

1.0 INTRODUCTION

This study has been produced under the National Cooperative Highway Research Program (NCHRP). It is NCHRP Project 25-25, Task 15, “A Historic Context for Historic Bridge Types.” The study has been prepared by the firm of Parsons Brinckerhoff, with the assistance of Engineering and Industrial Heritage, and has been overseen by a review panel assembled specifically for the NCHRP 25-25 Task 15 study. The panel is comprised of:

Chris Hedges, Senior Program Officer, Cooperative Research Programs
Rowe Bowen, Georgia DOT
Susan Gasbarro, Ohio DOT
Paul Graham, Ohio DOT
William R. Hauser, New Hampshire DOT
Timothy Hill, Ohio DOT
Mary Ann Naber, Federal Highway Administration
Nancy Schamu, State Services Organization

1.1 Research Objective

The objective of this study is to present a context for the most common historic bridge types in the United States. According to the National Park Service’s National Register Bulletin, *How to Apply the National Register Criteria of Evaluation*, a historic context is “an organizing structure for interpreting history that groups information about historic properties that share a common theme, common geographic area, and a common time period. The development of historic contexts is a foundation for decisions about the planning, identification, evaluation, registration and treatment of historic properties, based upon comparative historic significance” (1, p.53).

This study is intended to provide assistance to practitioners in assessing the historic significance of bridges within the context of the United States. The use of the study can improve the significance evaluation process by providing a picture of the bridge types that are very common and those that are much less common, as well as providing an assessment of the technological and historical significance of the individual types. The study lays the foundation for evaluating whether a bridge to be removed requires documentation, and to what level should the bridge be documented.

The research statement developed for this study by the NCHRP 25-25 Task 15 review panel is included below:

In recent years, numerous historic bridges have required replacement throughout the Nation. In each case, a permanent record is made which documents the historic context of the bridge. This level II Historic American Engineering Record (HAER) ranges in cost from \$9,000 to \$28,000. Currently, most state DOT’s lack the framework to evaluate whether this level of recordation is prudent for each and every historic

bridge. For most bridges in any given type, much of the historic context is common, and compilation of the HAER involves a good deal of unnecessary duplication. If the basic historical context were compiled for the most common historic bridge types, transportation agencies would be able to develop the permanent record for specific bridges much more quickly and at a lower cost. The research will provide centralized documentation for future researchers on a national level, and will assist DOTs in evaluating national significance. The National Cooperative Highway Research Program, Research Results Digest June 2003-Number 277, “Review and Improvement of Existing Processes and Procedures for Evaluating Cultural Resource Significance” concludes, “awareness of existing guidance and the utility of historic contexts and resource inventories may improve the significance evaluation process practiced within agencies that currently do not use these tools.”

1.2 Report Contents

This chapter describes the research methodology and provides background guidance to users of this study on assessing the significance of historic bridges, including assessing their individual eligibility for the National Register of Historic Places (NRHP).

Chapter 2 provides a historic context overview on a national level that illustrates where the different bridge types fit into the evolution of bridge design in the United States, and how events in the engineering, technological and political world influenced bridge design. The overview traces bridge development in the United States from its earliest times, through 1955, up to the passage of the Federal Aid Highway Act of 1956. This chapter is intended to help the user determine where a bridge fits into the general historic context of bridge development in the United States.

Chapter 3 provides a historic context for each of the most common extant historic bridge types in the United States. It begins with the definition of what constitutes a historic bridge type for the purposes of this study and then describes the most common bridge types identified by the Study Team. (The methodology for developing this list is described in Section 1.3 below.) For each bridge type, the text includes a summary history of its development, a structural description, and a statement of significance for the type within the context of common bridge types in this study. Each subsection also includes a list of examples that are listed in or eligible for the NRHP and an example that has been recorded for the Historic American Engineering Record (HAER), when the Study Team was able to find such examples. Users of the study can easily access the HAER examples on line at http://memory.loc.gov/ammem/collections/habs_haer/. One or more photographic examples of the type are also provided, as available, and some of the types have accompanying drawings. Unless otherwise noted, the photographs in this study are from the HAER collection. The bridge drawings were developed by Larry McGoogin of Parsons Brinckerhoff.

The final chapter (4) identifies issues encountered in the study and recommendations for future research related to the study topic.

1.3 Research Methodology

The Study Team, comprised of Margaret Slater of Parsons Brinckerhoff; Robert Jackson, formerly of Parsons Brinckerhoff; and Eric DeLony of Engineering and Industrial Heritage, utilized their knowledge, extensive libraries and contacts in the historic bridge field to draft a list of the most common bridge types. The Study Team also drafted a definition of what would constitute a “common historic bridge type” for the purposes of this study. The Study Team sent the draft list and definition to the Task 15 review panel for review and comment.

Once approved by the review panel, the draft list and the definition of what constitutes a “common historic bridge type” was sent via e-mail to all State Historic Preservation Offices (SHPOs) through Nancy Schamu of the National Conference of State Historic Preservation Officers (NCSHPO). The query was also posted by Kevin Cunningham of the Delaware Department of Transportation (DOT) to the TransArch List Serve, which reaches state DOT and Federal Highway Administration (FHWA) cultural resource staff. A request was made of the recipients to review the list and definition and to provide comments to the Study Team. The Study Team then considered the comments received, and made revisions to the list and definition, as appropriate. The Study Team sent a follow-up e-mail to respondents, which thanked them for their assistance, and included a table that summarized the comments and explained how the Study Team would address them.

The Study Team solicited the involvement of the Transportation Research Board (TRB) Committee on Historic and Archaeological Preservation in Transportation at the TRB’s January 2005 National Conference. As a result of that solicitation, Mary McCahon of Lichtenstein Consulting Engineers provided the Team with information on some of the more recent bridge types, for which existing scholarship is limited. The Team consulted the National Bridge Inventory (NBI), but was unable to readily sort and extract data useful for this study from the NBI. Carol Shull, Keeper of the National Register at that time, and her staff, provided guidance during the development of the work plan for this study.

The Study Team then commenced with the development of the summary historic context and the context for each of the historic bridge types identified, respectively, Chapters 2 and 3 of this study. Sources used for these chapters included state historic bridge surveys, NRHP multiple property historic bridge contexts and other historic bridge context reports, bridge and engineering history books, the HAER collection of the Library of Congress and other sources in the Study Team’s personal libraries. The Study Team developed the list of the five examples required for each type using this information, and came up short on the number of examples needed for certain types, particularly, the types that came into use later in the study period. To obtain missing examples, the Study Team developed a second e-mail query and received assistance in

the form of examples and photographs of some of the bridge types for which examples were missing, from Martha Carver of Tennessee DOT, Robert Hadlow of Oregon DOT, Kara Russell of PENNDOT, Mary McCahon of Lichtenstein Engineering and Andrew Hope of Caltrans.

The NCHRP review panel reviewed and commented on a preliminary draft of Chapter 3, while it was a work in progress. Paying consideration to the review panel's comments, the Study Team developed a preliminary draft report for "in-house" review. The following volunteer peer reviewers and editors reviewed and commented on the various chapters of the report:

Martha Carver, Historic Preservation Section Manager, Tennessee DOT
Debra Skelly, Certified Project Administrator, Parsons Brinckerhoff
Claudette Stager, National Register Program Coordinator, Tennessee SHPO,
Lisa Zeimer, AICP, Senior Professional Associate, Parsons Brinckerhoff

The preliminary draft was then revised and a Draft Report submitted to the NCHRP Task 15 review panel. The Study Team received and responded to the panels' comments, and then at the instruction of Chris Hedges, completed this final report.

1.4 Assessing Significance

1.4.1 What Makes a Bridge Significant?

As previously stated, this report intends to assist study users in making significance evaluations of historic bridges. The guidance for evaluating significance provided within this report is primarily for assessing the engineering significance of bridges within their historic context, and can assist practitioners with the evaluation of bridges for national, state, or local significance. The guidance is geared toward assessing the individual significance of bridges. But, it is important to note that bridges that are within historic districts have the potential to gain significance, beyond the significance level identified in this study, as a contributing element of the district.

This report provides a statement under each of the common bridge types regarding the level of significance of the type within the context of the most common types described in this study. Within certain types, statements are made identifying the most significant bridges within a type, such as structures built in the early years of a type's development. (This study does not provide guidance on assessing rare bridge types, as this is outside the study scope.).

Chapter 2 summarizes key events and trends that had a major impact on bridge development history in the United States. Bridges that possess integrity and are associated with these historic events and trends will likely possess historic significance. Relatively intact bridges associated with events, such as those listed below and those described in Chapter 2, will likely possess significance within the context of this study. For example, bridges that are associated with the following, likely possess significance:

- Early turnpikes and canals,
- The early development period of the railroad,
- Creation of state transportation departments, and
- The Depression-era work programs.

Both Chapters 2 and 3 identify significant activities in the field of bridge engineering that have a bearing on evaluating the significance of bridges. For example,

- Bridges associated with a prominent engineer or bridge designer or builder,
- Patented bridge designs,
- Government development of standardized bridge plans, and
- Innovations in the use of bridge construction materials and design.

Bridges, of course, can also be significant under local historic contexts, but this type of significance assessment is outside the scope of this study. Guidance on assessing such bridges is available in most of the state-wide bridge survey reports sponsored by the state departments of transportation and within the numerous state historic bridge contexts (multiple property contexts) that are listed in the NRHP. A list of a number of the completed contexts and 2004 links to a digital copy of these contexts is included as Appendix A to this report.

The first step for the evaluator who is attempting to assess the engineering significance of a bridge is to answer two questions: 1) Is the structure associated with an important historic context; and 2) Does the structure possess integrity, i.e., does it retain those features necessary to convey its historic significance?

1.4.2 Bridges and the National Register of Historic Places

If a bridge is important under the national contexts identified in this study, the bridge evaluator can assess the eligibility of the structure for the NRHP. As previously discussed, state and local contexts can provide additional guidance.

To be considered eligible for the NRHP, bridges must be at least 50 years old or it must possess exceptional importance. In addition, bridges must be significant under one or more of the NRHP criteria of eligibility. For example, they may possess historic significance for their association with crossings important in the development and growth of the nation, as examples of a solution to a difficult engineering challenge, as examples of new and innovative technologies, as examples of the work of prominent engineers, or for their architectural or artistic distinction.

Below is a discussion of the application of the NRHP criteria of eligibility to bridges.

Criterion A: A bridge associated with events that have made a significant contribution to the broad pattern of our history.

Under this criterion, bridges would need to have an important and direct connection to single events, a pattern of events or significant historic trends. A bridge could be significant under Criterion A, for example, for its association with important events or activities in transportation, community planning and development, or commerce. It must, however, have made a significant contribution to historical development. A bridge that possesses no ties to significant events would not meet Criterion A.

Criterion B: A bridge associated with the lives of persons significant in our past.

This criterion is not generally applicable to historic bridges because structures associated with important engineers or designers are represented under Criterion C.

Criterion C: A bridge that embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master or possesses high artistic values.

This is the criterion under which most bridges would be NRHP eligible. According to the National Register Bulletin, *How to Apply the National Register Criteria for Evaluation* (1,18), to be NRHP eligible, a property must clearly contain enough of the type's distinctive characteristics (also known as character defining features) to be considered a true representative example of a particular type, period, or method of construction. According to the Bulletin:

A structure is eligible as a specimen of its type or period of construction if it is an important example (within its context) of building practices of a particular time in history. For properties that represent the variation, evolution, or transition of construction types, it must be demonstrated that the variation, etc., was an important phase of the architectural development of the area or community in that it had an impact as evidenced by later [structures] (1, p.8).

This criterion applies to the common types of bridges that are technologically significant or that illustrate engineering advances. This means, for example, that the early examples of a bridge type may be NRHP eligible. The longer and more complex examples of a common type may also be eligible under this criterion. In addition, an unaltered, well-preserved example of a type may be NRHP eligible, regardless of whether it is more or less common within the context of this study. Examples that are not likely significant include structures built later in a type's development history that do not possess any extraordinary features and those that have been extensively altered through repairs or renovations.

Regarding bridges that represent the work of a master, examples of the common types of bridges that can be documented as the work of a well-known bridge engineer or fabricator are likely NRHP eligible if they possess integrity.

Bridges that possess high artistic value may be landmark bridges (that may also be significant due to their type or designer) such as the Brooklyn Bridge in New York or the Golden Gate in San Francisco, or they may be common types with applied decorative finishes, parapets or railings.

Examples of the less common bridge types identified in this study may also be significant due to their engineering significance, combined with their relative “rarity” within the context of common bridge types.

Criterion D: A bridge that has yielded, or may be likely to yield, important information in history or prehistory.

This criterion generally does not apply to bridges, but it could in rare instances apply to a bridge. According to the *Third Ohio Bridge Inventory, Evaluation and Management Plan* (2, Appendix B), Criterion D “can apply to structures or objects that contain important information if the structure or object is the principal source of important information. This could apply to an unusual or technologically significant bridge for which no plans or other documentation survives” (2, Appendix B).

Criterion Considerations

While moved properties are not commonly NRHP eligible, a bridge could be NRHP eligible under Criteria Consideration B: Moved Properties. Some types of bridges, such as pony trusses and moderate-length through trusses, were marketed as being “portable,” and these bridges have been historically relocated and more recently, have been relocated to off-system uses, such as pedestrian bridges. If they retain their historic appearance and function in the manner for which they were designed and have an appropriate new location, then they may be NRHP eligible. In addition, a technologically significant bridge that has been moved may also be NRHP eligible.

Bridges can also qualify for the NRHP that are less than fifty years old under Criteria Consideration G: Properties that have achieved significance within the last fifty years if they have exceptional importance. However, bridges that fall under this criterion are outside the context of this study, which ends at the end of 1955.

1.4.3 Integrity

To be individually eligible for listing in the NRHP, a bridge must not only meet one or more of the criteria of eligibility, but it also must have integrity. In a bridge, this means retaining its historic appearance and materials and its ability to function in the manner in which it was designed. Integrity is defined in *How to Apply the National Register Criteria for Evaluation* as “the ability of a property to convey its significance”

(I, 44). This National Park Service publication (2, 44-45) provides seven aspects, or qualities, that in various combinations define integrity:

1. Location is the place where the historic property was constructed or the place where the historic event occurred.
2. Design is the combination of elements that create the form, plan, space, structure, and style of a property.
3. Setting is the physical environment of a historic property.
4. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
5. Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
6. Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.
7. Association is the direct link between an important historic event or person and a historic property.

The question of integrity is answered by whether or not the property retains the identity for which it is significant. A property that retains integrity will possess many or most of the seven aspects. For bridges, some elements of integrity may have more importance. For example, while materials are of high importance to the integrity of a bridge that possesses engineering significance, the setting is less important.

To determine whether a structure retains integrity, the evaluator needs to ascertain whether the structure retains the elements of design and the materials necessary to convey the period in which it was constructed, i.e., its character defining features. The identification of alterations to a structure must be done to determine if they change the appearance, design or the way a bridge functions in a way that would compromise its historic or engineering significance. For example, it is highly unlikely that a fifty-year old bridge would retain its original deck or wearing/travel surface. Covered bridges would not likely retain their original siding, roofs or decks. In older bridges, original deck beams may have been replaced. This does not automatically eliminate the structure from NRHP eligibility, as deck replacement is common and necessary and was likely done periodically throughout the bridge's history. A bridge that retains its original deck structural system, however, would have higher integrity than a bridge with a replaced deck.

The use of the structure can be different than originally intended, such as a bridge converted to pedestrian use, but, the structure needs to function in the way it was originally intended, for example, a truss should still function as a truss. An exception to this criterion would be a rare, one-of-kind bridge that has been set by the side of the road or moved to a protected location. The authors know of several outstanding bridges that

have received this treatment. Though not perfect, it has preserved the artifact until a more appropriate use and location is found.

It is important to note that integrity does not apply to the structure's state of repair or its functional obsolescence (e.g., too narrow or structurally insufficient to meet modern traffic needs).

The evaluator should consult its state's historic bridge survey(s) or one of the many historic contexts listed in Appendix A for additional guidance on integrity and on specific character-defining features of bridge types.

1.5 Chapter 1 References Cited

1. National Park Service. National Register Bulletin. *How to Apply the National Register Criteria of Evaluation*. 1991.
2. Lichtenstein Consulting Engineers for the Ohio Department of Transportation, Federal Highway Administration and Ohio Historic Preservation Office. *Third Ohio Bridge Inventory, Evaluation and Management Plan for Bridges Built 1951-60 and the Development of Ohio's Interstate Highway System*. 2004.

