Historic Bridge Rehabilitation and Approaches to Programmatic Agreements

Summary and Analysis of Current Practices Nationwide

Prepared for
Minnesota Department of Transportation

Prepared by
Mead & Hunt
www.meadhunt.com

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Electronic version of this report can be found here:
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Introduction

Managing and funding historic bridge programs and rehabilitation projects remains a challenge throughout the country. Addressing these issues increasingly requires commitment and creativity on the part of state departments of transportation (DOTs), preservation advocates, and cultural resource and engineering professionals in order to strike a balance between preserving significant examples of our aging infrastructure while meeting modern engineering standards. This study was undertaken to compile and share a better understanding of current practices and funding for historic bridge rehabilitations and Programmatic Agreements (PAs) across the nation.

The primary source of data was an online survey. Survey participants responded to questions about historic bridge rehabilitation projects, state and locally owned bridges, analysis and funding for rehabilitation, challenges, and existing programs for managing and funding historic bridge projects. Respondents consisted of 11 DOTs, two State Historic Preservation Offices (SHPOs), five cultural resource and engineering consultants, one local agency, one interested citizen, two foreign countries (Australia and Canada), and a number of other respondents who did not share their state or affiliation.\(^1\)

In order to include as many states as possible, survey responses were supplemented with research that included examination of known historic bridge rehabilitation projects, state-specific PAs, known historic bridge programs and funding sources at the state and federal level, and online resources of the Federal Highway Administration (FHWA). A total of 24 states are represented in the results.\(^2\)

Section 1 of this report provides background information related to the bridge rehabilitations and PAs across the nation and serves as context for the document. Section 2 highlights challenges and approaches to balancing engineering and preservation standards when rehabilitating historic bridges. Section 3 discusses the processes used by states to assess the feasibility of rehabilitation and existing funding sources for rehabilitation projects. Section 4 summarizes the content and use of existing bridge PAs across the country.

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1 Mead & Hunt completed an online survey of DOTs, SHPOs, cultural resource and engineering professionals, and preservation advocates between January and April 2014. Individuals were targeted through the Historic Bridge Foundation, Historic Bridge Alliance, Transportation Research Board ADC50 Committee, and National Council of State Historic Preservation Offices; and outreach via social media including blogs, Twitter, and LinkedIn. Certain states with active historic bridge programs were targeted by email. It should be noted that survey responses posed certain limitations. Nearly half of all respondents did not provide contact information or indicate the state they represented. Participants did not always answer all questions and often provided inexact statistics, such as percentages or estimates with terms like “majority.” Results included in this document are only as accurate as the data received. Information from the foreign participants was not considered for the overall national data.

2 States represented in survey responses and additional research included the following: Alabama, California, Colorado, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Mexico, North Dakota, Ohio, Oregon, Pennsylvania, Texas, Vermont, Virginia, Washington, and Wisconsin.
1. Background

Historic bridge projects are most often completed by owners in compliance with regulations in Section 106 of the National Historic Preservation Act of 1966 and Section 4(f) of the Department of Transportation Act of 1966. These regulations require the identification and evaluation of historic bridges with consideration of project impacts on their historical, engineering, and design significance. Though the regulations have a federal basis, they are implemented at the state level, typically by DOT staff, and resultant practices and programs for historic bridges vary significantly among states and in some cases even differ among DOT districts within individual states. Many states have executed PAs that outline the process for complying with federal regulations for cultural resources and implementation of the Federal-Aid Highway Program, as outlined in detailed below.

According to survey respondents, the majority of states have rehabilitated less than 10 historic bridges and nearly one-fourth have completed more than 25 historic bridge rehabilitations. Twenty-one percent of respondents were unsure or did not answer this question.
Responses indicated the distribution between state-owned versus locally owned historic bridges that have been rehabilitated. Although only 15 responses were received for this question, most rehabilitated historic bridges appear to be non-state-owned structures. This has implications for funding historic bridge rehabilitation projects, which is examined later in this report.
2. Challenges and Approaches to Meeting Engineering and Preservation Standards

Survey participants were asked to share what they find most challenging about historic bridge rehabilitation projects. The most common obstacles cited, from a program and practical standpoint, included: the inflexibility of American Association of State Highway and Transportation Officials (AASHTO) standards; adhering to the preservation standards, specifically the Secretary of the Interior’s Standards for the Treatment of Historic Properties (Standards); and the overall struggle between preservation concerns and engineering needs. Illustrated below are responses, several of which are shared among different states and participants.

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Fourteen of the 24 states represented in the results report completing historic bridge rehabilitations, from minor repairs to multi-million-dollar restorations. The Standards serve as the primary guidance from a preservation standpoint for completing and making decisions about historic bridge rehabilitations. Referring to the Standards, one participant stated “bridges are often exposed to harsher conditions (salts, overloads) than other historic properties, which require more extensive changes than the standards seem to allow.” Another respondent indicated that the Standards “do not apply well to transportation features, which have a huge onus of having to be safe for the travelling public.” Several responses revealed that some DOT staff may be unaware of instances where the Standards have been adapted to bridges, such as in Virginia and Texas.

A knowledge shortfall is an underlying factor in many of the cited challenges. A comment from an engineering consultant expressed frustration with historic review staff at the state level, indicating that it is not hard to apply the Standards to bridge projects but that historic review staff are generally unfamiliar with bridges, materials, and structural concepts, which results in odd decisions from state-level officials. Review staff were also cited as tending to focus on railings to the exclusion of other important considerations on the bridge. One DOT staff member mentioned the evolution of standards as an
ongoing challenge: “Actions that at one time would have been considered fully acceptable, are now considered to be adverse effects.” For example, “certain types of replacement rail once embraced by the SHPO are now marginal and occasionally adverse.” Other challenges mentioned included interested parties that are vocal in advocating for preservation but that have little impact since their numbers are limited and local governments that have interest in preserving structures but show reluctance to take on the liability of the structure, which derails potential projects.

Despite the various hurdles, many states report successful historic bridge programs and several participants shared best practices for overcoming some of these obstacles. One participant mentioned the importance of collaboration, stating that plans should not be created in isolation, which “helps streamline the process by putting the time in early and throughout the process, especially once it hits SHPO or federal agency desk.” One DOT respondent shared an approach to addressing the height of parapets and barriers that do not meet modern engineering standards: “We typically resolve this through compromise; on the stone arch bridges, for example, we build a moment slab and face the concrete with the original stone. With railings on a truss bridge we try to leave the historic railing in place and put a railing meeting standards in front of it.”

A. Balancing existing conditions with modern standards

Historic bridges often have existing conditions that, if updated to meet modern engineering standards, may result in an adverse effect. Through permissible exceptions or variances, preservation outcomes that avoid adverse effect can be achieved. One state DOT reported having little flexibility in accepting adjustments to modern engineering standards, regardless of location, traffic volume, or bridge condition. However, the majority of states reported finding certain existing conditions acceptable despite their non-compliance with modern standards. Substandard bridge width, sidewalk width, and vehicular load capacity are the most common existing conditions mentioned by respondents that are deemed acceptable during historic bridge rehabilitation projects. A range of existing conditions were cited by respondents as having been allowable on past historic bridge rehabilitation projects, as illustrated below.
These existing conditions are typically accepted due to design limitations of bridge types like metal trusses and masonry arches, which cannot be widened or rehabilitated for higher load capacity without having an adverse effect on the bridge. As one respondent noted, the fracture critical and non-redundant nature of metal trusses does not meet modern engineering standards. Another DOT respondent indicated that in their state, due to funding and the infrequency of bridge replacements, none of the potentially problematic existing conditions are ultimately accepted and the bridge is slated for replacement.

Pennsylvania’s 1914 Stenton Avenue masonry arch bridge is a good example of a bridge rehabilitation that addressed some modern engineering standards while maintaining the historic character of the structure. Prior to rehabilitation, the masonry arch bridge was in critical condition and classified as structurally deficient. The roadway width and railings were substandard; the height and strength of masonry barriers was inadequate and guardrail connections also fell short of required standards. Rehabilitation activities addressed deterioration of the masonry walls and reconstructed the stone masonry parapets with reinforced concrete cores and full-width moment slab to meet safety needs. However, the substandard roadway width was not addressed.

![Before and after photos of the Stenton Avenue masonry arch bridge rehabilitation project.](image)

Another example of a successful rehabilitation project that balanced engineering needs with preservation is the National Register of Historic Places (National Register)-listed Red Cliff Arch Bridge in Eagle County, Colorado. The 1940 steel deck arch underwent a significant rehabilitation in 2003 to address substandard width, deck, rail, and girders. The project widened and replaced the bridge deck, added shear studs to strengthen the bridge for live loads, replaced girder connections, and cleaned and painted the entire bridge superstructure. The historic character of the bridge was maintained and the project resulted in a finding of no adverse effect.
B. Design exceptions and variances

Design exceptions and variances may be required when rehabilitation to modern engineering standards is not possible, and many states have processes for dealing with this. One response indicated that design exceptions are available but rarely, if ever, an option on bridge projects in their state. However, 16 of the 24 states represented in survey responses reported having such a process, and most confirmed its use for historic bridge projects. The Minnesota DOT has a specific document that provides guidance on how to apply design exceptions and variances to historic bridges. The Vermont DOT has a railing design process for historic bridges or new bridges in historic districts. Maryland’s PA indicates that design exceptions are considered on a case-by-case basis and can be useful in meeting engineering standards for sight distance, vertical and horizontal curve clearances, shoulder widths, and geometric improvements.

The 2012 rehabilitation of the 1922 Willamette River (Oregon City Arch) Bridge serves as an example where exceptions were made to width and approach roadway geometry standards in order to preserve the historic character of the steel through arch structure. Rehabilitation activities consisted of replacing the gunite coating on exterior surfaces, repairing deteriorated concrete and steel members, and replacing the rail with the innovative Oregon DOT “stealth rail.”
Railings are a feature that often requires design exceptions, and Minnesota’s Lester River Bridge serves as a good example. The south railing and spandrel wall section were severely damaged during a collision. A management plan was prepared to guide preservation of the bridge. The design for replacement railing was based on original plans and photographs but modified to include a solid concrete core with stone veneer to meet current safety standards.
3. Assessing the Feasibility of Rehabilitation and Funding Sources

Methods for assessing and documenting the feasibility of historic bridge rehabilitations vary between states. Several states responded that an analysis of the feasibility of rehabilitation is completed as part of the Section 4(f) process; one DOT responded, “For all replacement projects involving historic bridges, we evaluated rehabilitation as an alternative in both the Section 106 and the Section 4(f) process.” An alternatives analysis is conducted as part of the National Environmental Policy Act (NEPA) process and determines the alternatives evaluated under Section 4(f). Other responses regarding the process for assessing the feasibility of rehabilitation are summarized below:

- No formal process – Several survey participants indicated that the process for assessing the feasibility of rehabilitation varies or is inconsistent and decisions about rehabilitation are made on a case-by-case basis though meetings and discussions with engineers, state and federal agencies, and other stakeholders.

- Formal process – Several DOTs reported having formal processes for assessing feasibility. One respondent indicated that their state has a complicated process and provides training on the process for bridge owners. Another response stated that no guidelines existed until recently, when the FHWA instituted a more structured process of establishing the Purpose and Need in consultation with DOT staff prior to preparation of a rehabilitation feasibility analysis report. The Ohio DOT has a Historic Bridge Rehabilitation and Maintenance Manual. The Indiana DOT also has guidance on drafting a Historic Bridge Alternatives Analysis that is submitted to consulting parties as part of the Section 106 process and fulfills requirements of the Historic Bridge Programmatic Section 4(f) Evaluation.

- Historical and engineering data analysis – Several respondents cited analysis of historical and engineering data as the process through which decisions regarding rehabilitation and associated costs are made. One engineering consultant stated that the “project is feasible if bridge can continue to function; cost is secondary.” Other responses cited traffic volumes, accident history, maintenance inspection records, and structural calculations as pertinent to assessing feasibility of rehabilitation. Historical and engineering data are also used in most if not all of the other methods and processes discussed here, including NEPA, but several responses cited this data specifically.

- Feasibility study and cost analysis – Bridge-specific feasibility studies are another mechanism mentioned by respondents. Regarding rehabilitation feasibility analysis reports in their state, one DOT stated that a good report measures the “range of rehab alternatives against well-defined purpose and need” and “provides sufficient engineering analysis to justify conclusions.” One DOT uses a spreadsheet to estimate costs and a planned schedule for certain activities, which makes cost comparisons easier; cathodic protection is one example.
• Expertise of engineers – Several responses mentioned consultation with structural engineers for technical guidance when asked what processes or guidelines they use for assessing the feasibility of rehabilitation.

• Management plans – Several DOTs cited individual bridge management plans as providing guidance on decisions regarding rehabilitation. Development of management plans reflects a proactive rather than reactive approach to rehabilitation and assists bridge owners in planning and budgeting for work. Plans can also help owners take advantage of funding opportunities that arise; projects funded under the American Recovery and Reinvestment Act (ARRA) of 2009 is one example where having a management plan in place enabled quick implementation of rehabilitation activities once funding was available.

The various forms of documentation for developing and conducting feasibility analysis mentioned by survey participants included concept reports, individual feasibility analysis reports, comparative analysis of rehabilitation with the project Purpose and Need, and alternatives studies. One state DOT acknowledged that the documentation process is dictated by the NEPA project class: Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement. The Indiana DOT has guidelines and a template for preparing a Historic Bridge Alternatives Analysis Document, intended to increase consistent quality of documents and streamline the review process. The template outlines the components of the document and the recommended process for preparing such documents. MnDOT provides training on the process of feasibility analysis for bridge owners.

Although not included in survey responses, a 2013 study of Kentucky’s historic bridges was found online. This study created baseline data to improve decisions about replacement or rehabilitation. Stemming from a recent rehabilitation of the 1921 Rockcastle River Bridge, which ended up costing less than replacement, the study concluded that methods and knowledge regarding estimation of rehabilitation costs needs improvement. The study compiled a table for each transportation district based on interviews with bridge engineers that displays the sufficiency rating, historic qualities, effort rating for bridge work (easy to difficult), estimated cost to preserve the bridge, and treatment recommendations (replace, preserve, etc.). The majority of interviewees in this Kentucky example responded that preservation, not replacement, was the best option even with costs ranging from $100,000 to millions of dollars.

A. Funding for historic bridge rehabilitation projects

Funding for historic bridge rehabilitation projects continues to be a challenge and most states report having no special historic bridge funding in place. State and federal transportation funds are still the primary sources for funding rehabilitation projects according to the survey. Some of the programs mentioned by survey participants included standard FHWA assistance and Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Transportation Alternatives Program (TAP).

Funding for non-vehicular bridges, including those converted to pedestrian use or those that are no longer on the state system, is especially challenging due to certain limitations on federal funds. For example, if a bridge receives federal monies and is then converted to pedestrian use, no federal funds beyond the cost
of demolition can be spent on that bridge in the future, regardless of the original construction funding or the amount of previous 23 USC 144(n) expenditures. TAP funding can be used to preserve or rehabilitate bridges in non-vehicular use only when no federal funds were used in the past. Other limitations on federal funding are imposed by executed PAs, such as Indiana’s historic bridge PA that prohibits federal funding for the demolition of historic bridges with “select” status. Despite challenges to fund historic bridge rehabilitation projects, survey respondents mentioned the following funding programs that have had some success in their respective states:

- **Highway Bridge Program (HBP)** – The Washington HBP provides funding for the replacement and rehabilitation of deficient bridges and large preventative maintenance projects in Washington State. The Washington DOT Local Programs sponsors the Bridge Replacement Advisory Committee (BRAC), which provides advice to Local Programs Director to help inform the selection of bridge projects for funding from the HBP.

- **Colorado Bridge Enterprise (CBE)** - The CBE was formed in 2009 as part of Funding Advancement for Surface Transportation and Economic Recovery (FASTER) legislation. The CBE operates as a government-owned business within the Colorado DOT and its purpose is to finance, repair, reconstruct and replace bridges designated as structurally deficient or functionally obsolete, and rate “poor.” A bridge safety surcharge ranging from $13 to $32 has been imposed on vehicle registration based upon vehicle weight. Revenues from the bridge safety surcharge fee are phased in over a three-year period, and are estimated to generate approximately $100 million in annual funding. This program does not include funding for vehicular bridges converted to pedestrian use.

- **Colorado State Historical Fund** – This branch of History Colorado provides grants for historic preservation projects in Colorado using funds generated by gaming.

- **Ohio Credit Bridge Program** – This program is available to local governments who use Federal-aid funds to replace or rehabilitate their bridges. It permits counties and municipalities to replace or rehabilitate a bridge that is not on a Federal-aid highway and receive credit for up to 80 percent of the eligible construction costs. The credit, in turn, serves as the 20 percent non-Federal share for a future Federal-aid bridge project. To be eligible the bridge must meet a series of criteria. One participant noted that this program discourages the application of funds to rehabilitate or repair historic bridges because the Ohio DOT must determine that the project is not controversial, meaning it has minimal environmental impacts and no impacts to National Register-listed or eligible resource.

- **Legacy Amendment Funding through Minnesota Historical Society** – Grants can be applied to historic bridge rehabilitation projects but the funding is often not substantial enough to meet the project funding need.
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- ConnectOregon Program – In 2005 the Oregon Legislature created the Multimodal Transportation Fund to invest in infrastructure improvements. The Fund is part of what is known as the ConnectOregon Program, which provides grants and loans to non-highway transportation projects that promote economic development. The program is funded through lottery-backed revenue bonds and may be used for rehabilitating historic bridges for pedestrian use.

- Historic Bridge Rehabilitation Program – This Montana program applies to a select group of state administered, on-system historic bridges and county or city maintained off-system historic bridges. Off-system bridges are selected by the appropriate city and county governments in consultation with the DOT Administrators, the Environmental Services Bureau historian, and SHPO.

- Treasure State Endowment Program – TSEP is a state-funded program in Montana that has been designed to help address "affordability" by providing grants to lower the cost of constructing public facilities projects, including bridges. The program was authorized by Montana’s voters with the passage of Legislative Referendum 110 on June 2, 1992. The law has been codified as Sections 90-6-701 through 90-6-710, MCA.

- National Historic Covered Bridge Preservation Program – This program was established by Section 1224 of the Transportation Equity Act for the 21st Century (TEA21). The program provided funding to assist state governments with the preservation rehabilitation, or restoration of historic covered bridges. This funding was used for local bridge projects, including a number in Oregon. This federal program was not reauthorized in MAP-21 and is now defunct.

- Adaptive Use Program – The Vermont DOT makes annual appropriations to the Adaptive Use Program to fund the restoration, relocation (if required), and adaptation of all bridges enrolled in the Vermont Historic Bridge Program. Recommended annual appropriation will be $500,000, but amounts may vary depending upon yearly requirements and cost estimates for identified projects. Vermont prepares a detailed manual for Adaptive Use Program to outline methods for identifying and selecting new sites, preparing rehabilitation plans, cleaning and painting bridges, selecting contractors, and other details.

- Vermont Historic Bridge Program – Funding of town-owned historic bridges in vehicular use. The State commits to fund all rehabilitation costs for historic bridges owned by towns that have participation agreements and preservation easements with state.

Survey participants also mentioned special funding challenges posed by historic bridge rehabilitation projects. Finding a qualified recipient that is willing to accept liability and long-term maintenance for the structure once it comes off the state system was the most common challenge. Others included increasing awareness, marketing available sources such as TAP to local entities, and reliance on federal monies for major work.
B. DOT involvement with locally owned historic bridges and the Section 106 process

Involvement of the state DOT in the Section 106 process for locally owned bridge projects varies between states. Most participants indicated that the DOT has some role in the Section 106 process for locally owned bridges and only one DOT responded that they are not involved at any level; the FHWA and localities address Section 106 in that case. One DOT responded that their role for locally owned bridge projects is limited to reviewing documentation and transmitting to the FHWA. Another indicated that their historic bridge database incorporates all bridges through the state, including local and private structures, and that their PA encourages rehabilitation or reuse of locally funded historic bridge projects. In another state, the respondent noted that local agencies get state and federal money for projects and the DOT facilitates compliance with all federal requirements for those projects, including alternatives analysis for Section 106 and Section 4(f).

In other cases the DOT is involved given certain conditions. One respondent stated that involvement varies according to district, with some districts taking a more hands-on approach than others. DOT involvement is also triggered if there is a federal undertaking or permit as cited in several survey responses; otherwise it is the local agency’s responsibility to comply with any applicable regulations. One state DOT referenced its Local Agency Program for technical assistance and funding for such projects. In this case, because funding is through the state, Section 106 compliance is voluntary for the local agency. Another DOT expressed frustration that until very recently the FHWA had been absent from pertinent discussions and had often provided conflicting or insufficient guidance regarding Section 106 and locally owned bridges.

One DOT participant noted that they only assist local sponsors with vehicular bridges, which coincides with the funding shortfall for non-vehicular and off-system bridges mentioned previously. Some participants mentioned that other federal agencies may be involved with locally owned bridge projects using local funds; one DOT indicated that the U.S. Army Corp of Engineers is becoming more engaged on these projects where there is no FHWA funding.
4. **Programmatic Agreements**

Many states have executed PAs that outline the process for complying with federal regulations for cultural resources and implementation of the Federal-Aid Highway Program. A select number of states have PAs (or components of PAs) that focus on the management of historic bridges and provide agreed-upon guidance for meeting regulatory requirements on historic bridge projects. The map below provides a national perspective on the two major types of PAs that have bearing on the rehabilitation and management of historic bridges.

![Map of states with PAs](image)

Thirteen states have Section 106 PAs that include components that pertain to historic bridges that are executed or in draft form. Nine states have PAs specific to historic bridges that address a wide range of issues from inventory and evaluation processes to treatment options and management plans. Louisiana and South Carolina are in the process of drafting a bridge-specific PA. Some PAs summarize previous

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3 The Federal Highway Administration has undertaken past studies of PAs, including an ongoing summary of statewide PAs in its on-line Environmental Review Toolkit as part of a streamlining initiative. Information about PAs was supplemented through survey responses of state DOTs and SHPOs, and solicitation for information from membership of the Historic Bridge Foundation, Historic Bridge Alliance, Transportation Research Board ADC50 Committee, and National Council of State Historic Preservation Offices via list-serves. Other means of collecting information consisted of social media including blogs, Twitter, and LinkedIn.
activities to identify and evaluate historic bridges and others outline a process for completing these activities in the future.

Highlighted below are some elements of executed PAs that provide additional insight into how certain states have systematically addressed issues related to historic bridges.

A. Applicability to non-state-owned bridges

All of the executed PAs apply to state-owned historic bridges, but three of them also include some specific provisions for rehabilitating non-state-owned bridges, including Indiana, Vermont, and Minnesota. Notable findings include:

- Indiana’s PA acknowledges that the FHWA will work with the Indiana DOT and local bridge owners, if applicable, to develop a draft Purpose and Need and alternatives analysis for both “select” and “non-select” historic bridges and to assist local bridge owners in identifying locations for “select” bridges, if required.

- Vermont’s PA charges the Vermont DOT and SHPO to work together in persuading locals to enroll their town-owned bridges into the Vermont Historic Bridge Program. In order to enroll in the program, governing bodies of towns, cities, and villages must execute an agreement document to convey an easement to the state. The Vermont PA includes sample copies of such agreements.

- In Vermont, local bridge owners are required to perform certain routine maintenance and cleaning tasks in exchange for rehabilitation funding. The PA identifies several methods available to the FHWA and DOT for dictating the preservation of town-owned historic bridges. Two examples include active solicitation by the FHWA and DOT of historic bridge participation agreements and preservation easements from towns, cities, and villages that are eligible for inclusion in the historic bridge program and development of financial incentives for the maintenance of town-owned historic bridges.

- In addition to providing direction on identification and evaluation efforts and outlining the review process for historic bridge projects by FHWA, DOT, and SHPO, Minnesota’s PA includes provisions that encourage cooperation with the DOT, SHPO, and local groups to aid in the preservation of non-state-owned historic bridges. Some of the mechanisms for achieving this cooperation include technical guidance, sharing of GIS data, training maintenance staff, or assistance in drafting individual local bridge management plans.

B. Process for evaluating alternatives and the feasibility of rehabilitation

The level to which historic bridge PAs address the process for evaluating rehabilitation alternatives and feasibility varies between the PAs. Some PAs cite individual management plans for guidance on historic bridge rehabilitation and assessing the feasibility of rehabilitation while some states have already created management plans. Prior to execution of their PAs, Minnesota developed management plans for 24 state-owned historic bridges and Maryland for 17 of its priority bridges. Other states include development
of these plans as part of their PA and its implementation. Approaches to evaluating alternatives and their feasibility identified in reviewed PAs include:

- In Ohio, rehabilitation is the preferred alternative until proven infeasible or not prudent; only then are other alternatives considered. According to Ohio’s PA, alternatives that must be considered include a one-way pair, which includes rehabilitation of the historic bridge, bypass, and relocation if rehabilitation is found infeasible or not prudent.

- New Mexico’s PA lists six alternatives that must be considered at a minimum with preference for those that preserve the bridge in place. These alternatives include the following: (a) no build; (b) minor structural rehabilitation to historic bridge for continued vehicular use; (c) reduce traffic volumes on historic bridge; (d) bypass and preserve historic bridge in place; (e) relocate historic bridge; and (f) replace historic bridge.

- Maryland’s PA lists five alternatives to consider for preservation priority bridges prior to selecting a replacement alternative. The PA goes one step further by requiring development of an alternative management plan for historic bridges that are bypassed or relocated so that the bridge can continue to function for pedestrian use or another type of facility.

- Indiana’s PA outlines a rather detailed project development process for its “select” and “non-select” historic bridges. The FHWA and DOT work together, and with local owners as applicable, to draft a Purpose and Need statement and alternatives analysis. The PA outlines a hierarchy of options that must be considered during this process; rehabilitation for vehicular must be thoroughly evaluated until other options are considered.

- Indiana’s PA also charges Indiana DOT with developing a document entitled “Standards for Rehabilitation of Bridges on Low-Volume Roads” that will reside in the agency’s design manual and assist in evaluating if rehabilitation of a historic bridge for continued vehicular use is feasible and prudent.

Additional factors in evaluating rehabilitation alternatives are future maintenance and life-cycle costs. Survey participants were asked if there is concern whether such costs are sometimes elevated to make rehabilitation seem not prudent and responses were mixed. Five participants indicated that this is not a concern in their state. One participant responded, "Maintenance costs are generally low compared to first cost. Life-cycle costs generally do not drive the decisions, so the concern is not there. Preference is to minimize maintenance, but does not drive decisions."

In other states, elevated future maintenance and life-cycle costs are a concern. The Minnesota FHWA has decided that future maintenance and life-cycle costs will not be included in rehabilitation studies or Section 4(f) evaluation of what is prudent due to concerns about elevated costs. Based on other responses, painting large trusses is commonly an elevated life-cycle cost item and elevated costs tend to appear on county projects or smaller structures. One state acknowledged that the life-cycle costs have
been used in arguments against rehabilitation and that it has been accepted that the cost of rehabilitation and maintenance exceeds the cost of a new bridge in the long run.

Two states acknowledged that maintenance and life-cycle costs have not been effectively documented in their state, one stating that they have a “major issue in documenting future maintenance and life-cycle costs.” On respondent noted, “life-cycle cost estimates often simply noted as 100 year life for new bridge with no maintenance costs yet will spell out a 25-50 year cost for historic bridge maintenance. Costs don’t take into account foreseeable local demographic and economic adjustments that may affect maintenance costs.” Another response stated that these estimates assume a 100-year life cycle on the new bridge, which make the cost of rehabilitating and maintaining a historic bridge seem not prudent. “Over the course of 100 years a truss bridge will require two major rehabs that will typically add up to more than the cost of a replacement bridge, including factoring in on-going maintenance on the new bridge.”

C. Funding

PAs tend to address funding only when there is a specific program within the state for historic bridge rehabilitations. Findings from the review include:

- Two PAs address funding in a general sense and offer suggested approaches to obtaining and facilitating funding. Ohio emphasizes partnerships among the ODOT Office of Local Projects, ODOT District offices, FHWA, SHPO, and ODOT_OES to assist in the facilitation of historic bridge project funds and assist local bridge owners and agencies in applying for available funding. Montana’s PA encourages Community Transportation Enhancement Program (CTEP) and Treasure Endowment Program (TEP) funds for the preservation and rehabilitation of eligible bridges.

- Maryland’s PA does not speak to general funding for historic bridge rehabilitation projects but does address funding for 17 bridges selected as high priority for future preservation in that state using traditional funding sources and additional state and federal funding as needed.

- Vermont’s PA outlines its Historic Bridge Program through which rehabilitation projects for all historic town-owned bridges enrolled in its program are undertaken. The bridges must remain in vehicular use and in return for funding, the town must conduct several specified routine maintenance and cleaning activities.

D. Public outreach and education

All reviewed PAs include language that pertains to outreach efforts and mechanisms for educating the public and those involved or interested in historic bridge rehabilitations. The types of outreach included in reviewed PAs varies and typically relates to required coordination for regulatory processes, the need for training and technical guidance on bridge rehabilitation projects, information sharing, or stewardship of historic bridges beyond project completion. Some PAs address public outreach in terms of what is required for processes like the National Environmental Policy Act (NEPA) and Section 106. Notable example include:
• Technical guidance for practitioners through activities like training for bridge maintenance personnel, workshops and seminars, and retention of staff, in the case of DOTs, with expertise in bridge rehabilitations to serve as resources for future projects.

• Educational components that promote both information sharing and continued stewardship of historic bridges. For example, Ohio’s PA charges the DOT with exploring events and organizations to share its data with and that can help promote its research findings, historic bridge inventory results, programs, and overall interest in the state’s engineering heritage. Vermont’s PA stipulates development of a cooperative plan for heritage tourism with the Department of Tourism and Marketing to foster public appreciation of historic bridges.

• New websites, updates to existing websites, and the creation of historic bridge databases for future use.

• Public outreach as part of a historic bridge program. Vermont’s PA commits the DOT and SHPO to scheduling meetings with local officials and engineers, hold workshops and seminars, and distribute preservation plans and maps related to historic bridges as part of the Vermont Historic Bridge Program.