Management Plan for Historic Bridges Statewide

Prepared for

Louisiana Department of Transportation and Development

Prepared by

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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BDEM	Bridge Design and Evaluation Manual
FAST	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
IS&P	Iron and Steel Preservation
LADOTD	Louisiana Department of Transportation and Development
LASHPO	Louisiana State Historic Preservation Office
LTRC	Louisiana Transportation Research Center
NEPA	National Environmental Policy Act
NHPP	National Highway Performance Program
NHS	National Highway System
NPI	National Preservation Institute
NPS	National Park Service
PA	*Programmatic Agreement among the Federal Highway Administration, the Louisiana Department of Transportation And Development, the Advisory Council on Historic Preservation, and the Louisiana State Historic Preservation Officer Regarding Management of Historic Bridges in Louisiana*
STPG	Surface Transportation Block Grant Program

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Executive Summary

This *Management Plan for Historic Bridges Statewide* (Statewide Historic Bridge Plan) provides guidance to bridge owners on how to undertake preservation activities for Louisiana's historic bridges with the purpose of encouraging their continued use. The Statewide Historic Bridge Plan is part of the *Statewide Historic Bridge Inventory* completed by the Louisiana Department of Transportation and Development (LADOTD), in coordination with the Louisiana State Historic Preservation Office (LASHPO) and the Federal Highway Administration (FHWA), to study historic bridges throughout the state and develop a process to manage and preserve historic bridges.

Completion of the Statewide Historic Bridge Plan in conjunction with individual management plans for certain bridges fulfills terms of the *Programmatic Agreement among the Federal Highway Administration, the Louisiana Department of Transportation And Development, the Advisory Council on Historic Preservation, and the Louisiana State Historic Preservation Officer Regarding Management of Historic Bridges in Louisiana* (PA), executed on September 21, 2015. The PA provides treatment categories and the basis for their management for the 20-year term of the agreement. The PA can be found at http://wwwapps.dotd.la.gov/administration/public_info/projects/docs_test/48/documents/Executed_Programmatic_Agreement.pdf.

In accordance with the PA, bridge owners seeking state or federal funding for bridges in the Preservation Priority Bridge treatment category will be required to follow the guidance outlined in the Statewide Historic Bridge Plan, which is incorporated into individual management plans for these bridges. The guidance in this Statewide Historic Bridge Plan, however, is applicable to any of the historic bridges in other treatment categories where an owner is seeking to undertake preservation activities on a historic bridge.

Major components of this Statewide Historic Bridge Plan include:

- Section 1 – Background on historic bridge preservation, including the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (Secretary's Standards) and the collaborative team approach in assessing the preservation alternatives when undertaking preservation activities on historic bridges.

- Section 2 – Technical guidance on preventative maintenance and rehabilitation activities, cost estimating, design exceptions, and bridges located on very low-volume local roads (average daily traffic ≤ 400) to assist in the development of recommended preservation activities.

- Section 3 – Resources to be used with this Statewide Historic Bridge Plan including reports, guidelines, and manuals; sources of funding; historic bridge training; and agency contacts to assist in historic bridge preservation projects.

Mead & Hunt, Inc. (Mead & Hunt) prepared this Statewide Historic Bridge Plan and will prepare individual management plans for Preservation Priority Bridges in 2016-2017 under contract to the LADOTD. The LADOTD, FHWA, and LASHPO reviewed and provided input into the Statewide Historic Bridge Plan. This Statewide Historic Bridge Plan is informed by Mead & Hunt's more than 20 years of experience working with state transportation agencies and other bridge owners on historic bridges across the country.

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1. Background

A. Project history

The LADOTD, in coordination with the LASHPO and FHWA, commissioned a project to study historic bridges throughout the state and develop a process to manage and preserve these valued resources. In 2013-2015 a team of bridge engineers and bridge historians from Mead & Hunt worked with these agencies and other interested parties to complete the *Statewide Historic Bridge Inventory*.

As part of the *Statewide Historic Bridge Inventory*, Mead & Hunt conducted research on the history of Louisiana bridges, field surveyed certain bridges constructed through 1970, and recommended bridges that meet the National Register of Historic Places (National Register) criteria for listing in the National Register. An important background document is the *National Register Eligibility Determination Report: Pre-1971 Louisiana Highway Bridges* (Mead & Hunt, Inc., September 2013), which identifies the state's historic bridges.[1] Historic bridges are those that have been formally listed in or determined eligible for listing in the National Register. A glossary of terms is provided as Appendix A to this Statewide Historic Bridge Plan.

The FHWA determined, and the LASHPO concurred, that 150 historic bridges are present in Louisiana. The LADOTD owns 75 percent of the state's historic bridges, while local agencies and others (including cities, parishes, and other state and local agencies) own the remaining 25 percent. Of the 150 historic bridges, 121 are subject to the PA (see Attachment 1 of the PA). Another 29 historic bridges are not addressed by the PA, but are instead subject to separate review under Section 106 of the National Historic Preservation Act (Section 106); this review is in progress for certain bridges. These 29 bridges are listed in Attachment 3 of the PA. The guidance in this Statewide Historic Bridge Plan, however, is applicable to any of the 150 historic bridges where an owner is seeking to preserve the bridge.

The *Statewide Historic Bridge Inventory* identified historic bridges suitable for preservation through the application of a methodology balancing engineering and historical considerations to categorize the preservation potential of Louisiana's historic bridge population. As a result, historic bridges were placed into one of three treatment categories.

- Preservation Priority Bridges: Historic bridges that will be retained in long-term use and will be subject to preventative maintenance, preservation, and rehabilitation, as needed. Individual management plans for Preservation Priority Bridges were concurrently developed with this Statewide Historic Bridge Plan for their long-term use.

- Preservation Candidate Bridges: Historic bridges designated for preventative maintenance, preservation, and rehabilitation, when prudent and feasible.

- Non-Priority Bridges: Historic bridges that are not ideal candidates for long-term use and are eligible for replacement when needed.

[1] See Section 3.A for more information on this and other pertinent reports, guidelines, and manuals, including links to access the documents electronically.

The methodology and results are presented in another important background report titled *Results: Application of the Methodology to Identify Preservation Priority Bridges* (Mead & Hunt, Inc., April 2014; updated July 2015).

The *Statewide Historic Bridge Inventory* culminated with the PA executed on September 21, 2015, which can be found at http://wwwapps.dotd.la.gov/administration/public_info/projects/docs_test/48/documents/Executed_Programmatic_Agreement.pdf. The PA aides in future preservation efforts by setting forth procedures for project planning and reviews and by outlining commitments for the preservation of historic bridges. These commitments include the development of this Statewide Historic Bridge Plan and the preparation of individual management plans. Under contract to the LADOTD, Mead & Hunt will prepare 24 individual management plans for 33 Preservation Priority Bridges. One individual management plan will cover nine bridges in City Park in New Orleans. These individual management plans will be prepared in 2016 and early 2017 and will serve to guide bridge owners undertaking preservation projects so that work adheres to the Secretary's Standards.

B. Secretary of the Interior's Standards

The Secretary's Standards set the foundation for preservation activities and guidance outlined in this Statewide Historic Bridge Plan. The Secretary's Standards are a series of concepts related to maintaining, repairing, and replacing historic materials and designing new additions or altering a historic property in a way that retains its historic integrity. There are four approaches to the treatment of historic properties provided in the Secretary's Standards: Preservation, Rehabilitation, Restoration, and Reconstruction.

The Secretary's Standards for Rehabilitation and Preservation provide the basis for this Statewide Historic Bridge Plan's recommended treatments for historic bridges. The Secretary's Standards for Restoration and Reconstruction are less useful because bridges need to fulfill an ongoing transportation function and these standards allow fewer changes. As a result, Secretary's Standards for Preservation and Rehabilitation are provided.

As defined by the National Park Service (NPS), preservation is defined as:

> The act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.[2]

Rehabilitation is defined as "the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its

[2] National Park Service, "Preservation as a treatment," Technical Preservation Services, available at http://www.nps.gov/tps/standards/four-treatments/treatment-preservation.htm.

historical, cultural, or architectural values."[3] The Secretary's Standards for Rehabilitation acknowledge the need to alter and/or make additions to a historic property to meet continuing or changing uses while retaining the property's historic character. As such, the Secretary's Standards for Rehabilitation provide the most appropriate guidance for historic bridges where repairs are required.

The Secretary's Standards have been interpreted and applied largely to buildings rather than engineering structures. Because of this, the Virginia Transportation Research Council adapted the Secretary's Standards to address the special requirements of historic bridges. The LADOTD, like many bridge owners, has embraced Virginia's version of the Secretary's Standards. Table 1 illustrates each individual standard's relationship to the Standards for Preservation and Rehabilitation.

Table 1. Secretary of the Interior's Standards for the Treatment of Historic Properties, as Adapted for Historic Bridges

	Individual Standards	Included in Standards for Preservation	Included in Standards for Rehabilitation
1	Every reasonable effort shall be made to continue an historic bridge in useful transportation service. Primary consideration shall be given to rehabilitation of the bridge on site. Only when this option has been fully exhausted shall other alternatives be explored.	Yes	Yes
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 feature should be avoided.	Yes	Yes
3	All bridges shall be recognized as products of their own time. Alterations that have no historical basis and that seek to create a false historical appearance shall not be undertaken.	Yes	Yes
4	Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.	Yes	Yes
5	Distinctive engineering and stylistic features, finishes, and construction techniques or examples of craftsmanship that characterize an historic property shall be preserved.	Yes	Yes
6	Deteriorated structural members and architectural features shall be retained and repaired, rather than replaced. Where the severity of deterioration requires replacement of a distinctive element, the new element should match the old in design, texture, and other visual qualities and where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.	Yes	Yes
7	Chemical and physical treatments that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the most environmentally sensitive means possible.	Yes	Yes

[3] National Park Service, "Rehabilitation as a treatment," Technical Preservation Services, available at http://www.nps.gov/tps/standards/four-treatments/treatment-rehabilitation.htm.

Table 1. Secretary of the Interior's Standards for the Treatment of Historic Properties, as Adapted for Historic Bridges

	Individual Standards	Included in Standards for Preservation	Included in Standards for Rehabilitation
8	Significant archaeological and cultural resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.	Yes	Yes
9	New additions, exterior alterations, structural reinforcements, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.		Yes
10	New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.		Yes

The Secretary's Standards are not technical or prescriptive, but are intended to promote responsible preservation practices by providing advice and consistency to the work on historic bridges in Louisiana. They are to be used by anyone involved in historic bridge preservation projects. Since the terms "preservation" and "rehabilitation" may have a different meanings between bridge engineers and bridge historians, the next section provides a discussion of the differences in the use of these terms between these two professionals.

C. Collaborative team

Historic bridge preservation is most successfully accomplished through the efforts of a collaborative team including a bridge engineer and a qualified professional bridge historian (bridge historian).[4] This Statewide Historic Bridge Plan reflects this approach in which a bridge engineer is paired with a bridge historian and major steps, including field survey, assessing preservation alternatives, and developing recommendations for preservation activities, are conducted jointly. Formation of a collaborative team fosters ongoing dialogue between the engineering and historical perspectives to meet the purpose and need of a historic bridge project. The LADOTD provides expertise for historic bridge projects through experienced in-house engineering staff or through the use of consultants experienced in historic bridge projects. Further, the LADOTD ensures that work involving historic bridges is reviewed by a qualified professional historian who meets the Secretary's Standards. These personnel are responsible for executing historic bridge projects for the LADOTD and providing guidance to non-LADOTD owners following the guidance in this Statewide Historic Bridge Plan.

[4] A qualified professional historian is a person who meets the relevant standards outlined in the Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines at http://www.nps.gov/history/local-law/arch_stnds_9.htm. See *Role of the bridge historian* below for more information.

During the field survey, the historian visually examines the structure, comparing the current physical condition to the bridge's documented description and historical significance. At the same time, the bridge engineer compiles structural engineering data about the bridge that is obtained through the LADOTD's inspection process, in addition to visually examining the structure. Next, the bridge historian and bridge engineer review the purpose and need, assess the condition of the bridge, assess preservation alternatives, and complete the alternatives analysis, if applicable, within the framework of the Secretary's Standards. Recommendations for needed preventative maintenance and rehabilitation are then brought together into a plan for the bridge's future through this collaborative team approach.

In working collaboratively, it is important to keep in mind the technical vocabulary that different professionals may use. In particular, bridge historians and bridge engineers have different definitions for commonly used terms applied to treatments for historic bridges, which indicate differences in perspectives. The technical vocabulary of "preservation" and "rehabilitation" are examples of key terms common to both bridge engineers and bridge historians. Understanding the differences between these professional viewpoints is vital to effective communication and collaboration on historic bridge preservation projects. The technical definitions used by bridge engineers reflect a focus on functionality, service life, safety, and structural integrity of historic bridges. The technical definitions used by bridge historians reflect a focus on identifying and protecting features that convey historical significance and includes assessing a project's impacts on historic integrity. Table 2 highlights key terms to illustrate the different perspectives between a bridge historian and bridge engineer encountered during historic bridge projects.

Table 2. Differences in key terms between the bridge historian and bridge engineer

Bridge historian's definition[5]	Bridge engineer's definition[6]	Differences in perspective
Preservation – The act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction.	Preservation – The act or process of preventing, delaying, or reducing deterioration of bridges or bridge elements; restoring the function of existing bridges; keeping bridges in good condition; and extending their life. Preservation can be achieved through preventative maintenance or rehabilitation activities.	Guided by the Secretary's Standards, bridge historians focus on long-term retention of historic materials. Bridge engineers focus on maintaining functionality and meeting safety and capacity requirements. Preservation activities from an engineering perspective may involve modifications or additions to original parts of the historic bridge, which may not be considered "preservation" to bridge historians.

[5] Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings, available at http://www.nps.gov/tps/standards.htm. Standards and guidelines provided by the NPS are intended to promote responsible preservation practices.

[6] Federal Highway Administration, *Bridge Preservation Guide: Maintaining a State of Good Repair Using Cost Effective Investment Strategies*, August 2001. Available at http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf.

Table 2. Differences in key terms between the bridge historian and bridge engineer

Bridge historian's definition[5]	Bridge engineer's definition[6]	Differences in perspective
Rehabilitation – The act or process of returning a property to a state of utility and making a possible compatible use for a property through repair, alterations, and additions which makes possible an efficient contemporary use while preserving these portions or features which convey its historical, cultural, or architectural values	Rehabilitation – The act or process of completely restoring bridge elements or components to improve structural integrity and correct major safety defects. Per FHWA, rehabilitation is one of two preservation activities, the other being preventative maintenance.	Guided by the Secretary's Standards, bridge historians focus on a combination of retention and repair of historic materials to maintain the overall historic character of the bridge. Replacement of historic materials may be permitted if retention and repair are not feasible. Bridge engineers focus on safety, capacity, and functionality requirements. Rehabilitation activities from an engineering perspective may involve replacement or major repairs, and strengthening of bridge components, which may not be considered "rehabilitation" to bridge historians.

More detail about the respective roles for the bridge historian and bridge engineer is provided below. Relevant standards, guides, and manuals to assist the bridge historian and bridge engineer are listed in Section 3.A. A glossary of key terms is provided in Appendix A.

D. Role of the bridge historian

The role of the bridge historian is to understand and describe the significance of the bridge in order to guide its preservation in a manner consistent with the Secretary's Standards. To do so, the bridge historian identifies the character-defining features and historic fabric of the bridge, and then works with the bridge engineer in the development of recommended preservation activities. The desired outcome is to preserve and maintain character-defining features and historic fabric by avoiding, reducing, or minimizing impacts on historic integrity. The LADOTD requires that the bridge historian reviewing the work on historic bridges be a qualified professional who meets the relevant Secretary's Standards.[7]

The bridge historian is guided by the National Register documentation that has been prepared for a specific bridge, the Secretary's Standards, and relevant NPS Preservation Briefs. In particular, the bridge historian identifies character-defining features and historic integrity of the bridge. Important background is found in the statement of significance for each bridge as documented on its Historic Bridge Inventory form; see the *National Register Eligibility Determination Report: Pre-1971 Louisiana Highway Bridges* (Mead & Hunt, Inc., September 2013). A discussion of these and other relevant standards, guides, and manuals to assist the bridge historian are listed in Section 3.A. In isolated cases, other historical documentation, such as a National Register listing, may also be available.

[7] See Secretary of the Interior's Standards and Guidelines at http://www.nps.gov/history/local-law/arch_stnds_9.htm.

(1) Identifying character-defining features

The character-defining features are prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Such features may include materials, engineering design, and structural and decorative details that are essential to a bridge's historic identity. Under *Criterion A*, physical features that convey the bridge's appearance during the historic period would be considered character-defining. Under *Criterion C*, character-defining features are those that convey a bridge's distinctive design or method of construction.

Because many historic bridges are significant under *Criterion C* as examples of their bridge type, such as metal truss, concrete arch, or a steel beam and girder, the superstructure of a bridge is often a character-defining feature in itself. Smaller elements of the bridge and architectural detailing on elements such as piers, abutments, lighting, and railings may also be character-defining features. Site and setting may be considered character-defining features when they are major elements contributing to the significance of a bridge. Elements of the bridge that are not identified as character-defining features may be historic fabric. Historic fabric is material in a bridge that was part of original construction. It is important to consider both character-defining features and the bridge's historic fabric when planning a project. For Preservation Priority Bridges, character-defining features and historic fabric have been identified in the individual management plans.

(2) Assessing and maintaining historic integrity

The desired outcome is to preserve and maintain character-defining features and historic fabric by avoiding, reducing, or minimizing impacts on historic integrity while following the Secretary's Standards. Historic integrity is defined as the authenticity of a bridge's historic identity, which is evidenced by the survival and/or restoration of character-defining features and historic fabric that existed during the bridge's historic period. To assess and maintain historic integrity, the bridge historian works with the bridge engineer to identify preventative maintenance and rehabilitation activities that will not impair the seven aspects of integrity (location, setting, materials, design, workmanship, feeling, association), as defined by the National Register Bulletin *How to Apply the National Register Criteria for Evaluation*.[8]

An important step in assessing integrity is determining which aspects of integrity are important to the bridge's significance. In assessing integrity, the proposed degree of change is weighed against the nature and degree of its engineering or historical significance. The retention of specific aspects of integrity is paramount for a property to convey its significance under National Register criteria. The historic integrity of a bridge will be retained if most, if not all, of important aspects of integrity are retained and work meets the Secretary's Standards.

E. Role of the bridge engineer

The role of the engineer is to confirm and assess the transportation needs and the physical condition of the bridge. The bridge engineer works with the bridge historian to develop recommended preservation activities, which may be preventative maintenance activities and/or rehabilitation activities. To implement preventative maintenance projects, the bridge owner will typically employ its own forces, usually without

[8] The National Register Bulletin *How to Apply the National Register Criteria for Evaluation* is available at http://www.nps.gov/nr/publications/bulletins/nrb15/.

the need for plans, specifications, and estimates. To implement rehabilitation projects, the bridge engineer (either LADOTD bridge engineers or bridge engineers from consultants hired by the LADOTD) will prepare plans, specifications, and estimates. The rehabilitation project will then be let for construction following the LADOTD standard process for letting projects for construction.

The LADOTD requires that the bridge engineer or the bridge engineer overseeing or supervising the work on historic bridges complete the Louisiana historic bridge training course, which was established under terms of the PA (see Section 3.C).

To assess the transportation needs of individual bridges, the bridge engineer is guided by general bridge information found in conventional sources such as design plans, construction plans, as-built drawings, inventory and inspection reports, and related engineering studies. In addition to this information, assessing the condition of the bridge and development of plans, specifications, and estimates should utilize relevant standards, guides, and manuals listed in Section 3.A. In particular, factors related to the transportation needs, function, and condition of a bridge have previously been assessed as reported in *Results: Application of the Methodology to Identify Preservation Priority Bridges* (Mead & Hunt, Inc., April 2014; updated July 2015).

(1) Assessing transportation needs at the site

As an integral component of a transportation network, a bridge must permit the safe passage of goods and people on the highway system. This includes adequate geometrics (such as clear deck width and minimum vertical clearance), adequate live load capacity (inventory and operating ratings), adequate roadway approaches to the bridge, guardrail at bridge approaches, and adequate safety features (such as barrier railings). Requirements for some of the design parameters vary with Average Daily Traffic (ADT) volumes, posted speed limit, and other variables such as availability of alternate detour routes, protection for piers in waterways, and proximity to railroads. Limited deviations from the LADOTD's standard design requirements, known as design exceptions, may be granted as presented in Section 2.E. Data for traffic crashes (including type, severity, and frequency) in the vicinity of the bridge should also be reviewed. If the number of crashes is unusually high, the engineer should evaluate the features of the bridge for contributing factors. In cases where truck traffic is greatly influencing roadway safety or the bridge's structural capacity cannot be increased to facilitate heavy truck posting loads, the presence of an alternate route with minimal detour length for heavy trucks may make it easier to receive design exceptions.

(2) Assessing bridge condition

The assessment of the bridge's physical condition follows procedures used for conventional bridge inspection as described in the relevant reports, guidelines, and manuals to the bridge engineer (see Section 3.A). Many site- and bridge-specific characteristics should be combined to evaluate the condition of the bridge to evaluate alternatives and develop recommended preservation activities. Assessment relies on the existing data in *Results: Application of the Methodology to Identify Preservation Priority Bridges* (Mead & Hunt, Inc., April 2014; updated July 2015), especially the additional consideration forms in Appendix C, and on available inspection reports. Access to all areas of the structure during the field survey may not be possible without specialized equipment to reach the underside of the bridge or the upper members of truss spans. Traffic control signage and equipment may be necessary to safely maintain traffic on or under the bridge during the bridge condition assessment.

(3) Developing plans, specifications, and estimates

For bridge rehabilitation projects, the development of plans, specifications, and estimates will follow the guidance and requirements as described in the relevant reports, guidelines, and manuals available to the bridge engineer. See Section 2.C for recommended rehabilitation activities. The preparation of plans, specifications, and estimates for bridge rehabilitation projects will be done in accordance with the LADOTD's standard processes for letting projects to construction. This process can be done by LADOTD bridge engineers or by bridge consultants hired by the LADOTD.

For preventative maintenance projects, the work required is often performed by the LADOTD or other owner's maintenance personnel, typically without the need for specific plans, specification, and estimates. See Section 2.B for recommended preventative maintenance activities. The bridge engineer also develops cost estimates for recommended preventative maintenance and rehabilitation activities. Cost estimates are discussed in Section 2.D.

During plan development, the LADOTD or owner submits the project description and plans for necessary reviews under Section 106. The PA specifies when such reviews are required and provides the procedures to follow. These procedures have been incorporated into the Bridge Design and Evaluation Manual (BDEM). Chapter 4.2 – Historic Bridges of the BDEM outlines relevant stipulations in the PA that apply to bridge design and maintenance and provides the procedures to follow for projects (also referenced in Section 3.A).

Generally, rehabilitation projects that follow the guidance in this plan will meet the Secretary's Standards and result in a no adverse effect under Section 106. In rare cases it is anticipated that a project will result in an adverse effect under Section 106 due to alterations to a bridge that are needed to meet a specific purpose or need. The PA provides for such cases and requires that the project be planned and undertaken in an effort to minimize harm to the historic bridge.

F. Assessing preservation alternatives

In this step, the information assembled by the collaborative team during field survey is used to assess the preservation alternatives for the continued present and anticipated future use of a historic bridge to meet the purpose and need of a historic bridge project. The preferred approach for preservation projects and what is required for Preservation Priority Bridges is to retain the historic bridge for continued vehicular use in its original location. Bridges in other treatment categories, however, may have been designed with widths and load limits that cannot be adapted to current design standards without major alterations. In those cases, less-preferred preservation alternatives (discussed below) may be required to ensure a bridge's preservation and long-term use.

(1) Treatment categories

The three treatment categories and various preservation alternatives available to historic bridges within each category are described below. This Statewide Historic Bridge Plan focuses on Preservation Priority Bridges. When completing the alternatives investigation for projects affecting Preservation Candidate Bridges, follow the detailed procedures in the PA. Alternatives considered for the future use of a

Preservation Candidate category may be considered for Non-Priority Bridges at the owner's discretion. Table 3 describes the treatment categories and summarizes alternatives to be considered and recommended preservation activities for each category.

Table 3. Summary of treatment categories, alternatives, and preservation activities

Treatment category	Alternatives to be considered	Recommended preservation activities
Preservation Priority – includes historic bridges that will be retained in long-term use and will require preventative maintenance and rehabilitation	• Rehabilitation – for continued vehicular use on-site • Rehabilitation – for use in one-way pair	Apply the guidance contained in this Statewide Historic Bridge Plan and the individual bridge management plan once available for the bridges in this category
Preservation Candidate – includes historic bridges designated for preventative maintenance and rehabilitation activities, when prudent and feasible	• Rehabilitation – for continued vehicular use on-site • Rehabilitation – for use in one-way pair • Bypass and adaptive reuse – for non-vehicular use • Replacement	If it is determined that rehabilitation of a Preservation Candidate Bridge is prudent and feasible, the guidance on preventative maintenance and rehabilitation activities in this Statewide Historic Bridge Plan will apply
Non-Priority – historic bridges that are not ideal candidates for long-term use and are eligible for replacement when needed	N/A – The bridge owner will continue to maintain Non-Priority Bridges in accordance with standard LADOTD practices	This Statewide Historic Bridge Plan provides guidance on appropriate preventative maintenance and rehabilitation activities that may be used for these historic bridges at the owner's discretion

(2) Preservation alternatives

The preservation alternatives are outlined below. For Preservation Priority Bridges, also refer to Attachment 4A - Procedures for Projects Affecting Preservation Priority Bridges in the PA for specific procedures that must be followed. For Preservation Candidate Bridges, refer to Attachment 4B – Procedures for Projects Affecting Preservation Candidate Bridges in the PA for specific procedures that must be followed.

Rehabilitation – for continued vehicular use at its current location on-site

This is the preferred treatment because it represents the best combination of retaining historical features while meeting transportation needs. It can be less expensive than other alternatives, including construction of a new bridge. A bridge is a good candidate for on-site rehabilitation if it can continue to fulfill a transportation need without extensive alteration or loss of its significant historic features. To continue in vehicular use at its current site, a bridge must meet the current and projected transportation needs. In this alternative, existing geometrics of the bridge and original character-defining features and historic fabric are retained to the maximum extent possible.

Rehabilitation for use in one-way pair of bridges – rehabilitation of historic bridge and construction of an adjacent bridge on a new alignment; both bridges used as one-way pair

This alternative allows the bridge to remain in its current location, but with reduced transportation requirements in order to avoid major and unacceptable alterations to historic features. In this alternative, demands on the bridge may be reduced by making it one of a pair of bridges, each of which could serve traffic in one direction, or by rerouting heavy truck traffic. For this alternative, a new bridge would be

constructed adjacent to the historic bridge to serve additional traffic. For example, an existing historic two-lane bridge would carry one-direction traffic with the twin structure carrying traffic in the other direction.

Bypass and adaptive reuse for non-vehicular use on site and new bridge – rehabilitation of historic bridge and adaptation for non-vehicular use, such as pedestrian, bicycle, or equestrian use; new bridge constructed to meet project purpose and need

If a bridge cannot be rehabilitated to accommodate vehicular traffic at its original site, adaptation for non-vehicular use, such as pedestrian, bicycle, or equestrian use, is considered. In this alternative a new bridge is constructed to meet project purpose and need and the historic bridge is bypassed, but retained at its current location for less demanding use. The U.S. Coast Guard should be consulted to determine that the bridge will be allowed to remain in place. The bridge would need to be rehabilitated to meet the less demanding needs, such as structural capacity for non-vehicular traffic or lightweight vehicular traffic (such as pickup trucks or sport utility vehicles used for maintenance purposes), geometric considerations, and compatibility with the adjacent properties at each end of the bridge. State or local agencies interested in assuming ownership of a historic bridge for the purpose of adaptive reuse should have a strong commitment to preservation and be willing to assume ownership and maintenance responsibilities.

Replacement – for purposes of cost comparison, replacement of the bridge to meet project purpose and need is evaluated

This alternative is the complete removal and replacement of the bridge with a new bridge. If, following the investigation of alternatives, it is determined that a Preservation Candidate Bridge needs to be removed and replaced, additional steps outlined in the PA shall be followed for possible relocation. It may be possible to reuse a bridge at a new location, such as on a private road, or other less-demanding vehicular or non-vehicular route. A site over water where the bridge serves a transportation function, such as carrying a pedestrian trail, is more desirable than a non-transportation site. Individuals, organizations, and state or local agencies may be interested in assuming ownership of a historic bridge if they have a need for a bridge or have a strong commitment to preservation.

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2. Recommended Preservation Activities

The preventative maintenance and rehabilitation needs for a specific bridge are directly related to the recommended future use discussed in the previous section. This portion of the Statewide Historic Bridge Plan provides technical guidance on preventative maintenance and rehabilitation activities that are broadly applicable to historic bridges, along with other applicable considerations. These include the use of design exceptions, special considerations for bridges located on very low-volume roads (ADT ≤ 400), and guidance for cost estimating.

Preventative maintenance and rehabilitation activities are organized according to the FHWA's bridge preservation classification shown in Figure 1.[9] The FHWA's classification of bridge preservation encompasses rehabilitation and preventative maintenance, including the two types of preventative maintenance activities (cyclical and condition based). Replacement is not a preservation activity and is not to be considered as an alternative for Preservation Priority Bridges under the terms of the PA.

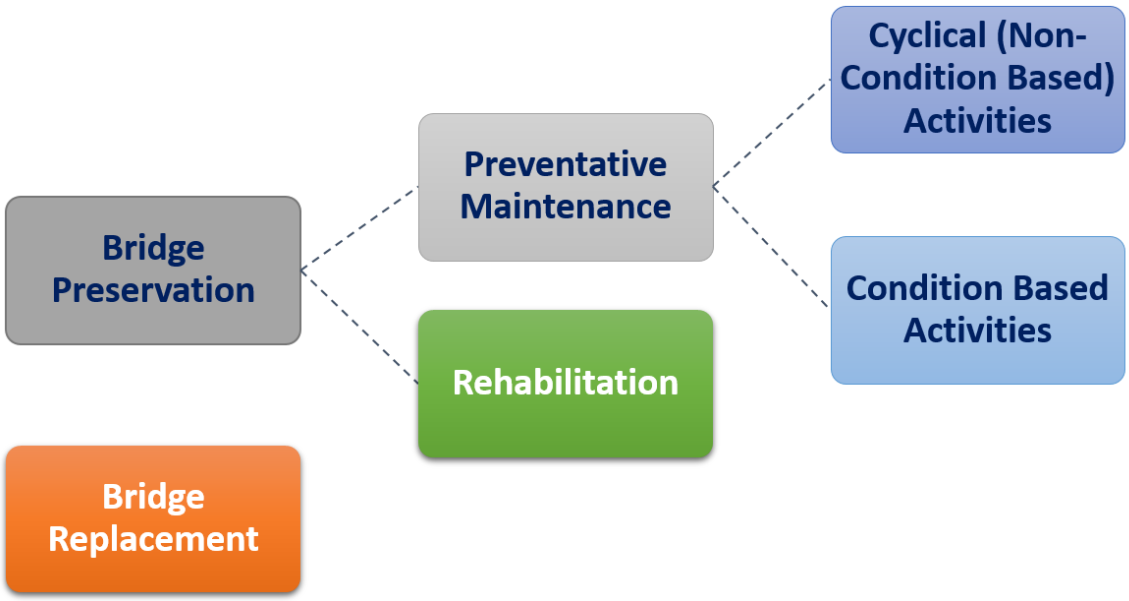


Figure 1. FHWA bridge preservation classifications.

Some preventative maintenance and rehabilitation needs are obvious and can be readily observed at the site or found in inspection reports (e.g., replacing embankments that have eroded away). Other needs are more subtle and may require additional analysis (e.g., refined load rating methods) or testing (e.g., testing of paint to determine if it is lead-based) to confirm the need for a particular activity. Bridge owners other than the LADOTD should consult with the LADOTD Bridge Design Section-Bridge Design Engineer Administrator and with the Bridge Maintenance Section-Bridge Maintenance Engineer Administrator for specific instructions. If additional guidance is needed, appropriate trades people or bridge engineers should be consulted.

[9] See Federal Highway Administration, *Bridge Preservation Guide: Maintaining a State of Good Repair Using Cost Effective Investment Strategies*, August 2001, available at http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf.

A discussion of relevant standards, guides, and manuals to assist the bridge historian and bridge engineer are listed in Section 3.A. It is important to note that the LADOTD BDEM has been updated to include a new Chapter 4.2, Historic Bridges, which incorporates PA stipulations related to design, maintenance, and rehabilitation of historic bridges.

A. Accepted preventative maintenance and rehabilitation activities

Certain activities are considered best practices for preventative maintenance and rehabilitation. Under the terms agreed upon in the PA, the bridge owner may undertake these activities on historic bridges in any treatment category without additional consultation or public notification. These activities are documented in Attachment 5 of the PA and are limited to activities specifically indicated below with an asterisk (*). Activities noted in this Statewide Historic Bridge Plan that do not have an asterisk (*) should be developed jointly through consultation between the bridge engineer and the bridge historian. The results are reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

B. Preventative maintenance

Preventative maintenance covers two types of maintenance processes: cyclical (non-condition-based) maintenance and condition-based maintenance. Both processes are defined in this section.

(1) Cyclical (non-condition-based) maintenance

As noted in the definitions for this plan, cyclical (non-condition-based) maintenance is work of a routine nature to prevent or control the process of deterioration of a bridge and is comprised of activities typically completed annually, biannually, or on some regular schedule. Routine cyclical maintenance is essential in addressing the safety and functional life of a bridge. In general, cyclical maintenance of historic bridges should consist of the following activities.

General

- Cleaning and maintaining painted surfaces of structures.* This activity is further defined as minor spot cleaning and painting of small areas of deterioration.
- Debris removal and structure cleaning or washing.* This activity includes removal of overgrown vegetation adjacent to or on the bridge and removing obstructions from the waterway.
- Low pressure water spray to clean exterior surfaces following testing on a small area to ensure no damage.*
- Maintaining drainage system.* This activity includes removal of debris from drains and repair of drainage pipes or inlets.
- Maintaining non-historic lighting, including poles, fixtures, and conduit.*
- Maintaining existing signs.*

Movable bridges

- Applying lubrication to bearings, moving parts, or other machinery.* This activity includes greasing and maintaining proper fluid levels in hydraulic systems, and changing of oil filters in motors.

Approach roadway, setting, and associated features

- Maintaining traffic control devices, pavement markings, and signs.*

- Maintaining guardrails and barriers on approach roadway.*

(2) Condition-based maintenance

As noted in the definitions for this plan, condition-based maintenance is the process of sustaining a bridge in its present state by means of making minor repairs until a more permanent repair or rehabilitation can be completed. Condition-based maintenance activities typically consist of repairs resulting from crashes (vehicular and navigation, if over a waterway), damage or vandalism, equipment failure, or structural deterioration of components of the bridge. Condition-based maintenance activities associated with a given bridge are non-cyclical and should be completed prior to rehabilitation activities in the interest of extending the life of the bridge. Certain condition-based maintenance activities may be considered minor rehabilitation, but are completed as part of maintenance work, such as work to electrical and mechanical systems and the operator's house on movable bridges. As a result, these activities are identified in both this section and in Section 2.C, Recommended rehabilitation activities.

Common condition-based maintenance activities that may be employed consist of the following:

General

- Cleaning and painting or maintaining painted surfaces of structures.* This activity is defined as spot cleaning and painting of entire deteriorated members and is more substantial than the spot painting in cyclical maintenance. Major cleaning and painting of a structure is considered rehabilitation and is discussed in Section 2.C.

- Replacing drainage system.*

- Replacing non-historic lighting, including poles, fixtures, and conduit.*

- Replacing loose fasteners or hardware.* This activity may also include repairing connections between approach span guardrails and the bridge superstructure to accommodate movement at expansion joints and tightening existing bolted connections or adding bolts to existing connections.

- Repairing bearings and bearing devices (pads, seats, and plates).* This activity may include resetting expansion bearings, based on amount of movement or rotation.

- Heat straightening or replacement matching existing historic appearance of damaged structural steel components.* This activity may include repair or replacement of damaged structural steel components.

- Non-destructive testing or load testing structure.*

- Non-destructive graffiti removal following testing on small area.* Methods utilized for graffiti removal must be carefully selected to ensure they do not abrade, discolor, or damage surfaces that are to remain. Careful testing of cleaning products and mechanical abrasion systems will be necessary to determine if a method can be found that will not result in marring, discoloration, or damage to surfaces to remain. Such products should only be used by an operator whose skill and experience can be documented. Use of high-pressure water is not recommended because of potential surface damage. In some cases it may be better to leave the graffiti in place due to potential damage to surfaces. In such instances, a paint color that closely matches the surrounding surface should be used. For concrete surfaces, consult NPS *Preservation Brief 38: Removing Graffiti from Historic Masonry,* which provides guidelines for removing graffiti from concrete surfaces, to determine the gentlest possible treatment for graffiti removal that will be effective.

Superstructure

- Deck preservation and preventive maintenance measures including cleaning and sealing, surface overlay, or in-kind deck patching.* This may include:

    - Sealing cracks to protect the bridge structure. By identifying the origin or the mechanism of the crack, the appropriate and approved repair techniques can be applied. When performing crack repairs with injected materials it is important to utilize a material that matches the adjacent material color to the extent possible, and to use application techniques that limit the spread of material onto the adjacent surfaces.

    - Repair of damaged elements of open-grid steel decks.

    - Patching of deck material. Patching repairs should match the existing material (bituminous replaced with bituminous, concrete replaced with concrete, steel with steel).

- Repairing abutment embankment slopes and installing abutment protection measures to combat scour.* This may include installing or repairing slope protection at ends of the bridge at abutments to decrease or arrest scour potential at bridges over a waterway or installation of scour revetment materials (such as stone riprap or engineered revetment mats) at piers or bents located in waterways to decrease or arrest scour potential.

- Applying waterproof sealant or painting to an abutment, bent, pile, or pier that is not integrated with the superstructure (does not apply to arch, culvert, or concrete rigid frame types).*

Railings

- Repairing traffic guard rail.* This item refers to traffic guard rail at roadway approaches to the bridge at each end of the bridge.

- Repairing bridge rail to match existing historic appearance and, where reasonable, materials.* The techniques to complete work on damaged or deteriorated concrete bridge railings should be informed by NPS *Preservation Brief 15: Preservation of Historic Concrete*. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards. See Section 2.C for a discussion of replacement of railing or parapets in the rehabilitation discussion.

Expansion joints

- Cleaning and re-sealing bridge joints.* This item refers to joints on the deck of the bridge.

- Repairing or replacing bridge deck joints.*

Movable bridges

- Repairing or replacing structure access platforms, stairs, ladders, and walkways.*

- Repairing or replacing traffic barrier gates and signal lights on approach roadway.* This activity includes repairing or replacing motors for gates.

- Repairing or replacing navigational aids, including signage and lighting.* Typical features that may need to be repaired or replaced during maintenance include damaged or inoperable advanced traffic warning signals and signs on the bridge and approaches to the bridge, warning lights at each end of a movable span, and navigation lights on a movable span and on the pier protection system.

- Repairing mechanical systems.* Typical mechanical components of movable bridges that may need to be repaired during maintenance are as follows: machinery, open and enclosed gearing, speed reducers, shafts and couplings, bearings, brakes, span locks, live load shoes and strike plates, buffer cylinders, counterweight supports, counterweights, counterweight wire ropes, wire rope attachments and sockets, sheaves and drums, tension adjusting devices, machinery supports and frames, emergency and auxiliary drives, swing span special components, balance wheels and track, and trunnion assemblies. It is recognized that many mechanical components of movable bridges are no longer made by the original manufacturers; therefore, modern equipment that meets the necessary mechanical functions will need to be provided.

- Repairing electrical systems.* Typical electrical components of movable bridges that may need to be repaired during maintenance are as follows: AC motors, DC motors, breakers, cables, starters, conduit and junction boxes, wiring, controls and control panels, transformers, switchgear, test equipment, generators, closed circuit TV systems, and communication systems. It is recognized that many electrical components of movable bridges are no longer made by the original manufacturers; therefore, modern equipment that meets the necessary electrical functions will need to be provided.

- Repairing or replacing interior features including equipment, cabinets, and furnishings within the operator's house.* This activity includes repairing or replacing flooring and other interior finishes.

- Repair to match existing historic exterior features of operator's house, such as windows, doors, roof, and, where reasonable, materials.* Most exteriors of operator's houses are utilitarian; however, repairs to exterior features listed above should match the existing appearance in design and, where reasonable, materials. When an operator's house requires major work or has required repeat maintenance, then rehabilitation should be considered. See Section 2.C for further guidance.

Fenders and pier protection systems

- Repairing fender system to match existing appearances for bridges over navigable waterways.* This activity includes repairs to access walkways or platforms to the fenders or pier protection systems.

Approach roadway, setting, and associated features

- Resurfacing or infill of deteriorated pavement such as pot holes and rutting on approach roadway.*

- Installing, repairing, or replacing bridge approach slabs and pavement relief joints.*

- Replacing or adding traffic control devices, pavement markings, and signs.*

- Replacing guardrails and barriers on approach roadway.*

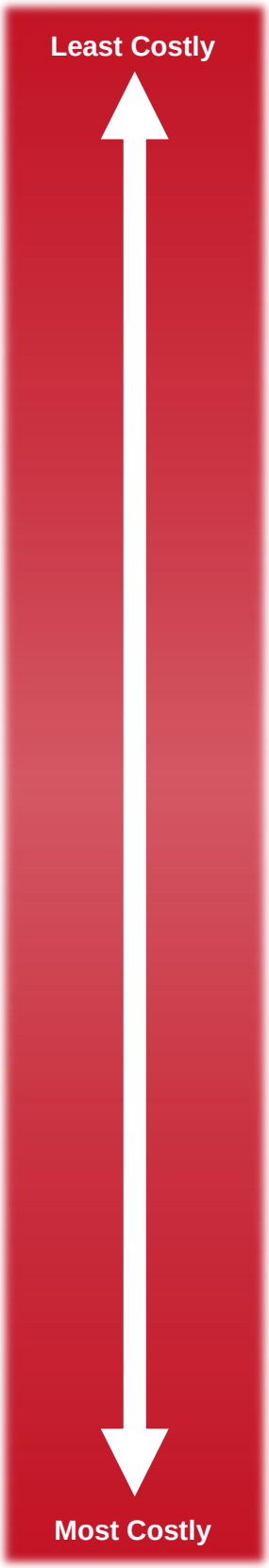
Once condition-based maintenance activities are completed, the bridge should be cyclically maintained to extend its useful service life.

C. Recommended rehabilitation activities

Rehabilitation means the act or process of applying measures to sustain the existing form, integrity, and material of a historic property, as noted in the definitions for this plan. Rehabilitation measures, as described in this section, may involve repairing, strengthening, or replacing bridge components directed at keeping historic bridges in long-term use. For practical purposes, "long-term" is taken to mean 20 years

into the future. A 20-year window was chosen as an upper limit of how far reasonable predictions can be made regarding how any given bridge will react to its environment. This does not mean the historic bridge will need to be replaced in 20 years, but means rehabilitation activities may be needed at that time to extend the life expectancy of the bridge. This timeframe also coincides with the term of the PA.

Many methods of rehabilitation are available and selection of actions required will depend on condition, function, and bridge type, among other factors. Figure 2 shows the relative cost of the various methods for rehabilitation. Material testing, supplemental fieldwork, and engineering studies may be warranted during the development of designs, reports, plans, specifications, and estimates. The following sections describe rehabilitation activities, categorized by bridge material and then by type, as needed, that may be employed in bridge preservation. Certain rehabilitation activities may be considered repair work and completed as part of a maintenance project, such as work to electrical and mechanical systems on movable bridges. As a result, these activities are identified in both this section and in Section 2.B.(2), Condition-based maintenance.



Maintenance (1 to 5 years)
- Washing
- Drainage system cleaning
- Concrete sealing
- Bearing lubrication
- Hydraulic system maintenance
- Vegetation removal
- Guardrail connections at approaches

Deck repair (5 to 25 years)
- Patching and spall repairs
- Crack sealing
- Overlay
- Repair open-grid deck elements
- Repair or replace joints/expansion joints

Railing rehabilitation (5 to 40 years)
- Painting
- Member repair
- Complete replacement
  - Steel
  - Concrete
  - Masonry

Substructure rehabilitation (10 to 40 years)
- Concrete
  - Crack and spall repair
  - Member removal and replacement
  - Foundation strengthening
- Steel
  - Spot and small area painting
  - Member strengthening
  - Member removal and replacement
- Masonry
  - Re-pointing mortar joints
  - Stone replacement

Superstructure rehabilitation (10 to 40 years)
- Concrete
  - Deck removal and replacement
  - Member removal and replacement
- Steel
  - Painting
  - Member strengthening
  - Member removal and replacement
- Masonry
  - Re-pointing mortar joints
  - Stone replacement

Movable bridge preservation
- Mechanical/machinery system repairs (10 to 25 years)
- Electrical system repairs (10 to 25 years)
- Operator's house repairs (10 to 25 years)

Pier protection and fender system repairs (10 to 40 years)

Complete structure painting (20 to 40 years)

Superstructure widening (20 to 40 years)

Substructure widening (20 to 40 years)

Notes

Parenthetical references are to the frequency with which these activities should be performed.

Figure 2. Relative costs of bridge preservation activities.

(1) General

- Cleaning and painting or maintaining painted surfaces of structures.* This activity includes major cleaning and painting activities for an entire bridge superstructure and/or substructure. If lead paint is present, proper containment and disposal is required, which should be conducted prior to painting.

(2) Superstructure

- Rehabilitating or replacement matching existing historic appearance of superstructure elements (e.g., girders, stringers, crossframes, floorbeams, etc.).* This activity includes replacing deteriorated concrete with a patch repair, replacing concrete components to match existing historic appearance, or repairing or replacing deteriorated steel members to match existing historic appearance (see more details on concrete and steel bridges below).

- Replacing the deck, sidewalks, and curbs without replacing the floor system.*

- Replacing bearings and bearing devices (pads, seats, and plates).*

(3) Substructure

- Rehabilitating or replacement matching existing historic appearance of substructure elements (e.g., bent, footings, pile, pier, or column, including cap).* This activity includes replacing deteriorated concrete with a patch repair as described in Section 2.C.(4) below.

(4) Concrete bridges

The following recommended rehabilitation activities apply to various types of concrete bridges, such as arch, rigid frame, beam and girder, and culverts.

- Sealing cracks matching existing historic appearance of superstructure elements.* Repairing cracks protects the bridge structure. By identifying the origin or the mechanism of the crack, the appropriate and approved repair techniques can be applied. When performing crack repairs with injected materials it is important to utilize a material that matches the adjacent material color to the extent possible, and to use application techniques that limit the spread of material onto the adjacent surfaces.

- Replacing concrete with a patch repair matching existing historic appearance of superstructure elements.* Replacing a deteriorated concrete surface protects the steel reinforcement that is underneath; however, it may promote the corrosion of reinforcement in concrete adjacent to the repair if the repair is not performed properly. Upon removal of the deteriorated concrete, any exposed reinforcing should be sandblasted, cleaned, and coated with a rust-inhibiting product. The replacement concrete material should be selected to be compatible in composition with the adjacent concrete and should be formed and finished to match the surrounding historic concrete

in color and texture (including any necessary exposed aggregate). Consult NPS *Preservation Brief 15: Preservation of Historic Concrete* to identify the appropriate methods for concrete patch repairs. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Replacing components in-kind matching existing historic appearance of superstructure elements.* Depending on the extent of damage, in-kind replacement of concrete components, such as a concrete girder, may be necessary instead of repair. In-kind means replacement material should match the same material type as the existing material (bituminous replaced with bituminous, concrete replaced with concrete, steel with steel). New elements may have greater structural capacity and durability than the original or repaired element. The decision to replace rather than repair should be made collaboratively by the engineer and the historian. The techniques to complete this work should be informed by NPS *Preservation Brief 15: Preservation of Historic Concrete*. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Strengthening main girders/beams. Due to the individual design and composition of each concrete deck girder structure, determination of preservation activities is often site-specific. As such, individual activities should be addressed on a case-by-case basis and should take engineering attributes and existing conditions into account. Strengthening main girders/beams should be done with extreme caution. Adding structural elements such as beams or columns, reinforcing, and/or post-tensioning through cored holes or slots cut in the concrete are all techniques that may be used to reinforce the structural support of the existing bridge. External post-tensioning can be added to supplement the existing structure. The techniques to complete this work should be informed by NPS *Preservation Brief 15: Preservation of Historic Concrete*. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Repairing masonry components on concrete bridges. A mortar analysis should be conducted by a bridge historian prior to implementing rehabilitation activities for purposes of specifying the mortar mix to be used during rehabilitation. The fundamental goals of the mortar analysis are to (a) match the historic mortar color, texture, and tooling; (b) match the repointing mortar sand with the historic mortar to the extent possible; and (c) specify a repointing mortar with the same or less compressive strength as the historic mortar and stone masonry. Repointing should be consistent with the findings of the mortar analysis. For further guidance, refer to NPS *Preservation Brief 2: Repointing Mortar Joints in Historic Masonry Buildings.* When the condition of the original masonry is so deteriorated that it precludes repair, replacement is a durable method of repair. To the extent possible, masonry should be replaced in-kind. Mismatching of materials may result in visual incongruence and may weather differently. Replaced masonry should match the size, composition, and coursing pattern of the original components. If existing masonry is sound and needs re-anchoring, the anchoring system should be compatible with the in-kind masonry and it should be concealed so as not to alter the aesthetics of the bridge. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

(5) Steel bridges

The following recommended rehabilitation activities apply to steel bridges, such as steel beam, steel girder, steel truss, and movable bridge superstructures. These activities also apply to steel components of movable bridges, such as towers and machinery supports.

- Repairing or replacing steel components to address section loss from deterioration, matching existing historic appearance of superstructure elements.* Corrosion in steel components may be severe enough to warrant replacement of the member. Replacing a member in-kind is an effective way to retain the original appearance of the bridge. In-kind means replacement material and design should match the same material and design as the existing component. Riveting or welding new (supplemental) plates to a bridge member can also be an acceptable activity depending on the location and size of the repair and its resulting impact to the component's appearance. Extensive welding or plating should be avoided, if possible, since it is likely to substantially alter the historic appearance. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Rivet replacement. Replacing corroded, damaged, or otherwise deficient rivets should be completed using high-strength structural button-head bolts of similar shank diameter. However, consideration needs to be given to clearances needed for the installation of button-head bolts. When replacing rivets with button-head bolts the button-head portion of the bolt should be on the visible surface of the bridge. If the use of button-head bolts is not feasible, conventional high-strength structural steel bolts may be used.

- Strengthening main girders/beams. Replacing girders/beams with similar or higher-strength material, but members that are geometrically in-kind, and/or erecting supplemental girders and/or beams between existing members reinforces the structural support of the existing bridge. In-kind means replacement material and design should match the same material and design as the existing component. Providing supplemental steel plates to flanges and/or webs will strengthen the structure. Determination of the appropriate use of these treatments may require additional analysis and consultation between the engineer and the historian to ensure that the most appropriate treatment with the least impact to historic features is utilized. Visual appearance should be carefully reviewed by a bridge historian to confirm results conform to the Secretary's Standards. This criteria applies to beam and girder floor systems of truss spans also.

- Strengthening truss members. Replacing deteriorated main truss members and gusset plates with similar or higher-strength material, but members that are geometrically in-kind, and/or erecting supplemental steel plates or shapes between existing members reinforces the structural support of the existing bridge. In-kind means replacement material and design should match the same material and design as the existing component. Providing supplemental steel plates or members, or removing and replacing deteriorated gusset plates, will strengthen the structure. Determination of the appropriate use of these treatments may require additional analysis and consultation between the engineer and the historian to ensure that the most appropriate treatment with the

least impact to historic features is utilized. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

(6) Movable bridges[10]

Rehabilitation activities for concrete and steel components of movable bridges are noted above. Other rehabilitation activities specific to movable bridges not covered elsewhere include the following:

- Replacing mechanical systems.* Typical mechanical components of movable bridges that may need to be rehabilitated or replaced are as follows: machinery, open and enclosed gearing, speed reducers, shafts and couplings, bearings, brakes, span locks, live load shoes and strike plates, buffer cylinders, counterweight supports, counterweights, counterweight wire ropes, wire rope attachments and sockets, sheaves and drums, tension adjusting devices, machinery supports and frames, emergency and auxiliary drives, swing span special components, balance wheels and track, and trunnion assemblies. It is recognized that many mechanical components of movable bridges are no longer made by the original manufacturers; therefore, modern equipment that meets the necessary mechanical functions will need to be provided.

- Replacing electrical systems.* Typical electrical components of movable bridges that may need to be rehabilitated or replaced are as follows: AC motors, DC motors, breakers, cables, starters, conduit and junction boxes, wiring, controls and control panels, transformers, switchgear, test equipment, generators, closed circuit TV systems, and communication systems. It is recognized that many electrical components of movable bridges are no longer made by the original manufacturers; therefore, modern equipment that meets the necessary electrical functions will need to be provided.

- Replacing to match existing historic exterior features of operator's house, such as windows, doors, roof, and, where reasonable, materials.* Additional guidance is as follows:

    - Most of the exteriors of operator's houses are utilitarian; however, repair or replacement of exterior features and materials should be completed to match the existing historic exterior features in design and, where reasonable, materials. Removal of non-historic features and/or materials (e.g., non-original fascia added to the top of the operator's house) and returning to original condition or compatible design is acceptable. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards

    - Operator's houses are subject to certain state statutes and building code and design requirements due to the critical function they provide. Factors to consider include:

[10] Eight types of historic movable bridges are present in Louisiana and are addressed by this Statewide Historic Bridge Plan: bascule, lift – span and span tower, lift – tower, pontoon swing, swing – cable stayed, swing – plate girder, swing – pony truss, swing – through truss.

  - Louisiana Revised Statute 1730 consisting of the State Uniform Construction Code and the International Existing Building Code (IEBC). Section 406 of the IEBC requires the installation or replacement of glass.

  - The LADOTD requires that windows, doors, and roofing systems, if replaced, meet or exceed the wind load requirements of the IEBC.

- Replacement windows, doors, and roof should be designed to be compatible with the historic character of the structure, such as similar size, scale, location, and details. Examples include replacing windows with the same type such as double-hung sash with double-hung sash. Due to the IEBC requirements, window systems often need thicker glass and mullions than the original windows.

- Consult relevant NPS Preservation Briefs for best practices for rehabilitation work on exterior features of operator's houses.

- Where replacement cannot match existing due to code or other limitations, visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards to the extent possible.

- Rehabilitating or replacing elements of pontoon bridges. Rehabilitation or replacement of the pontoon elements, including floating pontoon and hinged approach ramps, should match the historic appearance of existing pontoon elements. The replacement of associated mechanical and electrical components are addressed above. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

(7) Railings

Railings on historic bridges vary based on the type of structure and include concrete parapets; painted, galvanized, and unpainted metal railings; and combinations of metal and concrete railings, among other types.

- Replacing traffic guard rail.* This activity is for guard rail at roadway approaches to the bridge, including attachments to the ends of the bridge.

- Repairing bridge rail to match existing historic appearance and, where reasonable, materials.* The techniques to complete work on concrete railing and parapets should be informed by NPS *Preservation Brief 15: Preservation of Historic Concrete* and the visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards. In addition to repairing deficient bridge railings, it may be possible to supplement the existing railings with a deck- or curb-mounted railing in front of the existing railing, adjacent to the traffic lanes (see *Adding new bridge railing* below).

- Replacing bridge rail. When retaining or repair of the existing parapets or railings is not feasible, the original design should be replicated to the extent possible while conforming to current design

standards. The following should be considered when preservation activities are not able to match the existing historic appearance or materials of the railings or parapets:

- Safety implications of using a bridge with the existing railings that do not meet current minimum height requirements and vehicular impact test loading requirements should be considered as part of future rehabilitation activity planning. Safety factors that should be considered for assessing the crashworthiness of the existing railing system include the nature and extent of the deficiency, crash history, and cost-effectiveness of the recommended improvement. For example, it may not be necessary to replace existing railings when there is no crash history on the bridge, provided the safety aspects can be mitigated or acceptably addressed. Where existing railings do not meet current structural or geometric standards or criteria, future improvements may require a structural and/or geometric design review.

- Any railing modifications should be designed to be compatible with the historic character of the structure.

- Where the height of the parapet or railing does not meet current design standards, it may be acceptable to increase the height of the parapet or railing by embedding a new rail to allow the rail to meet current design standards.

- For railings with openings that are too large to meet current standards, it may be acceptable to install a cable or other slender non-obtrusive element across the opening. The cable or other element should be a reversible addition.

- The techniques to complete work on concrete railing and parapets should be informed by NPS *Preservation Brief 15: Preservation of Historic Concrete*.

- Replacement of historic railing should be done in consultation between the engineer and the historian. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Adding new bridge railing.

  - Addition of bridge railing on bridges that historically did not have railing should be done in consultation between the engineer and the historian.

  - Deficient bridge railing may be supplemented with a deck- or curb-mounted railing that is load-rated for traffic impact and installed between the existing railing and traffic lanes. This will result in leaving the existing railing unaltered while still providing a rail system that meets safety requirements.

- The railing type should consist of materials and design compatible with the historic character of the bridge. Visual appearance should be carefully reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

(8) Fenders and pier protection systems

- Rehabilitating or replacing fender system to match existing appearance in terms of design and materials for bridges over navigable waterways.*

- Rehabilitating or replacing fender systems to provide greater protection and/or strengthening may require the addition of new members in-kind. In-kind means replacement material and design should match the same material and design as the existing component. Due to increases in vessel size, fender systems may need to be rehabilitated or reconstructed to prevent damage. Work should be done in consultation between the engineer and the historian and the visual appearance should be reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

- Installing access walkways or platforms.*

(9) Associated bridge features

- Repairing or replacing historic light fixtures. Historic light fixtures should be repaired rather than replaced, when feasible. Replacement of historic lights should match the appearance of ornamental light fixtures to the extent possible while complying with current requirements. The design may need to change to accommodate new light technologies. Any modifications to the design of a historic light fixture should be accomplished in a manner acceptable to meet the Secretary's Standards.

- Repairing or replacing other associated historic bridge features, such as plaques and retaining walls. Associated features that contribute to the character of the bridge or its setting should be replicated to the extent possible, such as the use of a compatible design and when possible material.

Activities noted in this Plan that do not have an asterisk (*) should be developed jointly through consultation between the bridge engineer and the bridge historian. The results are to be reviewed by a bridge historian to confirm the results conform to the Secretary's Standards.

D. Cost estimating considerations

Cost estimates are provided in individual management plans for Preservation Priority Bridges for budget planning and programming purposes. Cost estimates are also required for the cost-benefit analyses during the investigation of alternatives for Preservation Candidate Bridges and in the development of plans, specifications, and estimates for individual bridge rehabilitation projects. Cost estimates should include an itemized list of activities and state the date the estimate was completed along with any

assumptions or limitations. Further guidance is provided below since this activity may involve more detailed investigations.

Customized activities required for preserving a historic bridge may be more costly than repairs to a non-historic bridge because the efforts are often more labor intensive and require unique skills. In addition, some activities require specialized equipment, techniques, and materials to preserve or repair character-defining features that will need to be accounted for (e.g., use of rivets or button-head bolts adds expense due to the limited number of skilled professionals able to perform the work). The engineer may use multiple sources to estimate costs for bridge preventative maintenance and rehabilitation activities, such as past bid tabulations, cost-estimating manuals, and local engineering, architectural, and construction contractor resources.

Cost estimates for preservation efforts require detailed investigations and associated repair plans. Therefore, until investigations and repair plans are completed, cost estimates are considered opinions of probable construction costs, and are appropriate only for determining programming project cost. The development of preliminary plans based on detailed fieldwork will improve the precision of cost estimates. Finally, actual costs may vary significantly from early cost estimates. Prudence suggests the inclusion of contingency funds for unanticipated costs and to account for the construction contractor's indirect costs associated with specialized work. These contingency costs can range from 5 to 15 percent, depending on the type of work, of the subtotal for the detailed estimated costs, to arrive at a total budget for the construction work. Engineering design, historical consultation, and construction administration costs are not included in the estimates as these efforts may be provided by the owner or consultants.

E. Use of design exceptions

(1) General

The application of design exceptions may be considered if the transportation needs and condition or features of the structure limit a bridge's ability to meet appropriate design standards. This section provides direction on where design exceptions may be applied. Also refer to Attachment 4A in the PA for additional guidance.

Design exceptions are deviations from standard bridge design practices that take into account structural, real estate, utilities, environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project.

A design exception is used for federally funded projects where federal and state standards are not met. Design exceptions must be submitted to and approved by the LADOTD's Chief Design Engineer or in accordance with the latest FHWA and LADOTD Stewardship and Oversight Agreement for Federal-aid highway program projects, depending on project specifics. Design exceptions must be justified and adequately documented, with documentation answering two questions:

- Why is the exception appropriate?
- Why is there no other practical alternative?

(2) Applicability

While it is the LADOTD's procedure to at least meet standard design criteria for a project, the LADOTD recognizes that there may be some situations where exceptions to design standards are allowable. Where appropriate, design exceptions may be granted for deviation from the accepted design standard. The design exception process allows designers to deviate from normal practice and consider non-standard options in order to safeguard environmental or historic resources.

The need for bridge-specific design exceptions will be based on the magnitude of the preservation efforts to be implemented. For example, there is no need for design exceptions when undertaking preventative maintenance efforts as described previously. However, if a substantial portion of a bridge is to be reconstructed, the standard design criteria are more stringent; hence, the greater potential for design exceptions in these circumstances.

A deficient bridge may be allowed to remain in vehicular use if it can be improved to meet applicable design standards or if a design exception is approved for the deficiency. In general, retention of a historic bridge can be justified when crash history indicates that safe operations are possible.

Design exceptions may be requested in the following situations:

- Horizontal alignment and vertical profile. Existing horizontal alignment and vertical profile may be retained or alignment and/or profile changes made in the roadway rather than the bridge.

- Vertical and lateral clearance. Existing vertical clearance and existing lateral clearance may be retained depending upon the type of roadway the bridge serves and the volume of traffic.

- Geometric elements. Individual geometric elements, including smaller curve radii and shorter stopping sight distance, may be adopted.

- Bridge roadway width. Narrower widths for lanes and shoulders, and reduced horizontal distance to obstructions, can be considered.

- Structural capacity. Minimum acceptable structural capacity can be considered, depending on the classification of the roadway. The intent of the rehabilitation of the structure is to remove the load posting on the bridge to the extent feasible and possible.

- Type of railing. Historic railings may be retained provided they meet the minimum design criteria based on several factors, such as design speed of the roadway, crash history, and whether existing railing is planned to be repaired or replaced. Additional options may be considered, as discussed in Section 2.C.(7), Railings. For example, deficient bridge railing may be supplemented with deck- or curb-mounted railing installed between the existing historic railing and traffic lanes. This will result in leaving the existing railing unaltered while still providing a rail system that meets safety requirements.

(3) Design criteria considerations

Variables that should be considered when evaluating the need for, and applicability of, design exceptions include:

- Transportation needs for the bridge.
- Degree to which design standards would be reduced.
- Effect of the design exception on safety and operation of the bridge and compatibility with approach roadway.
- Cost of attaining full design standards, including structural, real estate, utilities, environmental, cultural, or historic consequences.
- Whether other design factors would lessen the effect of the exception.
- Risk particular to site conditions such as truck traffic (volume and weights), crash history, geometrics, vertical clearance, and facilities crossed.
- Measures that may be implemented to reduce the risks or safety impacts of the requested exception. In addition to structural load posting signs, examples would be installation of cautionary signs to warn motorists of sharp non-compliant horizontal or vertical curves. In cases of substandard railing (structural and/or geometric deficiencies), cautionary signs alerting pedestrians to substandard railings can also be considered. Where there is bicycle traffic, signs requiring bicyclists to walk their bikes over the bridge can also be considered.

F. Guidance for bridges on very low-volume local roads (ADT ≤ 400)

There are 23 historic bridges in Louisiana with an ADT at or less than 400. Historic bridges on these very low-volume local roads that are 100 feet or greater in length should be evaluated individually to determine if the clear roadway width (defined as the most restrictive minimum distance between curbs, rails, or other obstructions on the bridge roadway) is appropriate. By definition, a very low-volume local road is functionally classified as a local road and has a design ADT volume of 400 vehicles per day or less. The American Association of State Highway and Transportation Officials (AASHTO) publication *AASHTO – A Policy on Geometric Design of Highways and Streets (current edition), Section 5.5 Very Low-Volume Local Roads (ADT≤ 400)*, commonly known as "The Green Book," provides guidance. The key elements in reviewing and evaluating the existing bridge width are the width of the adjacent roadway (traveled way and shoulder widths) and the safety performance of the existing bridge.

The Green Book states that existing bridges can remain in place without widening unless there is evidence of a site-specific problem related to the width of the bridge. Evidence of a site-specific safety problem may include not only crash history but also other indications such as skid marks; vehicular impact damage to bridge members, bridge rail, or guardrail; and concerns by police or local residents.

Bridge usage by trucks, farm implements, school buses, emergency response vehicles, and recreational vehicles should also be considered in determining if the bridge has the appropriate width. Typically for a one-lane roadway, a clear width of 16 feet is adequate; for a two-lane roadway, a clear width of 20 feet is adequate.

3. Resources

This section provides resources to be used along with this Statewide Historic Bridge Plan to assist the bridge historian and bridge engineer in historic bridge preservation projects. These reports, guidelines, and manuals work to inform and provide additional technical information to assess preservation alternatives and select appropriate preventative maintenance and rehabilitation activities. Sources of funding and contacts are listed for bridge owners in addition to technical training that is available to historic bridge owners, maintenance personnel, engineers, and associated professionals undertaking historic bridge projects.

A. Reports, guidelines, and manuals

This Statewide Historic Bridge Plan requires the use of Louisiana-specific and national reports, guidelines, and manuals in the development of historic bridge preservation projects. An annotated list of these reports, guidelines, and manuals for use by the bridge engineer and bridge historian to be used with this Statewide Historic Bridge Plan are provided below.

- *Methodology to Identify Preservation Priority Bridges*, prepared by Mead & Hunt, Inc., November 2013 at http://wwwapps.dotd.la.gov/administration/public_info/projects/docs_test/48/documents/Methodology_to_Identify_Preservation_Priority_Bridges.PDF. This report provides a description of the methodology used to identify historic bridges in Louisiana that are most suitable for preservation. The methodology draws upon bridge-specific data obtained from the most recent bridge inspection (as recorded in the National Bridge Inventory) and field review conducted for this project to evaluate each historic bridge.

- *Results: Application of the Methodology to Identify Preservation Priority Bridges,* prepared by Mead & Hunt, Inc., April 2014; updated July 2015 at http://wwwapps.dotd.la.gov/administration/public_info/projects/docs_test/48/documents/Results_Application_of_Methodology_to_Identify_Preservation_Priority_Bridges.pdf. This report provides the analysis and data used to categorize historic bridges for future treatment. In particular, Appendix C, Additional Consideration Forms, in this report provides relevant information needed for the bridge engineer to confirm and assess the various elements of a historic bridge outlined above that should be considered in developing recommended preservation activities.

- *Guidelines for Historic Bridge Rehabilitation and Replacement*, prepared by Lichtenstein Consulting Engineers, Inc., in association with Parsons Brinckerhoff Quade & Douglas, Inc., March 2007, as part of NCHRP Project 25-25/Task 19, at http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(19)_FR.pdf.
  (This report was adopted by AASHTO in November 2008 and is available for purchase here https://bookstore.transportation.org/item_details.aspx?ID=2357.)
  These guidelines provide a protocol for defining when rehabilitation of historic bridges can be considered prudent and feasible and when it is not based on engineering and environmental data and judgments. The guidelines include identification of various approaches to bringing historic

bridges into conformance with current design and safety guidelines/standards, and the effect or implications of remedial action on historic significance.

- *Bridge Preservation Guide: Maintaining a State of Good Repair Using Cost Effective Investment Strategies,* prepared by Federal Highway Administration, August 2011, at http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf
  This guide provides bridge-related definitions and corresponding commentaries, as well as the framework for a systematic approach to a preventive maintenance program and the FHWA's guidance on bridge preservation.

- *Bridge Design and Evaluation Manual (BDEM), Chapter 4.2 – Historic Bridges*, prepared by LADOTD, latest edition at http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Bridge_Design/Pages/BDEM.aspx. Chapter 4.2 – Historic Bridges of the BDEM outlines relevant stipulations in the PA that apply to bridge design and maintenance and provides the procedures to follow for projects affecting the different treatment categories.

- *Minimum Design Guidelines,* prepared by LADOTD, latest edition, at http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Memoranda/English_Design_Guidelines.pdf. This guide provides the LADOTD's minimum geometric design guidelines for various classifications of roadways, and can be used as the basis for evaluation of these geometric characteristics of the bridge and roadway approaches to the bridge.

- NPS Preservation Briefs. In addition to the Secretary's Standards, relevant NPS Preservation Briefs are a useful reference to guide the rehabilitation approach. The NPS publishes a technical series known as Preservation Briefs to provide owners and developers of historic properties with expert advice on recognizing and resolving common preservation and maintenance problems. Specific briefs are cited in Section 2. Refer to the NPS website at http://www.nps.gov/tps/how-to-preserve/briefs.htm for more information.

- *National Register Eligibility Determination Report: Pre-1971 Louisiana Highway Bridges* (Mead & Hunt, Inc., September 2013) at http://wwwapps.dotd.la.gov/administration/public_info/projects/docs_test/48/documents/National_Register_Eligibility_Determination_Report_for_Louisianas_Pre-1971_Highway_Bridges.pdf. This report provides Louisiana Historic Bridge Inventory Forms with a statement of significance in which the bridge historian should use to identify character-defining features, historic fabric and, where appropriate, important features in the setting that need to be considered when assessing integrity and applying the Secretary's Standards.

- *Bridge-specific historical documentation.* Existing documentation such as National Register Nominations or determinations of eligibility may assist the bridge historian to identify character-defining features, historic fabric and, where appropriate, important features in the setting that need to be considered when assessing integrity and applying the Secretary's Standards.

B. Funding sources

The majority of funding for the rehabilitation and reuse of historic bridges in Louisiana is available through federal funding programs. As of 2016, the legislation authorizing the various federal transportation programs is Fixing America's Surface Transportation Act (FAST). When available, state funding may be used to supplement federal funding.

The two main federal highway programs are the National Highway Performance Program (NHPP) and the Surface Transportation Block Grant Program (STBG). The NHPP supports improvement of the condition and performance of the National Highway System (NHS). STBG funds have the broadest eligibility and can be used on any federal-aid highway, bridge, transit, or non-road transportation project.

Federal legislation and funding is subject to change and these programs may change; see the FHWA website for up-to-date information related to legislation and funding at https://www.fhwa.dot.gov/resources/legsregs/.

(1) National Highway Performance Program

The purposes of the NHPP are to provide support for the condition and performance of the NHS, provide support for the construction of new facilities on the NHS, and ensure that investments of federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets established in a state's asset management plan for the NHS. Eligible activities include the construction, replacement, rehabilitation, preservation, and protection (including scour countermeasures, seismic retrofits, impact protection measures, security countermeasures, and protection against extreme events) of bridges on the NHS.[11]

The FAST Act expands funding available under the NHPP for resurfacing, preservation, and reconstruction projects of bridges not on the NHS if the bridge is on a federal-aid highway.[12]

(2) Surface Transportation Block Grant Program

The FAST Act converts the previous Surface Transportation Program to the STBG, a block grant program. The STBG apportions money to states based on a formula. STBG funds can be used for a wide array of transportation projects on any federal-aid highway, such as construction, reconstruction, resurfacing, restoration, rehabilitation, and operational improvements for highways and bridges. STBG funds may be used for bridge projects on any public road. According to current FHWA guidance, projects that accommodate other transportation modes (such as adding bicycle and/or pedestrian lanes) can also qualify. The FAST Act rolled the Transportation Alternatives Program into the new block grant program, allowing 50 percent of certain transportation alternatives funding to be allocated to local agencies to be used on any project eligible under the program.

[11] Federal Highway Administration, "National Highway Performance Program (NHPOP) Implementation Guidance" available at https://www.fhwa.dot.gov/map21/guidance/guidenhpp.cfm.

[12] U.S. House of Representatives, *FAST Act Conference Report to Accompany H.R. 22*, Report 114-357, December 1, 2015, 27. Available at https://www.gpo.gov/fdsys/pkg/CRPT-114hrpt357/pdf/CRPT-114hrpt357.pdf.

The former Transportation Alternatives Program is now included in the STBG program as a set-side for transportation alternatives and recreational trails. According to current FHWA guidance, the program includes funding for historic preservation projects, including bridge rehabilitation. Funds can be used to rehabilitate historic bridges for both vehicular and non-vehicular uses. For most projects, the program includes 80-percent federal funding with the remaining 20 percent a mixture of state and local funds. The FAST Act left the details of selecting eligible projects to the states and, while the FHWA provides interpretative guidance on eligible categories for the program, state transportation agencies have most of the responsibility for the program.

(3) Dedicated historic bridge funding

Subject to the availability of funds, the LADOTD will dedicate $3 million annually for the preservation of LADOTD-owned Preservation Priority Bridges. Recognizing that individual bridge projects will occur on different schedules depending on individual bridge needs, funds may be pooled over a period of several years. If a portion of this dedicated fund is not required for Preservation Priority Bridges, the LADOTD may use the funds for Preservation Candidate Bridges. Non-LADOTD owners of Preservation Priority Bridges will be eligible for the State's apportioned federal funds for activities completed in accordance with the individual management plans. LADOTD contacts are provided in Section 3.D.

(4) Other state funding

The Louisiana Division of Historic Preservation administers the federal and state tax credit programs and a restoration tax abatement program. Historic bridges do not currently qualify for these programs. No other sources of state funding for historic bridge preservation are currently available.

C. Historic bridge training

Successful bridge preservation starts with technical training on approaches to preventative maintenance, preservation, and rehabilitation for historic bridge owners, maintenance personnel, engineers, and associated professionals. As such, the LADOTD requires that the bridge engineer or the bridge engineer overseeing or supervising the work on historic bridges has completed the Louisiana historic bridge training, established under terms of the PA.

(1) Louisiana historic bridge training

The LADOTD, in cooperation with the Louisiana Transportation Research Center (LTRC), is sponsoring historic bridge training. The training will provide education on approaches to preventative maintenance, preservation, and rehabilitation of historic bridges and related processes outlined in the PA and this Statewide Historic Bridge Plan through its existing technical conference series. The LADOTD will deliver this training every two years beginning in April 2016. Notice of the training will be posted to the website at http://www.ltrc.lsu.edu/ and sent via email or mail to each historic bridge owner and the signatory and concurring parties of the PA.

(2) Other historic bridge training

Other technical training programs also provide professionals with the opportunity to exchange ideas on successes, best practices, failures, and emerging technologies available for bridge projects. Existing training programs on historic bridge maintenance and preservation that may be helpful to engineers, historians, owners, and contractors include:

- Historic Bridges: Management, Regulations, and Rehabilitation. Sponsored by the National Preservation Institute (NPI), this two-day seminar provides information on bridge typology and history and a discussion on impacts, avoidance of adverse effects, alternatives, and rehabilitation techniques for historic bridge projects that will meet engineering and historic standards. Review how to successfully navigate the requirements of the National Environmental Policy Act (NEPA), Section 106 of the National Historic Preservation Act, and Section 4(f) of the U.S. Department of Transportation Act processes. For more information visit the NPI website at http://www.npi.org/sem-bridge.html.

- Iron and Steel Preservation (I&SP) Conference and Workshop. IS&P is a partnership between Purdue University and Lansing Community College (LCC). An annual conference and workshop includes practical demonstrations on a variety of metal repair and preservation methods along with hands-on experience related to the preservation of metal historic bridges. For more information see the I&SP website at http://www.lcc.edu/manufacturing/welding/ISPCConference/.

D. Agency Contacts

The following LADOTD contacts are available to assist bridge owners with historic bridge projects and answering questions about this Statewide Historic Bridge Plan:

(1) LADOTD

Cultural Resources contact
The Environmental Section should be contacted for questions on this Statewide Historic Bridge Plan. For assistance contact:

Environmental Impact Specialist
Environmental Section
Louisiana Department of Transportation and Development
1201 Capitol Access Road
Baton Rouge, LA 70802
Phone Number: (225) 242-4502
Website: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Environmental

Bridge Design and Structures and Facilities Maintenance
The Bridge Design and Structures and Facilities Maintenance offices are available to answer questions on bridge rehabilitation techniques and design standards. For assistance contact:

Bridge Design Engineer Administrator
Louisiana Department of Transportation and Development
1201 Capitol Access Road
Baton Rouge, LA 70802
Phone Number: (225) 379-1302
Website: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Bridge_Design/Pages/default.aspx

Assistant Bridge Design Engineer and Bridge Program Manager Louisiana Department of Transportation and Development
1201 Capitol Access Road
Baton Rouge, LA 70802
Phone Number: (225) 379-1067
Website: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Bridge_Design/Pages/default.aspx

Structures and Facilities Maintenance Administrator
Louisiana Department of Transportation and Development
1212 East Highway Drive
Baton Rouge, LA 70802
Phone Number: (225) 379-1552
Website: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/BridgeMaintenance/Pages/default.aspx

(2) Louisiana State Historic Preservation Office

As part of the Office of Cultural Development, Division of Historic Preservation, the LASHPO provides statewide leadership on preservation initiatives and helps carry out the nation's historic preservation program. The LASHPO identifies and evaluates the state's historic and archaeological properties, encourages the development of local history organizations and activities, and assists government agencies in carrying out their historic preservation responsibilities. The LASHPO offers assistance in meeting the Secretary's Standards and the administration of grant programs. For assistance contact:

Office of Cultural Development
Division of Historic Preservation
Capitol Annex Building
1051 North Third Street
Baton Rouge, LA 70802
Phone: (225) 342-8160
Fax: (225) 219-9772
Website: http://www.crt.state.la.us/cultural-development/historic-preservation

Appendix A. Glossary of Engineering and Preservation Terms

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Appendix A. Glossary of Engineering and Preservation Terms

This glossary expands upon the glossary in Attachment 2 of the PA, providing additional terms relevant for bridge preservation.

AASHTOWare – the successor to PONTIS, see below.

Abutment – Component of bridge substructure at either end of bridge that transfers load from superstructure to foundation and provides lateral support for the approach roadway embankment.

Approach alignment – One of five NBI inspection ratings. This rating appraises a bridge's functionality based on the alignment of its approaches. It incorporates a typical motorist's speed reduction because of the horizontal or vertical alignment of the approach.

Character-defining features – Prominent or distinctive aspects, qualities, or characteristics of a historic property that contribute significantly to its physical character. Features may include structural or decorative details and materials.

Corrosion – The general disentegration of metal through oxidation.

Cutwater – The wedge-shaped end of a bridge pier, designed to divide the current and break up ice.

Decay – Deterioration of wood as a result of fungi feeding on its cell walls.

Delamination – Surface separation of concrete, steel, glue laminated timber plies etc. into layers.

Deck geometry – One of five NBI appraisal ratings. This rating appraises the functionality of a bridge's roadway width and vertical clearance, taking into account the type of roadway, number of lanes, and ADT.

Deficiency – The inadequacy of a bridge in terms of structure, serviceability, and/or function. Structural deficiency is determined through periodic inspections and is reflected in the ratings that are assigned to a bridge. Service deficiency is determined by comparing the facilities a bridge provides for vehicular, bicycle, and pedestrian traffic with those that are desired. Functional deficiency is another term for functionally obsolete (see below). Remedial activities may be needed to address any or all of these deficiencies.

Deficiency rating – A nonnumeric code indicating a bridge's status as structurally deficient (SD) or functionally obsolete (FO). See below for the definitions of SD and FO. The deficiency rating status may be used as a basis for establishing a bridge's eligibility and priority for replacement or rehabilitation.

Design exception – A deviation from federal design and geometric standards that takes into account environmental, scenic, aesthetic, historic, and community factors that may have bearing upon a transportation project. A design exception is used for federally funded projects where federal standards

are not met. Approval requires appropriate justification and documentation that concerns for safety, durability, and economy of maintenance have been met.

Design load – The usable live-load capacity that a bridge was designed to carry, expressed in tons according to the AASHTO allowable stress, load factor, or load resistance factor rating methods. An additional code was recently added to assess design load by a rating factor instead of tons. This code is used to determine if a bridge has sufficient strength to accommodate traffic load demands. A bridge that is posted for load restrictions is not adequate to accommodate present or expected legal truck traffic.

Deterioration – Decline in condition of surfaces or structure over a period of time due to chemical or physical degradation.

Efflorescence – A deposit on concrete or brick caused by crystallization of carbonates brought to the surface by moisture in the masonry or concrete.

Extant – Currently or actually existing.

Extrados – The upper or outer surfaces of the voussoirs which compose the arch ring. Often contrasted with intrados.

Footing – The enlarged, lower portion of a substructure which distributes the structure load either to the earth or to supporting piles.

Fracture Critical Members – Tension members or tension components of bending members (including those subject to reversal of stress) whose failure would be expected to result in collapse of the bridge.

Functionally obsolete – The Federal Highway Administration (FHWA) classification of a bridge that does not meet current or projected traffic needs because of inadequate horizontal or vertical clearance, inadequate load-carrying capacity, and/or insufficient opening to accommodate water flow under the bridge. An appraisal rating of 3 or less for deck geometry, underclearance, approach alignment, structural evaluation or waterway adequacy will designate a bridge as functionally obsolete.

Gusset plate – A plate that connects the horizontal and vertical members of a truss structure and holds them in correct position at a joint.

Helicoidal – Arranged in or having the approximate shape of a flattened coil or spiral.

Historic fabric – The material in a bridge that was part of original construction or a subsequent alteration within the historic period of the bridge (i.e., more than 50 years old). Historic fabric is an important part of the historic bridge and the removal, concealment, or alteration of any historic material or distinctive engineering or architectural feature should be avoided if possible. Historic fabric can be found on elements of a bridge that have not been noted as character-defining.

Historic bridge – A bridge that is listed in, or eligible for listing in, the National Register of Historic Places.

Historic integrity – The authenticity of a bridge's historic identity, evidenced by the survival and/or restoration of physical characteristics that existed during the bridge's historic period. A bridge may have integrity of location, design, setting, materials, workmanship, feeling, and association.

Inspections – Periodic field assessments and subsequent consideration of the fitness of a structure and the associated approaches and amenities to continue to function safely.

Intrados – The innner or lower surface of an arch. Often contrasted with extrados.

Inventory rating – The load level a bridge can safely carry for an indefinite amount of time expressed in tons or by the rating factor described in design load (see above). Inventory rating values typically correspond to the original design load for a bridge without deterioration.

Load Rating – The determination of the live load carrying capacity of a bridge using bridge plans and supplemented by field inspection.

Maintenance – Work of a routine nature to prevent or control the process of deterioration of a bridge.

National Bridge Inventory – Bridge inventory and appraisal data collected by the FHWA to fulfill the requirements of the National Bridge Inspection Standards (NBIS). Each state maintains an inventory of its bridges subject to NBIS and sends an annual update to the FHWA.

National Bridge Inspection Standards – Federal requirements for procedures and frequency of inspections, qualifications of personnel, inspection reports, and preparation and maintenance of state bridge inventories. NBIS applies to bridges located on public roads.

National Register of Historic Places – The official inventory of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, which is maintained by the Secretary of the Interior under the authority of the National Historic Preservation Act of 1966 (as amended).

Non-vehicular traffic – Pedestrians, non-motorized recreational vehicles, and small motorized recreational vehicles moving along a transportation route that does not serve automobiles and trucks. Includes bicycles and snowmobiles.

Operating rating – Maximum permissible load level to which a bridge may be subjected based on a specific truck type, expressed in tons or by the rating factor described in design load (see above).

Pack rust – Rust forming between adjacent steel surfaces in contact which tends to force the surfaces apart due to the increase in steel volume.

Pier – A substructure unit that supports the spans of a multi-span superstructure at an intermediate location between its abutments.

Pointing – The compaction of mortar into the outermost portion of a joint and the troweling of its exposed surface to secure water tightness and/ or desired architectural effect (when replacing deteriorated mortar).

Pony truss – A through bridge with parallel chords and having no top lateral bracing over the deck between the top chords.

Posted load – Legal live-load capacity for a bridge which is associated with the operating rating. A bridge posted for load restrictions is inadequate for legal truck traffic.

PONTIS – Computer-based bridge management system to store inventory and inspection data and assist in other bridge data management tasks.

Preservation – Preservation, as used in this report, refers to historic preservation that is consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties for Preservation*. It is the act or process of applying measures to sustain the existing form, integrity, and material of a historic building or structure, and its site and setting. See discussion in Section 1.B for additonal details.

Preventive maintenance – The planned strategy of cost-effective treatments that preserve a bridge, slow future deterioration, and maintain or improve its functional condition without increasing structural capacity.

Rehabilitation – The act or process of returning a historic property to a state of utility through repair or alteration which makes possible an efficient contemporary use, while preserving those portions or features of the property that are significant to its historic, architectural, and cultural values. Historic rehabilitation, as used in this report, refers to implementing activities that are consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties for Rehabilitation*. See dsciussion in Section 1.B for additonal deatils.

Scaling – The gradual distentegration of a concrete surface due to the failure of the cement surface caused by chemical attack or freeze-thaw cycles or rebar too close to the surface and oxidizing from exposure to chlorides.

Scour – Removal of material from a river's bed or bank by flowing water, compromising the strength, stability, and serviceability of a bridge.

Scour critical rating – A measure of a bridge's vulnerability to scour.

Section loss – Loss of a member's cross sectional area and resulting strength usually by corrosion or decay.

Serviceability – Level of facilities a bridge provides for vehicular, bicycle, and pedestrian traffic, compared with current design standards.

Smart flag – Special Pontis inspection element used to report the condition assessment of a deficiency that cannot be modeled, such as cracks, section loss, and steel fatigue.

Spall – Depression in concrete caused by a separation of a portion of the surface concrete, revealing a fracture parallel with or slighty inclined to the surface.

Spring line – The imaginary horizontal line at which an arch or vault begins to curve. As example, the point of transition from the vertical face of an abutment to the start of arch curvature extending from abutment face.

Stringcourse – A horizontal band of masonry, generally narrower than other courses and sometimes projecting, that extends across the structure's horizontal face as an architectural accent. Also known as belt course.

Structural evaluation – Condition rating of a bridge designed to carry vehicular loads, expressed as a numeric value and based on the condition of the superstructure and substructure, the inventory load rating, and the ADT.

Structurally deficient – Classification indicating NBI condition rating of 4 or less for any of the following: deck condition, superstructure condition, substructure condition, or culvert condition. A bridge is also classified as structurally deficient if it has an appraisal rating of 2 or less for its structural evaluation or waterway adequacy.. A structurally deficient bridge is restricted to lightweight vehicles; requires immediate rehabilitation to remain open to traffic; or requires maintenance, rehabilitation, or replacement.

Sufficiency rating – Rating of a bridge's structural adequacy and safety for public use, and its serviceability and function, expressed on a numeric scale ranging from a low of 0 to a high of 100. It is a relative measure of a bridge's deterioration, load capacity deficiency, or functional obsolescence. Typically, bridges which are structurally deficient and have sufficiency ratings between 50 and 80 are eligible for federal rehabilitation funds and those which are structurally deficient with sufficientcy ratings of 50 and below are eligible for replacement.

Through truss – A bridge with parallel top and bottom chords and top lateral bracing with the deck generally near the bottom chord.

Under-clearances – One of five NBI appraisal ratings. This rating appraises the suitability of the horizontal and vertical clearances of a grade-separation structure, taking into account whether traffic beneath the structure is one- or two-way.

Vehicular traffic – The passage of automobiles and trucks along a transportation route.

Waterway adequacy – One of five NBI appraisal ratings. This rating appraises a bridge's waterway opening and passage of flow under or through the bridge, frequency of roadway overtopping, and typical duration of an overtopping event.

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