Historic Bridges

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Resources

The following guidance documents are available for project managers:

- Purpose and Need
- Design Exceptions and Variances on Historic Bridges: Effective Application and Utilization
- Evaluation Criteria – Rehabilitation Study (coming soon!)
- Management Plan for Historic Bridges in Minnesota
- Guidelines for Completing a Historic Bridge Project
- Rehabilitation Study Report Format
- Guidance for Developing Historic Bridge Rehabilitation Alternatives

The following training documents are available for project managers:

- Historic Bridge Training Powerpoint presentation
- Historic Bridge Training handouts

Introduction

There are over 200 historic bridges in Minnesota on trunk highway and local highway routes. In 2008, the FHWA, the State Historic Preservation Office (SHPO), the Corps of Engineers, and MnDOT signed a historic bridge Programmatic Agreement to streamline the federal historic review of both MnDOT and local bridge projects when federal funds were involved. This eliminates the need to evaluate every bridge over 50 years old before projects can begin, thereby reducing costs and delays. Bridges built prior to 1971 have already been evaluated for possible historical value. The Management Plan for Historic Bridge in Minnesota provides information on applicable laws, funding options, rehabilitation alternatives, and Minnesota's innovative collaborative approach, where engineers and historians collaborate to find solutions to rehabilitating bridges. More information about historic bridges is available on the following website: http://www.dot.state.mn.us/historicbridges/index.html.

Rehabilitation Study Report Format

Items to keep in mind when writing rehabilitation study:

- A rehabilitation study has an audience with varying levels of technical expertise and a wide array of professional specialties. The narrative needs to be written not only to cover the needs of the bridge engineers and general transportation engineers involved in the project development process, but also the non-engineers that are substantial players in this process (e.g. architects, historians, general public). Technical language may be unavoidable but it needs to be supplemented with visuals to bridge the knowledge gap(s) within the audience.
- This guidance is intended to help standardize the general structure of rehabilitation studies and provide concepts of what the writer should achieve. This guidance is not a cookbook and the 'examples of information to provide' are not intended to be a definitive listing or listing of minimum requirements of information to include in a rehabilitation study.
- The base assumption is that all historic bridges commencing the Section 106 process will be retained. In other words, a project proposer enters this process with the mindset of finding ways to retain a historic structure in highway use.
- Traffic Forecasts: FHWA expects all Federal-aid highway projects to follow the HPDP Manual which indicates that traffic forecasts for 20 years from anticipated date of opening are typical. FHWA acknowledges that structures are likely to remain in place for periods far in excess of 20 years, however the accuracy of traffic forecasts and the additional expenditure of funds for capacity which may or may never be utilized make it prudent to only look at maximum 20 year traffic forecast.
    - We both support and encourage the use of materials and technology that will reduce maintenance cost and extend the structure's life.
- Rehabilitation Alternatives Development and Analysis
    - When developing an alternativesanalysis, the range of alternatives may run from the 'No Build' up to a level of what is necessary to carry the target load rating listed in Table G-1 of the MnDOT policy document, "Bridge Preservation, Improvement, and Replacement Guidelines for Fiscal Year 2006-2008," and the 20-year traffic forecast. The alternatives shall consider the use of avoidance and minimization techniques, some of which are contained in the historic bridge programmatic agreement.
    - There are situations when the inventory and operating ratings of a structure are markedly different. A structure may have an inventory rating less than the target listed in Table G-1 but also possess an operating rating such that no load posting is necessary for the structure. Part of a reasonable range of alternatives would

include an alternative that does not meet the target inventory rating but would still have an operating rating that would result in the structure not being load posted.

- If the bridge is located on a roadway where trucks are permitted to operate with annual permits, then it is appropriate to conduct a loading analysis that evaluates both legal loads for that roadway as well as the annual permit loads. Similarly, if the bridge has been carrying the annual permit loads then it would be expected that the rehabilitated structure should also carry the annual permit loads with no additional demands placed on the historic structure. FHWA would expect the project proposer to utilize more refined load rating analysis techniques, including the use of reasonable rating factors (inventory versus operating level) to demonstrate that every effort was made to preserve the bridge without adversely impacting the historic integrity of the structure. Contact the MnDOT Bridge Rating Engineer or the MnDOT Bridge Permits Unit for annual permit loads allowed on a given roadway.
- Alternatives that improve load rating beyond the target listed in Table G-1 of the MnDOT policy document may be considered in the range of alternatives if they do not induce an adverse effect as defined by Section 106.

Guidance for Developing Historic Bridge Rehabilitation Alternatives

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Step 1 – Collect Background Information

Step 1a – Understand the project background

- Evaluate the structural, functional, and geometric conditions of the bridge and identify all extant and emerging issues
- Review and provide input (or Assist) in developing the overall project Purpose and Need statement, to understand the overall project objectives and their priorities. [See separate guidance on Purpose and Need]
- Brainstorm and list preliminary (high level) ideas/concepts to address issues keeping in mind draft evaluation criteria in Step 2 and the action levels in Step 3a
- Consult with historian to understand the character-defining features and historic fabric of the structure, to better help you to identify ways to rehabilitate the bridge so that it can be kept in service without significantly altering those elements that are important to its historic character; collaborate as often as possible
- Refer to the MnDOT Bridge Preservation, Improvement and Replacement (BPIR) guidelines and other design guidelines (e.g., MnDOT Bridge Design Manual) as

background information for engineering design objectives, but give serious consideration to employing variances and design exceptions beyond what would be done for a routine bridge *including flexibility in loading analysis.*

Step 1b – Understand the overall process requirements

- Review the process requirements and training materials on following the Section 106 process. [See separate guidance on Completing Historic Bridge Projects]
- Utilize an "ordered approach" to study practical means for the treatment of the historic integrity of the bridge. The following sequence must be considered in the order listed below:
    - **Avoid** an impact (adverse) altogether by not taking a certain action or parts of an action
    - **Minimize** an impact by limiting the degree or magnitude of the action and its implementation
    - **Mitigate** as a last resort if no other workable option in the first two steps in the sequence exists

Step 2 – Work with Team to Develop Draft Evaluation Criteria

- Develop draft evaluation criteria for the bridge project. [See separate guidance on development of Evaluation Criteria] The evaluation criteria may evolve based on additional information obtained as project development proceeds, but understanding the basis for comparison of alternatives may be helpful in brainstorming the development of alternatives.

Step 3 – Identify Range of Rehabilitation Alternatives

When developing the range of rehab alternatives, keep the following in mind:

- Ensure each alternative meets the project's primary purpose and need
- Consider rehab activities that produce the highest benefit with the least impact to the historic integrity and offer the best value within a reasonable scope of work.
- Develop the range of alternatives in a collaborative process with FHWA, historian, CRU, and other stakeholders as necessary (Project Team).
- Get concurrence from the Project Team regarding range of alternatives prior to performing extensive analysis. If possible, have Project Team review possible alternatives during the alternatives development process.
- Keep communicating with Project Team members throughout the development of rehab alternatives to get input on: range of alternatives, level of detail to develop each rehab alternative, preliminary findings, etc.
- Anticipate the preferred alternative might actually land between the low and high action options (See Step 3a).

- Document your alternatives development and decision-making process, so it can be easily understood by others without much bridge knowledge (e.g., FHWA, SHPO, other stakeholders). [See separate guidance on Rehab Study Report Format.]
- Budget additional time for significant refinement and/or analysis of rehab activities and details after the preferred alternative is identified.
- The level of detail of each alternative needs to be similar in order to make an equitable comparison between alternatives.
- Keep in mind that additional alternatives may need to be explored as discussions unfold.
- Each alternative may have its own unique design criteria.
- Goal is to have at least one rehab alternative result in 'no adverse effect' (as a basis for comparison).

Range of Alternatives:

- Minimum-level Action alternative – Address the most 'important' structural issue(s) using minimal maintenance options to meet the purpose and need with minimal impacts to the historic fabric.
    - Evaluate and maximize the potential use of design exceptions and variances especially if it is beneficial to the historic integrity of the bridge.
    - Collaborate with the historian to define this alternative
    - If needed for comparison to other alternatives with longer 'life expectancy', identify future maintenance resources that would be needed throughout the duration of the expected service life of the bridge

- Mid-level Action alternative(s) – Develop mid-level action(s) to 'test' increases in structural benefits vs. increases in potential for adverse impacts; in collaboration with historian and other stakeholders (as needed)

- High-level Action alternative – Use this level to more effectively address comprehensive structural issues (and address secondary project needs and other considerations) with resulting higher level of structural improvement and higher potential for impacts to historic integrity.
    - Collaborate with the historian to define ways that this alternative could minimize impacts to the bridge's historic integrity.
    - Itemize and describe rehab actions and details that would require a higher up-front level of effort but result in a minimized demand on maintenance resources throughout the duration of the expected service life of the bridge; extending the service life and minimizing life-cycle costs of the bridge is of relatively higher importance in this alternative
    - Investigate opportunities for other structural, functional and geometric improvements.
    - The use of design exceptions and variances are considered a relatively lower priority, but still necessary, in this alternative.

- Highest-level Action alternative (if needed)– to address additional needs or concerns (this would be similar to the High-level Action alternative, but would address more secondary needs or additional considerations)

Step 3a – Bridges with Structural Issues

If structural condition is the primary deficiency identified for the bridge, then based on the problem areas identified in the assessment, identify potential alternative 'levels' of action:

- Categorize alternatives into different levels of effort strategies (minimum, mid, high, highest) that prevent, delay or reduce deterioration, restore intended function, and extend the useful life of the bridge.
- Determine construction costs of alternatives to use as an equitable comparison. Include anticipated service life of each alternative (time until next major rehabilitation).
- The relative 'importance' of structural concerns may need to be discussed with FHWA and other project stakeholders to get agreement. Example structural issues include, but are not limited to:
    - Degradation of structural members/components
    - Structural stability
    - 'need' vs. 'desire' to increase load capacity
    - Fracture critical/non-redundancy (need to assess as per Ch 152, but not a requirement as per FHWA)

Step 3b – Bridges with Geometric Issues

For bridges that are primarily deficient in geometric or functional issues (e.g., inadequate portal width/horizontal clearance; inadequate vertical clearance), identify potential alternative(s) to address the primary need(s), while maintaining the historic integrity of the structure to the maximum extent possible. [If inadequate width to accommodate traffic operations or capacity is identified as a need, see Step 3c]

If secondary needs are not addressed by the initial range of alternatives, consider additional alternatives that could address these needs, while still taking into account the historic bridge features.

- The development of the range of alternatives should include consideration of different extent of use of design exceptions and variances.
- Utilize the levels of action [See Step 3] to develop the range of alternatives.
- Collaborate with FHWA, historian, CRU and other stakeholders as needed to identify the range of potential alternatives.
- Collaborate with the historian to identify ways that alternatives could minimize adverse impacts to the historic bridge.
- Itemize and describe the range of alternatives and details for each alternative.
- Get concurrence from Project Team on alternatives and approach before proceeding with detailed study of alternatives (and, if appropriate, at interim points in the study/decision-making process).

Step 3c – Bridges with Other Issues

Needs other than structural and/or geometric problems may be identified for historic bridge projects, e.g., pedestrian bicycle accommodations, need for additional capacity to address traffic operational problems, mobility, etc. Approaches to identifying the range of alternatives should be discussed with Project Team members. Alternatives may include structural additions (to add pedestrian and/or bike accommodations), potential for a new bridge paired with the existing bridge, etc depending on the specific needs. Overall process suggestions described in Step 3b would also apply.

Step 4 – Evaluation of Alternatives

As rehab alternatives are developed, information related to each of the evaluation criteria agreed upon with the Project Team will also need to be compiled, as the basis for comparing and making decisions regarding retaining vs. eliminating alternatives. During the development of alternatives, additional criteria that differentiate among alternatives may also be identified. Also, as comparisons are compiled, it may become apparent that one or more alternatives may have a 'fatal flaw' (e.g., doesn't meet the project primary need; is infeasible to implement; results in unacceptable environmental impacts).

- One or more interim informational updates and/or meetings of the Project Team might be warranted, to keep the project decision-makers informed on work progress and to make mid-course decisions, if necessary.
- Project staff need to document the decision-making process including, but not limited to, the basis for evaluating and eliminating alternatives (e.g.: which alternatives carry forward into the environmental documents).
- Depending on the complexity of the project, number of alternatives considered, etc. CRU staff should consult with SHPO to identify a process for initial assessment and/or screening of alternatives, so detailed rehab packages don't need to be prepared for all alternatives being considered.
- Good communication with team members is important to keep work progressing, guide work, and to 'bring decision-makers along' in the process, to avoid having the results questioned at the end of the evaluation process.