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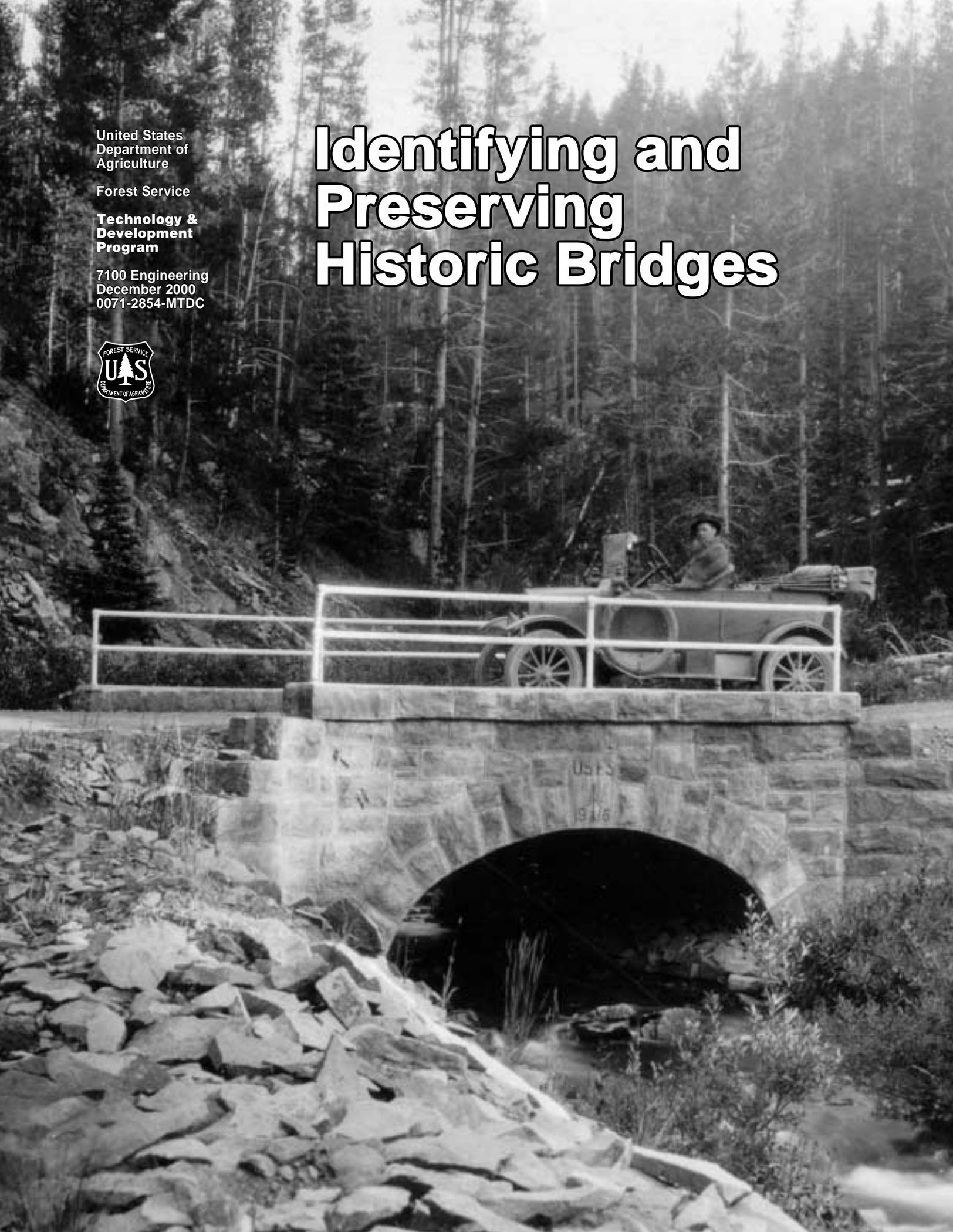
Forest Service

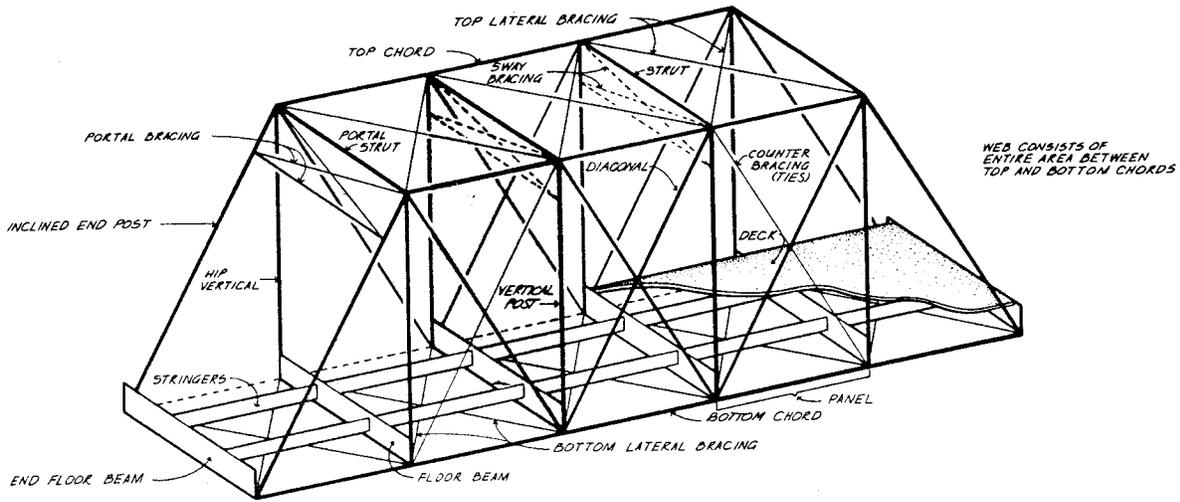
**Technology &
Development
Program**

7100 Engineering
December 2000
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Identifying and Preserving Historic Bridges





TRUSSES

A STUDY BY THE HISTORIC AMERICAN ENGINEERING RECORD

A TRUSS IS COMPOSED OF STRUCTURAL TRIANGLES JOINED TOGETHER, WITH PINNED OR RIVETED CONNECTIONS. THE MAIN PIECES OR MEMBERS MAY BE EITHER STIFF HEAVY STRUTS, POSTS OR THIN FLEXIBLE BARS. IT IS THE ARRANGEMENT OF THESE MEMBERS THAT DETERMINES THE SPECIFIC TRUSS TYPE.

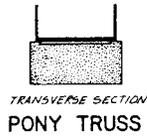
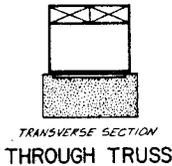
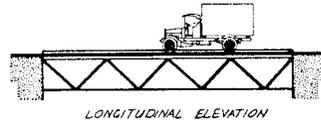
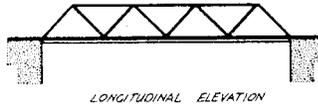
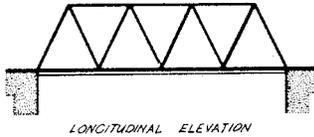
STRUCTURAL MEMBERS RESIST FORCES IN TWO PRIMARY WAYS — COMPRESSION AND TENSION. HEAVY RIGID MEMBERS MAY RESIST BOTH COMPRESSION AND TENSILE FORCES, BUT THIN RODS CAN ONLY RESIST TENSION AND THESE CHARACTERISTICS ARE MAJOR CLUES IN TRUSS IDENTIFICATION. NOTE THAT THE MAIN STRUCTURAL MEMBERS OF A TRUSS PANEL MAY BE SUPPLEMENTED BY THIN DIAGONAL TIES. BECAUSE TRUSS TYPES ARE DETERMINED BY THEIR MAIN STRUCTURAL MEMBERS, THESE COUNTER BRACES (INDICATED BY DASHED LINES ON THE IDENTIFICATION SHEET) MAY BE IGNORED. AFTER MATCHING THE STRUCTURAL OUTLINE OF THE TRUSS IN QUESTION WITH THE DIAGRAM IT MOST RESEMBLES, CHECK TO MAKE SURE THE ARRANGEMENT OF HEAVY COMPRESSION AND LIGHT TENSION MEMBERS IS COMPATIBLE WITH THE DIAGRAM. IF THERE IS AGREEMENT, THEN

THE BASIC TRUSS TYPE IS IDENTIFIED.

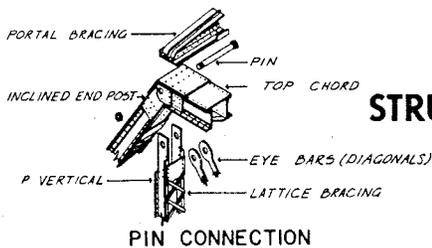
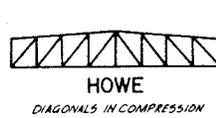
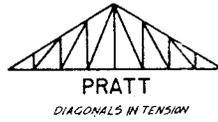
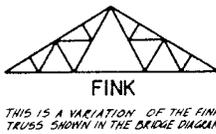
THE SHEET OF TRUSS DIAGRAMS PRESENTS ONLY THE STANDARD FORMS OF THE MOST COMMON TRUSSES. THERE ARE ALSO MANY "UNSAID" TRUSSES THAT DO NOT FALL INTO EASILY-DEFINED CATEGORIES. IN SUCH CASES, IDENTIFICATION SHOULD BE MADE AS CLOSELY AS POSSIBLE IN TERMS OF THE STANDARD DESIGNS. ADDITIONALLY, TRUSSES OFTEN ARE INVERTED, CREATING OUTLINES QUITE DIFFERENT FROM THE ORIGINAL — TENSION MEMBERS BECOMING COMPRESSION MEMBERS AND VICE VERSA BEFORE ASSUMING A TRUSS IS NOT REPRESENTED ON THE DIAGRAM, CHECK TO SEE IF IT IS AN INVERTED FORM.

MOST BRIDGE TRUSSES ARE OF THREE BASIC TYPES. IF THE DECK AND/OR RAILS ARE LEVEL WITH THE BOTTOM CHORDS, IT IS A THROUGH TRUSS. A PONY TRUSS IS A THROUGH TRUSS WITH NO LATERAL BRACING BETWEEN TOP CHORDS. A DECK TRUSS CARRIES ITS TRAFFIC LOAD LEVEL WITH THE TOP CHORDS.

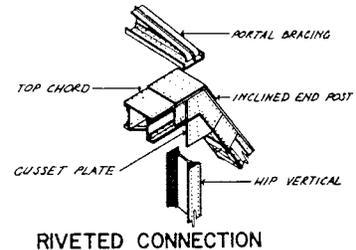
TRUSS BRIDGES



ROOF TRUSSES



STRUCTURAL CONNECTIONS



Identifying and Preserving Historic Bridges



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USDA Forest Service
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Missoula, Montana

8E82L47—Historic Bridge Evaluation

December 2000

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Acknowledgments



A project of this scope requires the efforts of many people. The authors gratefully acknowledge the Washington Office Engineering Staff and the Technology and Development Program Engineering Steering Committee for providing guidance and funding.



This bridge is a steel replica of the 83-foot log toll bridge Matt Taylor built across the Snake River during 1865. Freighters and miners crossed the log bridge on their way from Salt Lake City to the gold fields in the north, passing through what is now Idaho Falls, ID. The bridge, built in 1997, is not eligible for listing on the National Register of Historic Places.

The following persons are thanked for project guidance, reviewing documentation, and providing comments, photos, and project examples:

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Cover Photo—Neihart Bridge. Model T crossing the Neihart Arch near Neihart, MT, in 1916.



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Background

According to the USDA Forest Service Bridge and Major Culvert (BMC) database, the Forest Service currently owns and manages over 8,000 bridges of various types and styles within the United States and its territories. Many of these bridges are in need of substantial maintenance or replacement. Some of these bridges have historic values and should be preserved.

The National Historic Preservation Act of 1966, as amended (NHPA), mandates that Federal agencies consider the effects of their actions that may adversely affect historic properties, i.e., properties listed or eligible for listing on the National Register of Historic Places (NRHP). Section 106 of the NHPA outlines the process by which the historic significance for properties is determined.

Few bridges in the USDA Forest Service have actually been listed on the NRHP, however, many bridges have been evaluated for NRHP listing as part of the compliance process outlined in section 106 of the National Historic Preservation Act and been found to be “eligible for listing.”

Bridges found to be eligible for listing are treated in exactly the same manner as bridges actually listed on the NRHP. The Forest Service has the same legal responsibility for a “historic bridge” whether it is listed, is found to be eligible for listing, or has not been evaluated for NRHP listing. Any bridge more than 50 years old must be treated as if it is eligible for the NRHP unless it has been evaluated and found not eligible. Ignorance of a bridge’s historical significance and/or the effect a Federal undertaking will have on it does not in any way relieve the agency of responsibility for protecting historically significant bridges.

Demolishing a bridge (or other historic property) in anticipation of it becoming 50 years old, and hence potentially eligible for NRHP listing, is referred to as “Anticipatory Demolition.” Anticipatory Demolition is prohibited by the National Historic Preservation Act.

In 1992 the Whispering Pines Bridge on the Tonto National Forest in Gila County, AZ, was under contract for replacement, when it was discovered that the bridge had not been evaluated for historic significance. The delay caused by the eleventh-hour evaluation, subsequent determination of eligibility, and mitigation requirements resulted in significant project delay and cost.

Purpose of this Publication

This publication has been written to improve communication and streamline coordination between engineers and heritage resource specialists and to effectively and efficiently identify and manage Forest Service historic bridges. This publication will serve as a guide and information source for evaluating bridges for potential NRHP listing and preserving and maintaining significant historic bridges.

In the USDA Forest Service, responsibility for bridges (design, inspection, and maintenance) lies with the regional engineer with assistance from the regional bridge engineer. However, responsibility for compliance with section 106 of NHPA usually lies at the forest level with the heritage resource specialist. All heritage resource determinations of eligibility and determinations of effect must be conducted under the supervision of a qualified journeyman-level archeologist or historian who meets the qualifications outlined in the U.S. Secretary of the Interior’s *Standards and Guidelines for Archeology and Historic Preservation* (36 CFR 61). The qualifications require a master’s degree in archeology, history, anthropology, or historical architecture and experience in heritage resources management.

Generally, engineers have little or no experience with the National Register criteria for evaluating properties or the Section 106 compliance process, and heritage resource specialists on forests are usually prehistoric or historic archeologists who have little or no experience working with road systems and bridges.

The following sections describe:

- The legal requirements for historic preservation outlined in the amended (1992) National Historic Preservation Act of 1966.
- A brief history of the road and bridge infrastructure development in the USDA Forest Service.
- Guidelines for evaluating bridges under section 106 of the National Historic Preservation Act.
- Methods for mitigating adverse actions.
- Examples for preserving historic bridges.
- Guidelines for managing USDA Forest Service historic bridges.

Appendixes A–D provide USDA Forest Service bridge information, addresses of State Departments of Transportation (DOT’s) addresses of State Historic Preservation Offices, and National Park Service Field Offices for document mitigation.



Congress enacted the National Historic Preservation Act in 1966 as a response to the rapid loss of our Nation's heritage resources due to Federal and Federal/State projects such as the Federal highway program (the interstate program, in particular), urban renewal, and dam construction projects. Numerous archeological and historical sites were being leveled. Unique architecture and rare, historic bridges were being removed with no knowledge of their historic significance.

National Historic Preservation Act, Section 106—Evaluation Process

The National Historic Preservation Act created the National Register of Historic Places (NRHP). The NRHP defines what is historic and worthy of preservation at the National, State, or local level and lists the criteria to be used when evaluating a property's eligibility for listing on the NRHP. Historic properties eligible for listing can be bridges, buildings, sites, objects, and entire districts. For example, U.S. Route 66 in New Mexico, Arizona, and California has the entire right-of-way corridor for a 200-mile stretch of the old highway listed on the NRHP as a historic district.

The NHPA also codified procedures for the consultation (evaluation) process and established criteria for "effect" and "adverse effect," as outlined in 36 CFR Part 800.9. Effect is simply what impact a Federal undertaking or action, such as repair or reconstruction, might have on a historic property. To decentralize the NHPA Section 106 evaluation process, each State established a State Historic Preservation Office that is managed by a State Historic Preservation Officer (the office and the individual in charge are both referred to as the SHPO). The SHPO, in consultation with Federal agencies, determines NRHP eligibility, the effect of a proposed undertaking, and any required mitigation measures. Mitigation measures are attempts to reduce the negative effect an undertaking may create.

The NHPA also established the Advisory Council on Historic Preservation (ACHP). This appointed board retains a professional staff to comment on preservation issues and resolve disputes between State Historic Preservation Offices (SHPO's) and Federal agencies.

The ACHP is only consulted in the event of a disagreement (in determining the effect on a historic property) between the SHPO and the Federal agency or in the case of an adverse effect. Cases requiring

ACHP comment that are located in States east of the Mississippi River, as well as in Minnesota, Iowa, and Missouri, are sent to:

Advisory Council on Historic Preservation
1100 Pennsylvania Avenue, NW., Suite 809
Washington, DC 20004

Cases from Western States (all remaining States) are sent to:

Advisory Council on Historic Preservation
12136 W. Bayaud Ave., Suite 330
Lakewood, CO 80228

If a dispute occurs between a Federal agency and a SHPO concerning NRHP eligibility, the "Keeper" of the NRHP makes the final decision. The National Park Service administers the NRHP program, is the lead agency for historic preservation in the United States, and functions as the Keeper of the NRHP.

The ACHP recently drafted new regulations that incorporate the 1992 amendments to the National Historic Preservation Act. These new regulations appeared in the Federal Register Vol. 64, No. 95, on Thursday, May 18, 1999, and took effect June 17, 1999.

Section 106 Process Flowchart

The flow chart shown in figure 1 was prepared by the Advisory Council on Historic Preservation to outline the NHPA Section 106 process and highlight changes made in the 1992 amendment. The primary change to the Section 106 process is increased public involvement, including Native American Tribal groups. The complete ACHP 106 Regulations Flow Chart Explanatory Material is available at the ACHP website at <http://www.achp.gov/flowexplain.html>. This website explains the flow chart in a step-by-step narrative format.

What Constitutes an Undertaking?

An undertaking is any Federal action, or Federally permitted or approved action that has potential to affect historic properties. This would include actions by local governments or private groups using Federal funds. When the Forest Service shares in the cost of bridge repairs or replacements or awards grants for bridge replacements, the NHPA regulations apply and a Section 106 evaluation is required. Many types of undertakings can adversely affect historic properties. Undertakings



Section 106 Consultation Flow Chart
(May 1999)

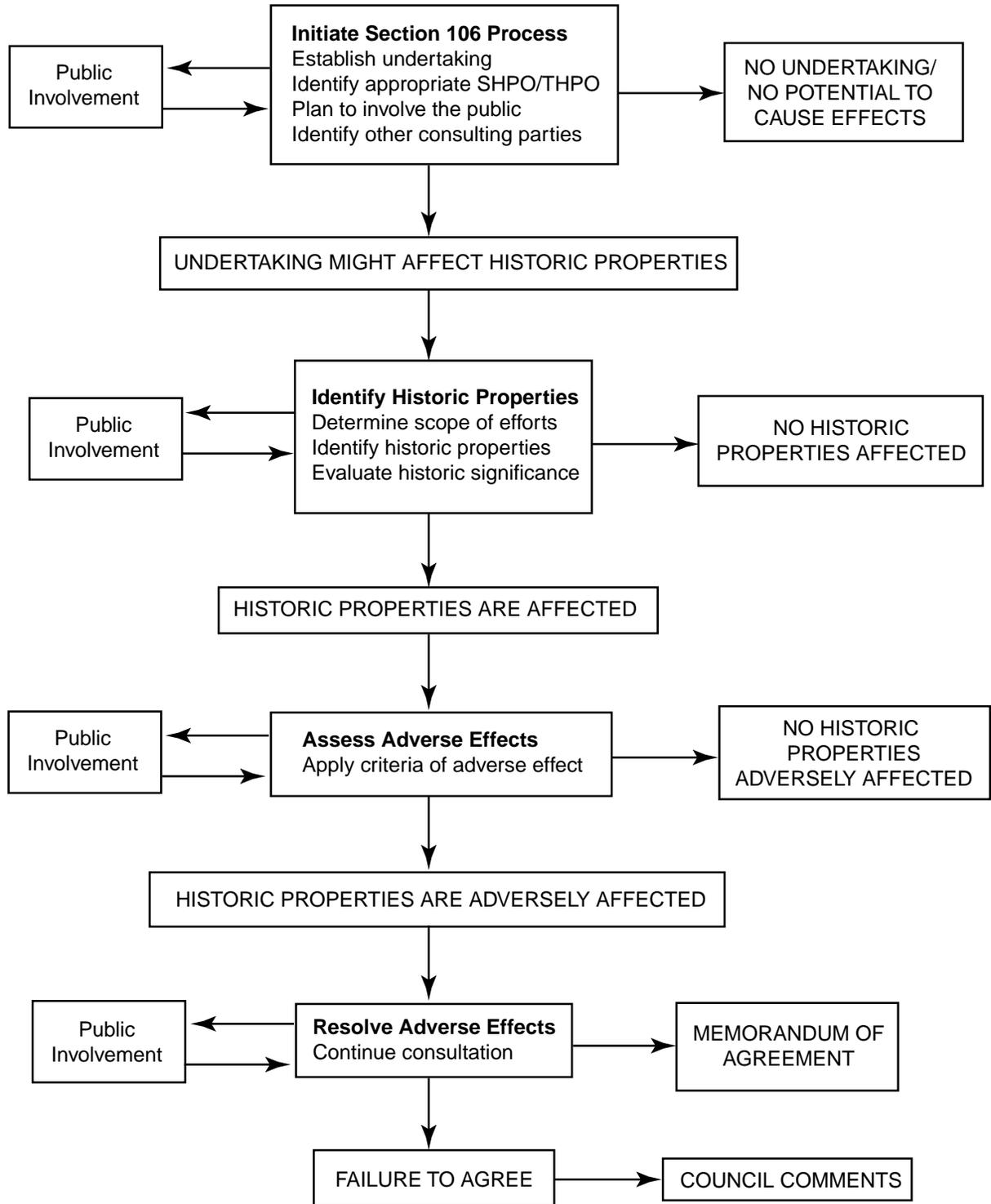


Figure 1—Flowchart showing the National Historic Preservation Act evaluation process.



that could adversely affect National Forest bridges include, but are not limited to, the following actions: 1) permitting heavily loaded logging trucks to use a historic bridge, 2) replacing a historic bridge with a modern bridge, and 3) removing or altering critical structural or design elements that change the bridge's historic appearance. Consequently, many bridge maintenance activities and permits are undertakings that require Section 106 evaluation.

National Register of Historic Places Evaluation Criteria

The criteria for determining eligibility for listing a bridge on the NRHP are very specific and are outlined in 36 CFR 60.4. Forest Service responsibilities for historic bridges are the same whether a bridge is listed on the NRHP or is only determined to be eligible for listing. The agency heritage resource specialist in consultation with the respective SHPO makes the determination of eligibility for NRHP listing. If the agency and the SHPO agree, the bridge is determined eligible with a "consensus determination of eligibility." If, on the other hand, the agency and the SHPO disagree, the Keeper of the NRHP, in Washington DC, makes the final decision. The Federal agency and the SHPO usually reach an agreement on NRHP listing eligibility.

Generally, for bridges to be eligible for the NRHP, they must be at least 50 years old, be historically significant, and have a high degree of integrity. A property has a high level of integrity if it possesses characteristics that convey its historical significance through its setting, materials, design, location, workmanship, feeling, and association (see the glossary for definitions). Determining integrity will be discussed in more detail later in this section. A property's significance in American history, architecture, archeology, engineering, and culture is determined by the integrity of the districts, sites, buildings, structures, and objects that are part of the property and its surroundings. To be considered historically significant, a bridge must meet at least one of the following basic criteria:

- A. The property must be associated with events that have made a significant contribution to the broad patterns of our history.
- B. The property must be associated with the lives of persons significant in our past.
- C. The property must embody the distinctive

characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.

- D. The property must show, or may be likely to yield, information important to history or prehistory.

Bridges are most often eligible for the NRHP under criterion A or C. On rare occasions a bridge may also be eligible under criterion B if the bridge builder or designer is, or was, a significant individual who had a direct role in the design and construction of the bridge. John Roebling, developer of modern cable suspension bridge technology and the designer of the Brooklyn Bridge, would be such an individual. Bridges that John Roebling designed, and whose construction he supervised, would be eligible under criterion B.

Although the NRHP is a "national" register, historic properties can be eligible because of local, State, or National significance under any of the four criteria. Under criterion A, the applicable history could be local, statewide, or National. Under criterion B, the person could be a local, State, or National figure. Under criterion C, the architectural significance could be local, statewide, or National.

Bridges may be historically significant (eligible for NRHP listing) either individually or as a contributing element to a much larger historic district. Bridges on U.S. Route 66 in New Mexico, Arizona, and California are significant as part of the Route 66 Historic Corridor District.

Not only must a bridge meet one or more of the NRHP criteria, it must have a high degree of integrity. A property has a high level of integrity if it possesses characteristics that convey its historical significance through its setting, materials, design, location, workmanship, feeling, and association. The bridge must retain, to a significant degree, at least five of the following seven characteristics from its original design:

1. *Setting*—the character of the location and how the bridge is situated in relationship to other features, such as the roadbed and landforms.
2. *Materials*—the elements that were originally combined to construct the structure.
3. *Design*—reflects the historic function and technology. Design applies to individual structures as well as districts.



4. *Location*—the place where the bridge was originally placed or where a historic event occurred. Integrity of location can be extremely important and most historic buildings lose their historical significance if they are moved. Bridges, on the other hand, have traditionally been moved from site to site, so location integrity will not always be a disqualifying issue.
5. *Workmanship*—evidence of the builder's craft skills and technology.
6. *Feeling*—the expression of the aesthetic or historic sense of a particular time period.
7. *Association*—the direct link between an important historic event or person and the bridge. Association requires the presence of physical features to convey the relationship.

The heritage resource specialist completes the initial recording of the bridge and associated features, such as roads, landscapes, etc. He or she also completes the initial historical background research for the bridge and then applies the criteria for evaluation and determines the level of integrity. The bridge engineer can be an excellent resource concerning the bridge history, past maintenance practices, and technical issues. However, the heritage resource specialist, in consultation with the respective SHPO, is responsible for making the final recommendation for NRHP eligibility.

Exceptional Significance

Generally, a property must be at least 50 years old to qualify for listing on the NRHP. However, as with all rules there are exceptions. Cape Canaveral Florida is listed on the NRHP for its association with the nation's space program. Likewise, the Dallas Book Repository where Lee Harvey Oswald shot President John F. Kennedy is also listed on the NRHP. Occasionally, bridges less than 50 years old may have exceptional significance and be eligible for the NRHP under the exceptional significance measure.

Bridges less than 50 years old cannot be ignored. Not only could existing bridges be historically significant under the exceptional significance measure, but existing bridges less than 50 years old could become eligible during the repair/reconstruction/construction process.

Most State Departments of Transportation (DOT's) evaluate any bridge more than 45 years old for NRHP eligibility.

The Pugsley Suspension Bridge, which spans the Marias River near Chester, MT, is an example of a bridge eligible for National Register listing because of its exceptional historical significance (figure 2). The Hurdle brothers of Billings, MT, built the Pugsley Bridge in 1951 and it is the only vehicular suspension bridge in the state. The Liberty County commissioners chose this design because site conditions made construction of a steel truss or girder bridge impracticable because of frequent ice jams and flooding. The bridge is 326 feet long with a 290-foot center span (between towers). The towers rise 54 feet above the concrete piers on which they stand. The bridge design is also considered unique because it is a rare example of a braced-cable suspension structure that was designed specifically for this site. Both chords are cables rather than the traditional longitudinal girder or stiffener truss lower chord. The bridge is eligible for the NRHP under criteria A and C.



Figure 2—Pugsley Suspension Bridge near Chester, MT. This bridge is eligible for the National Register of Historic Properties under criteria A and C as a historic property with exceptional significance. Photo by Archie Bishop.



Determination of Effect

For each bridge listed, or determined eligible for listing on the NRHP, the Forest Service must analyze the effect an undertaking will have on the bridge and any surrounding historical resources. This analysis of effect must be coordinated with the SHPO.

Each undertaking has an area of potential effect. This area, as determined by the heritage resource specialist and SHPO, is the area physically or visually affected by the proposed undertaking.

An undertaking has an effect when it has the potential to cause any change, beneficial or adverse, to the quality of the historical, architectural, archeological, or cultural character that qualifies the resource for listing on the NRHP. Many routine maintenance activities, such as painting or deck or guardrail replacement, are undertakings, as well as the more obvious activities, such as bridge replacement.

The effect of a proposed undertaking will be one of three types:

No Effect – If an undertaking results in no change to the characteristics that qualify the bridge for listing on the NRHP either directly or indirectly, then it has no effect.

No Adverse Effect – If an undertaking will have some effect on the characteristics from which the bridge derives its significance, but the expected effect does not meet the criteria of “Adverse Effect,” the undertaking will have “No Adverse Effect” on the bridge.

Adverse Effect – An undertaking has an adverse effect when one or more of the following conditions are likely to occur:

- Destruction or alteration of all or part of the bridge.
- Isolation from or alteration of its surrounding environment.
- Introduction of visual, audible, or atmospheric elements that are out of character with the bridge.
- Transfer or sale of a Federally owned property without adequate conditions or restrictions regarding maintenance or use.
- Neglect of a property resulting in its deterioration or destruction.