Conflict between structurally deficient and historically significant bridges

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Conflict between Structurally Deficient and Historically Significant Bridges

Conflit entre la sécurité des ponts et leur valeur historique

Konflikt zwischen den Sicherheitsanforderungen an Brücken und ihrem historischen Wert

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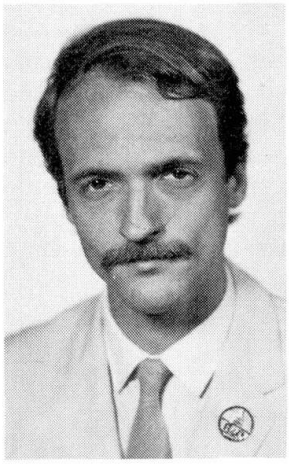

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SUMMARY
This paper highlights issues in the conflict between making America's bridges safe and secure and the desire to preserve selected examples of historically significant bridges for future generations.

RESUME
L'article illustre le conflit existant entre la nécessité de disposer de ponts sûrs et la volonté de garder, à l'intention des générations futures, des ponts de valeur historique.

ZUSAMMENFASSUNG
Der Artikel erläutert die bestehenden Konflikte zwischen der Notwendigkeit, über sichere Brücken zu verfügen, und dem Willen, zugunsten späterer Generationen Brücken von historischem Wert beizubehalten.

1. BACKGROUND TO THE BRIDGE ISSUE

The Historic American Engineering Record (HAER) [1] had been in business only six years when notice was taken of an article buried in the back pages of the July 19, 1975, issue of The New York Times entitled "32,000 Old Bridges Are Termed Unsafe." This article was an early warning that thousands of bridges built during the last half of the 19th and first quarter of the 20th centuries were threatened by massive federal programs to rid the primary and secondary road system of the United States of structurally deficient and functionally obsolete bridges. This did not mean that industrial archeologists, historic preservationists or historians of civil engineering were insensitive to the threat to life and property posed by unsafe bridges. But rather, we were concerned that the country was about to lose one of the most significant contributions made by civil engineers to the development of this vast land. What confounded the problem further was that few engineers, much less the lay public or historic preservationists, would recognize a historic bridge if they saw one. Like many other structures of the industrial revolution, bridges, especially metal trusses, at the time were not considered part of the historic patrimony; they were not viewed in the same context as great works of architecture. However, when viewed with an appreciative eye, bridges are wonderful expressions of the engineer's art. The truss bridge in particular was indigenous to America. No other country experimented with the truss concept as widely as we did during the 19th century. With unlimited wood, and the need to construct railroads and roadways as quickly and cheaply as possible to open up the frontier, the timber truss was a natural solution. Once the trunklines opened up the hinterland, people moving westward built a network of primary and secondary roads to connect their farms to market towns, and the towns to larger cities. The solution to crossing thousands of streams and rivers was the prefabricated metal truss which evolved from the wooden truss about the middle of the 19th century. Manufactured first in cast and wrought iron, and later in steel in a bewildering number of configurations, hundreds of patents were taken out during this period. HAER realized that many examples of these patented bridges remained among those defined as structurally deficient and functionally obsolete. Thus began intensive conscious raising efforts to sensitize the engineering profession, the preservation community, federal officials and the lay public to the historical significance of bridges, especially of the metal truss kind.

Fig.1. The Brooklyn Bridge, one of the most famous bridges in the world, celebrates its Centennial in 1983. Though no one would dream of replacing it, a cable corroded by pigeon dung snapped last year, killing a pedestrian; rehabilitation costs are estimated at $105 million. Jack Boucher, HAER.

2. HAER INITIATIVES TO FOSTER RECOGNITION OF HISTORIC BRIDGES

Articles were written, speeches were made and symposiums were given by members of the HAER staff. To arrest the attention of transportation engineers and Federal Highway Administration (FHWA) officials who pressed on with bridge replacement regardless of environmental or historical concerns, the question was asked - Is the bridge eligible for listing in the National Register of Historic Places [2]? While many viewed this tactic as obstructionist, and not in the tradition of cooperation between federal agencies, it was necessary on several occasions to delay the demolition of a bridge to allow the environmental review process, as mandated by law, to run its course. The intent was to promote the concept of comprehensive statewide inventories to identify those bridges that may be eligible for listing in the National Register. Having such inventories, it would be possible to advise the federal agency involved or the State or county highway engineer of the bridge's historical significance. Appropriate steps could then be taken at the earliest planning stages to mitigate any adverse effects. Mitigative measures would indicate which bridges should remain in situ and be sympathetically restored or strengthened; which might be dismantled and relocated for continued use elsewhere; and which should be recorded so their loss would not be total if in the final analysis, they could not be saved. This is the purpose of our historic preservation and environmental laws.

3. FHWA INITIATIVES FOLLOWING THE SURFACE TRANSPORTATION ACT OF 1978

Evidence that these measures were beginning to have an effect was revealed in 1978. The Surface Transportation Assistance Act of 1978 (PL 95-599, Sec. 124 & 202, 92 Stat. 2689) permitted the optional use of Federal Highway Bridge Replacement and Rehabilitation funds for inventories of historic bridges. In 1980, FHWA adopted a policy of encouraging states to conduct such inventories, and has recently moved to add a one-digit entry for historicity to the National Bridge Inventory Data Sheets. An adversary relationship between HAER, the Advisory Council on Historic Preservation, State Historic Preservation Officers, and bridge enthusiasts on the one side, and FHWA and state highway and transportation officials on the other, changed during this period to one of mutual cooperation. HAER, with the assistance of the SHPOs and FHWA, sponsored three regional Historic Bridge Symposia in 1979-80 that highlighted inventory methodology, ascertained historical and environmental significance, defined structural problems and strong points, and discussed the feasibility of preserving historic bridges. FHWA, with the assistance of HAER, produced "An Introduction to Historic Bridges," a 35 mm slide/cassette tape that is available to highway engineers and preservationists.

4. STATUS OF STATEWIDE HISTORIC BRIDGE INVENTORIES

By latest count, 28 out of the 50 states have completed or made significant progress on statewide historic bridge inventories [3]. This is a remarkable statistic considering the vast size of the United States, its many political subdivisions, and the fact that just seven years ago, the Commonwealth of Virginia was the only state that had completed an historic bridge inventory [4]. Most of the states are publishing the findings of their inventories thus adding to the scholarship on bridge building in America, and enabling regional comparisons to be made when necessary. Fast approaching is the day when it can be claimed that we have completed a national historic bridge inventory.

5. PROGNOSIS FOR THE FUTURE

Once the states that have not begun inventories come into line, the identification and evaluation phase will be behind us. Bridges determined eligible for the National Register will logically serve as the basis for preservation planning. For states that have completed inventories, approximately 10% of the bridges identified are eligible for the National Register. The remainder are of no historical interest. Preservation planning alternatives may entail: 1) Rehabilitation in situ; 2) Relocation and rehabilitation at a new site; 3) Adaptive reuse; 4) Recording prior to demolition.
regardless of the fact that inventories identify bridges that may qualify for these treatments, few bridges in the United States have been rehabilitated, relocated, or adaptively reused since the bridge rehabilitation program began. Based on the 4(f) statements [5] HAER has reviewed over the past two years, the primary mitigative measure has been recording prior to demolition. The reason is that few highway engineers seriously address the preservation potential of 19th and early 20th century bridges. In most cases they are stymied by modern geometric and loading standards established by the American Association of State Highway and Transportation Officials (AASHTO). FHWA has been reluctant to approve federal funding unless these standards are met. In other instances state and local highway departments will not assume legal responsibility for deficient bridges that could be bypassed and abandoned. Few local communities or private groups that may be interested in saving a bridge have the resources to upgrade a bridge to safe standards and then maintain it year by year, much less assume the burden of liability. Only in an extremely limited number of cases have non-highway interests gotten behind the preservation of a bridge and convinced highway officials that rehabilitation was feasible. Surprisingly, the few bridges that have been rehabilitated and continue to be used for vehicular purposes have been rehabilitated at a fraction of the cost of new replacement structures. Most of these efforts have had strong local supporters who have hired their own engineering consultants to reject the claims of deficiency and prove that it is feasible to rehabilitate to safe standards. However, local groups are reluctant to confront highway officials and few have the resources to hire consulting engineers.

Fig.2. Bollman's Suspended & Trussed Bridge (1869) was relocated from a main line of the Baltimore & Ohio RR to service the mill at Savage, Maryland. It is the only known example of its type and facilitated the rapid expansion of early American railroads westward. Robert Vogel, Smithsonian Institution.

6. THE NEED FOR CASE STUDY DATA

Now that the identification and evaluation gap is being closed, the next goal will be to develop case studies demonstrating the economic and engineering feasibility of rehabilitating, relocating, and adaptively reusing historic bridges. We know there probably are more bridges than expected that have been rehabilitated or relocated to other sites. Reports on the results of statewide bridge inventories reveal that it was normal practice during the early decades of the 20th century to dismantle and relocate bridges. Needed is specific information on the techniques and costs of such procedures. We also need detailed information on rehabilitation measures, both those that take into account the historic characteristics of bridges and those that ignored them. We need examples and data on bridges that have been adaptively reused for purposes other than vehicular. Once cost data, engineering specifications, and illustrations of acceptable rehabilitation techniques begin to accumulate, it will be possible to advance the argument that bridges are imminently suitable for these measures, that it can be done without threatening human life and property, and at a savings over new construction. This is implied in the Highway Bridge Rehabilitation and Replacement Program. To date, replacement has been funded almost exclusively.

Also pointed out while monitoring bridge rehabilitation and replacement projects is the lack of understanding and sensitivity on the engineer's behalf towards historic bridges. Few engineers have been trained or have sought experience in preservation projects. There is little ethic to understand the profession's past accomplishments or to strive to preserve noteworthy examples of these achievements. An exception to this general observation is the landmark designation program of the History and Heritage Committee of the American Society of Civil Engineers (ASCE). And, it should be pointed out that once a state highway department becomes involved in an historic bridge inventory, many staff engineers develop keen interests and appreciation of old bridges. However, rarely does one find an engineering firm assuming a leadership role in a preservation project. The fact that architects and buildings rather than engineers and engineering structures have captured media headlines in these areas speaks for itself.

7. APPEAL FOR CASE STUDY DATA

The reason for seeking the opportunity to present this paper at the International Association for Bridge and Structural Engineering is that European engineers have a far better success rate for rehabilitating bridges than we have in America. Specifically being referred to are the rehabilitated bridges of Thomas Telford, and the first Ironbridge, constructed in 1779 at Coalbrookdale, England. Certainly notable examples in other continental European countries exist that I am not familiar with. We in America seek your assistance in lending us information on your accomplishments. Because we have such limited examples to point to in this country, we need specific information on rehabilitation projects that have been completed for historic bridges of all types. We need to know how you have addressed such issues as codes and standards, aesthetics, specifications, and costs. If such information is forthcoming, it will be forwarded to Howard Newlon, Chairman, Transportation Research Board (TRB) Subcommittee A1B03(1), Historic & Archeological Considerations in Transportation Planning [6]. After this information is digested into useful case studies, it is hoped that the Federal Highway Administration will extend the same level of support and assistance as was given to the National Historic Bridge Inventory. If the "Maintenance, Repair and Rehabilitation of Bridges" is as significant a

subject to merit an international symposium, then it seems only logical that the techniques of maintenance repair and rehabilitation can be defined to ensure the preservation of historic bridges. If this comes about, then not only can we save limited financial and material resources, but we can also maintain notable achievements of the engineer's art, and the aesthetic character and environmental quality of our urban roads and rural landscapes.

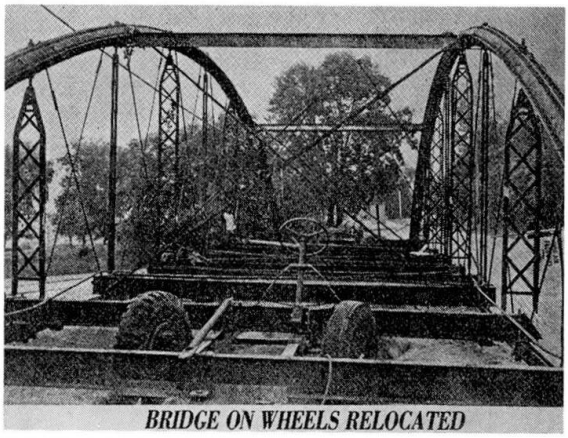

Fig.3. Espyville Road Bridge (1873), a bowstring arch-truss fabricated by the Wroght Iron Bridge Company of Canton, Ohio, was braced, lifted from its abutments, placed on a wheeled under carriage, and driven to a new location over the Olentangy River near Caledonia, Ohio - an unusual, but simple alternative to demolition.

NOTES

[1] HAER was established in 1969 by the National Park Service, the Library of Congress, and the American Society of Civil Engineers to compile a graphic and written archive of historic industrial and engineering sites in the United States.

[2] The National Register is the official list of historic properties of state, local and national significance considered worthy of preservation maintained by the Secretary of the Interior.

[3] Chamberlin, William P., Criteria for Decisions Involving Historic Bridges. Scheduled for publication later this year by the Transportation Research Board as part of the National Cooperative Highway Research Program Synthesis series.

[4] Newlon, H. H. Jr. A Proposal for Initiating Research on History of Road and Bridge Building Technology in Virginia. Virginia Highway and Transportation Research Council, VHRC 72-P2, Charlottesville, 1972.

[5] Section 4(f) Statements emanate from the Department of Transportation Act of 1966 which states in part that the Secretary of Transportation shall not approve any program or project which requires the use of... any land from a historic site...unless (1) there is no feasible and prudent alternative...and (2) such program includes all possible planning to minimize harm...

[6] The TRB subcommittee on Historic & Archeologic Considerations in Transportation Planning was formed in 1977 to address the conflict between Transportation improvements and historic preservation. TRB is a program of the National Academy of Sciences, National Research Council.