historic roads and bridges and on their construction and significance.

3. MDOH will augment its historic sign program by developing interpretation for the traveling public at existing rest areas or pull-overs to explain Montana's road construction and bridge engineering. It will develop on-site interpretation for significant resources that can be viewed and appreciated by the public.

4. By April 15, 1990 MDOH will develop and circulate a traveling exhibit that portrays the history of the development of transportation in Montana.

5. By December 1, 1991 MDOH will develop and circulate a public program (slide/tape or video) of approximately 20 minutes, suitable for use at public or organization gatherings, classrooms, etc.

B. For Historic Road and Bridge Preservation

1. The FHWA, in co-operation with the MDOH, will prepare a plan for the preservation of significant and representative road segments and bridge types around the state as identified in the research in Part A. of this Agreement. The Historic Preservation Plan (HPP) will be presented to the FHWA, MSHPO, the ACHP and [a] list of qualified reviewers by September 1, 1991, and 45 days comment period will be allowed for discussion and adoption. FHWA will work to resolve disagreement on the proposed HPP. If agreement cannot be reached by December 1, 1991, all FHWA undertakings affecting historic roads and bridges will again become subject to 36 CFR 800 procedures.

   The HPP for historic roads and bridges shall be prepared in accordance with the following guidelines:

   a. The essential purpose of the HPP will be to establish processes for integrating the preservation and use of historic roads and bridges with the mission and programs of the FHWA and the MDOH in a manner appropriate to the nature of the historic properties involved, the nature of the roads and bridges in Montana, and the nature of FHWA's mission, to provide safe, durable and economical transportation;

   b. In order to facilitate such integration, the HPP, including all maps and graphics, will be made consistent with the Federal Aid road and bridge numbering systems;

   c. The HPP will be prepared in consultation with the owners, managers, caretakers, or administrators of historic roads and bridges, including county governments, city governments, federal agencies, and private individuals or corporations, and with interested parties or organizations, including the American Society of Civil Engineers - Montana Section, and the Montana Society of Engineers;

   d. The HPP will be prepared with reference to the Secretary of Interior's Standards and Guidelines for Preservation Planning (48 FR 44716-20); and

   e. The HPP will be prepared by or under the supervision of an individual who meets, or individuals who meet, at a minimum, the "professional qualifications standards" for historian and archaeologist in the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738-9).

2. The contents of the HPP will be developed in conjunction with the MSHPO, and will include, but not be limited to, a schedule for the anticipated implementation of the various elements, plus the formulation and presentation of programs to:

a. Preserve historic bridges that do not meeting safety rating standards by rehabilitation in a manner that would preserve important historic features while meeting as many AASHTO standards as can be reasonable met;

b. When a historic bridge must be replaced, give full consideration and demolition savings to reuse of the historic bridge in place by another party.

c. When a historic bridge must be replaced and in place preservation is not feasible, give full consideration and financial assistance to relocating and rehabilitating the historic bridge as a part of the replacement project;

d. Develop and implement a program to encourage relocation and reuse of bridges of historic age that cannot be preserved in place or used on another location by the state or county;

e. Provide a financial incentive by offering demolition savings on all relocation and reuse of bridges of historic age;

f. Develop a list of historic roads and bridges that can be preserved. The list should include the variety available to reflect Montana highway construction history, while considering current condition and use. The list should be presented to and discussed with managing units to solicit their cooperation and/or participation in the preparation of the HPP; and

g. Devise a program to pursue the preservation of the state's representative and outstanding examples of road and bridge technology. A list of historic roads and bridges shall be preserved will be developed to implement this program, given currently known commitments to do so by property managers and subject to change by obtaining future commitments for other properties covered by this Agreement.

3. The HPP will not include information developed in Part A. above, narrative histories, but will be guided by and used in conjunction with Part A. above, and will be distributed to the same parties.

4. MDOH will prepare a report annually on its implementation of the HPP, and provide this report to the FHWA, the SHPO, and the ACHP for review, comment, and consultation as needed.

C. Other Legal and Administrative Concerns

1. FHWA will continue to inventory, evaluate and seek determinations of eligibility, and fully comply with 36 CFR 800 for all undertakings with the potential to affect historic properties besides roads and bridges which are hereby excluded from such consideration.

2. The MSHPO, and the ACHP may monitor FHWA and MDOH activities to carry out this PA, by notifying FHWA in writing of their concerns and requesting such information as necessary to permit either or both MSHPO and ACHP to monitor the compliance with the terms of this Agreement. FHWA will cooperate with the SHPO, and the ACHP in carrying out their monitoring and review responsibilities.

3. FHWA will carry out the existing MOA's to preserve or record historic bridges that are now scheduled for replacement.

4. If a dispute arises regarding implementation of this PA, FHWA will consult with the objecting party to resolve the dispute. If any consulting party determines that the dispute cannot be resolved, FHWA will request further comments of the ACHP.

5. During any resolution of disagreements on the PA, and/or in the event MDOH does not carry out the terms of the PA, FHWA will carry out the procedures outlined in 36 CFR 800 for all undertakings otherwise covered by this agreement.

Execution of this PA evidences that FHWA has afforded the ACHP a reasonable opportunity to comment on FHWA's program to construct and improve Montana highways when those undertakings affect historic roads and bridges, and that FHWA has taken into account the effects of these undertakings on significant historic roads and bridges.

BY: FEDERAL HIGHWAY ADMINISTRATION

[Roger K. Scott] [May 11, 1989]
Roger K. Scott Date
Division Administrator

BY: MONTANA STATE HISTORIC PRESERVATION OFFICER

[Marcella Sherfy] [May 11, 1989]
Marcella Sherfy, MSHPO Date

BY: ADVISORY COUNCIL ON HISTORIC PRESERVATION

[Robert D. Bush] [June 1, 1989]
Executive Director Date

CONCUR
BY: MONTANA DEPARTMENT OF HIGHWAYS

[Stephen C. Kologi] [May 11, 1989]
Stephen C. Kologi, P.E., Chief Date
Preconstruction Bureau

Amendment To The Programmatic Agreement Regarding Historic Roads and Bridges In Montana

We are hereby amending the following stipulations in the Programmatic Agreement.

A. For Public Education

1. In the third sentence December 1, 1990 becomes December 1, 1992. In the fourth sentence, May 1, 1991 becomes May 1, 1993.

5. December 1, 1991 becomes December 1, 1993.

B. For Historic Road and Bridge Preservation

1. September 1, 1991 becomes September 1, 1993 and December 1, 1991 becomes December 1, 1993.

By: Federal Highway Administration

[D. C. Lewis for] _____ Date [February 27, 1992] _____
Hank Honeywell
Division Administrator

By: Montana State Historic Preservation Officer

[Marcella Sherfy] _____ Date [February 27, 1992] _____
Marcella Sherfy, MSHPO

By: Advisory Council on Historic Preservation

[Robert D. Bush] _____ Date [March 16, 1992] _____
Robert D. Bush, Executive Director

Concur
By: Montana Department of Transportation

[Edrie Vinson] _____ Date [February 25, 1992] _____
Edrie Vinson
Environmental & Hazardous Waste Bureau

APPENDIX F

North Carolina and Texas DOT's Historic Bridge Marketing Programs

NCDOT HISTORIC BRIDGE PRESERVATION PROGRAM

The North Carolina Department of Transportation (NCDOT) established a program for the preservation of the state's historic metal truss bridges in 1978-79. The results of a statewide inventory and evaluation of metal truss bridges, sponsored jointly by NCDOT and the North Carolina Division of Archives and History, were recorded in *North Carolina's Metal Truss Bridges: An Inventory and Evaluation*, published in 1979. Subsequent to the publication, thirty-four metal truss bridges were determined eligible for the National Register of Historic Places.

NCDOT's Historic Bridge Preservation Program is a pro-active program designed to develop preservation strategies and alternatives to demolition for metal truss bridges scheduled for replacement. Among the strategies employed by NCDOT are donation of bridges with protective covenants to new owners, assistance with disassembly and relocation as part of project costs, disassembly and storage in a NCDOT bridge yard if a new owner cannot be identified during the project, and preservation in place. For both eligible and non-eligible bridges, NCDOT actively seeks recipients through advertisements both in and out of state and maintains a directory of individuals and organizations interested in obtaining a bridge.

While it is necessary to replace metal truss bridges which have become functionally obsolete and cannot be maintained to meet design standards, NCDOT through its bridge preservation program has actively sought alternatives to demolition for the state's historic metal truss bridges. NCDOT is committed to preserving North Carolina's historic metal truss bridges.

Contact: Clay Griffith
Planning & Environmental Branch
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

TxDOT's Historic Bridge Marketing Program

In the market for a historic truss bridge? If so, you may be interested to know more about TxDOT's historic bridge marketing program. Before TxDOT removes old historic truss bridges from state highways, county roads and city streets, the state markets these antique metal spans to the public for use at new locations. Limited federal monies are available on a reimbursable basis to help cover relocation expenses.

Bridges acquired through the program can be used for almost any purpose (except to serve vehicular traffic on a public roadway). During the past 10 years, recipients have moved more than 20 truss spans to golf courses, recreation parks, hike-and-bike trails, pedestrian walkways, and private roads.

All trusses are offered on an "as is" basis. Most of the marketed spans are relatively lightweight and can be moved in one piece, with no disassembly required. A typical truss weighs 10 to 15 tons (without the deck), and is 50 to 150 feet long and 10 to 18 foot wide.

TxDOT markets truss bridges at various time throughout the year. When a truss bridge becomes available, TxDOT sends out bridge information packages to the individuals and entities on its bridge marketing mailing list. Each of the bridge information packages contains detailed location and structural information on the truss span, as well as instructions for preparing a bridge re-use proposal. If more than one proposal is received, TxDOT then evaluates the proposals in consultation with the Texas Historical Commission. Uses that keep a bridge accessible to public and that are sensitive to the bridge's historic fabric are given preference in the selection process.

If you want to add your name to TxDOT's historic bridge marketing list, you can contact the program administrator at Bstockli@mailgw.dot.state.tx.us or at (512) 416-2628. In the future, we plan to feature information on marketed trusses at this location, so stay tuned!

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APPENDIX G

Texas DOT's Rehabilitation Criteria for Historic Bridges

Texas Department of Transportation

Stand-Alone Manual Notice 98-1

To: All Districts and Divisions

From: Robert Cuellar, P. E.

Functional Manual: Highway Designs and Operation And Planning Manual

Date: February 3, 1998

Purpose

Historically significant bridges usually cannot be cost effectively upgraded to meet the current design standards for roadway width, load carrying capacity or traffic railing without significantly altering the aspects that make the bridge historically significant. This historic bridge design criteria would eliminate the need for design exceptions in cases where an appropriate level of safety can be met. This would eliminate unnecessary reviews by the Design Division and delegate decision-making to the districts to the maximum extent possible.

Contents

OFF-SYSTEM HISTORICALLY SIGNIFICANT BRIDGES
Allowable Minimum Criteria for Preservation Projects
To Support Continued Use by Vehicular Traffic

A Texas Department of Transportation administered project for restoration and repair work on a historically significant bridge that is located on a public road or street **not** on the designated State highway system, may be developed and carried out to raise the condition level of the bridge where it may continue to carry vehicular traffic. Historically significant bridges are those listed or eligible to be listed in **The National Register of Historic Places.**

Normally these historically significant bridges cannot be cost effectively upgraded to meet the usual design standards for roadway width, load carrying capacity or traffic railing without significantly altering the aspects that make the bridge historically significant. The following table applies to historically significant bridges. Historic Off-System bridges that cannot be upgraded to meet or exceed these minimum criteria may be considered for preservation projects on a case by case basis when approved as a design exception.

Allowable Minimum Criteria To Support Continued Use by Vehicular Traffic

CURRENT AVERAGE DAILY TRAFFIC (ADT)	MINIMUM CLEAR ROADWAY WIDTH [1]		MINIMUM LOAD CARRYING CAPACITY (Operating Rating)	
	One-Lane, Two-Way Operations [2]	Two-Lane, Two-Way Operations	Alternate Route Available [5]	Alternate Route **Not** Available
ADT 50 or less	10 feet	18 feet	HS 5	HS 12[6]
ADT 51 to 250	10 feet	18 feet	HS 8	HS 12
ADT greater than 250	Not applicable [3]	Not applicable [4]	HS 15	HS 15

Notes: (1) For a minimum roadway length of 50 feet adjacent to the bridge end, roadway crown should match clear width across the structure plus additional width to accommodate guard fence if necessary.

(2) One-Lane, Two-Way operations are assumed to allow for sight distance across the entire length of the structure. In cases where sight distance across the length of the structure is not available, the allowable minimum clear roadway width shall be the allowable minimum for Two-Lane, Two-Way operations.

(3) For ADT greater than 250, One-Lane, Two-Way operations on a structure are not permissible.

(4) For ADT greater than 250, use design standards as appropriate for the class of highway as shown within appropriate sections of the Highway Design Division Operations and Procedures Manual (Part III and Part IV).

(5) To allow these values, the identified alternate route must add no more than 5 miles to a trip for essential services such as school buses, and emergency fire and medical access. All bridges on the identified alternate route must have a minimum load rating of HS 12. Historic Bridges which do not meet the state legal load limit shall be posted.

(6) HS 12 load rating was selected as it appears to represent a typical minimum value for vehicles essential for educational, medical and fire suppression services.

In addition to the criteria listed in the preceding table, vertical clearance restrictions caused by portal or other bracing on trusses should be carefully evaluated to insure that it will allow passage of essential service vehicles. It may be impossible or impractical to provide a crash tested rail on the bridge. As a minimum, delineation of obstructions and bridge members at the roadway level should be provided. In addition to any required load limit signs, maintenance of needed warning and traffic control signs will become a responsibility of the local government.

Action Required

Please refer to this Stand-Alone Manual Notice before submitting design exception requests for Off-System historically significant bridges.

Contact

If you have any questions please contact your Bridge Planning Engineer, Design Division, (512) 416-2175.

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, a private, nonprofit institution that provides independent advice on scientific and technical issues under a congressional charter. The Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering.

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The National Academy of Sciences is a nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encouraging education and research, and recognizes the superior achievements of engineers. Dr. William A.Wulf is president of the National Academy of Engineering.

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Transportation Research Board
National Research Council
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ADDRESS CORRECTION REQUESTED