CHAPTER TWO

PRESERVATION PATTERNS

Historic bridges have been a prominent focus of preservation interest for nearly a quarter century, long enough that preservation patterns should be discernible. It is useful to identify these patterns because they are the result of the policies and practices that are the subjects of this synthesis. If these patterns are not what was expected or intended by those who have been promoting historic bridge preservation, then the policies and practices may need to be reexamined. Unlike many endeavors, where policies and practices evolve from stated or implied goals, goals for preserving historic bridges have never been stated at either the national or the state level. That is, nowhere does there exist a statement of what the final mix of preserved bridge structures should be composed or what specifically it should represent. All we have are criteria for determining historic value (i.e., National Register eligibility and state ranking systems) and procedures to assure that those values are considered when rehabilitation or replacement decisions are made. This is not to argue that stated goals for historic bridge preservation are necessarily desirable or even possible, but that in their absence, preservation patterns may be interpreted as de facto goals, and that anyone concerned about historic bridge preservation should be aware of those patterns.

This chapter includes a summary of national preservation patterns that could be inferred from responses to the study questionnaire. That summary is preceded by a brief discussion of regional variations in both the mix of bridge types that survive and the criteria that are used to assess their historical importance. These variations, plus the fact that usable data were available from only 29 of the 38 responding states, caution against interpreting these patterns as anything but tentative and certainly against applying them to any specific region or state.

REGIONAL CONSIDERATIONS

The factors that contribute to the historic importance of a bridge and support its eligibility for listing in the National Register derive from the physical attributes of the bridge itself, from its association with historical events and/or persons, and from the characteristics of the particular population of bridges from which it was selected, that is, its context. These factors are discussed in detail in chapter 4 of *NCHRP Synthesis 101*, and they have been used in various combinations and weights by most state highway agencies to rank the relative importance of their historic bridges. These rankings have become a primary factor in judging eligibility for the National Register, which is what warrants preservation consideration when highway agencies make decisions about bridge replacement and rehabilitation. However, whether a particular eligible bridge is, in fact, preserved or demolished is determined by a variety of other factors that come under the general headings of preservation feasibility, preservation alternatives, and preservation policy. These other factors are diagrammed in Figure 2.

Determining preservation patterns for historic bridges, that is, what types of bridges are being preserved and in what proportions, is complicated by the fact that criteria for judging historic importance vary from one region to another and even among states within the same region. These criteria reflect variations in the mix of bridges that survive, regional variations in the development of transportation that influenced what bridge types were built, and the perceptions of those making the judgments as to what weight should be given to each of the contributing elements. For example, the Rio Hondo Bridge of Figure 1 (*9*) was one of the 14 highest ranked of about 750 bridges built before 1945 that were evaluated for their historic importance by the New Mexico State Highway and Transportation Department. It was assigned a score of 70 points out of a possible of 108, and was judged on that basis to be NR-eligible (Table 4). Yet, had that same bridge been located in one of the states of the industrial Northeast or Midwest where the population of surviving metal truss bridges is vastly different in terms of design diversity, age distribution, and frequency of occurrence, it most certainly would not have been ranked as highly as it was in New Mexico and may, in fact, not have been judged NR-eligible at all.

Other examples of these regional differences that can be expected to influence the pattern of bridge preservation can be cited. For example, because bridges are generally less common in the less densely populated states, any bridge is apt to be of more interest there than it is elsewhere. Uncovered timber bridges, in particular, have been more important to the development of transportation in such areas that are also arid, and thus constitute a greater proportion of the mix of survivors there than elsewhere. Because transportation developed later in the western states than in the East and Midwest, few of the very early cast- and wrought-iron trusses are found west of the Mississippi. Concrete bridges of all types, as well as stone masonry arches, are more common in areas where the natural materials of which they are constructed are abundant.

Thus, any attempt to describe general preservation patterns for historic bridges must acknowledge that the patterns in specific states or regions may deviate significantly from those found in the nation as a whole.

TABLE 4

SCORING THE HISTORICAL IMPORTANCE OF NEW MEXICO'S RIO HONDO BRIDGE *(9)*

Evaluation Factors	Awarded
Physical Attributes	
Type of bridge (truss, suspension or arch)	6
Rarity of design in state in its time (common)	2
Overall length (100–199 feet)	4
Length of longest span for multi-span bridges	NA
Presence of special design or decorative features (none)	0
Original design elements unaltered	2
Materials consistent with original	2
Elements of original workmanship present	2
Integrity of location and setting (moved)	0
Historicity	
Fabrication company known	4
Date of construction (pre-1912)	20
Historical importance (of state significance)	6
Feeling and association with the past (excellent)	10
Context	
Number of type surviving in New Mexico	(4–5)
Rarity (oldest known example of type in state)	4
Unique features (longest known in state)	4
Total Points	70

QUESTIONNAIRE RESPONSES

The two following questions were included in the study questionnaire to elicit data on the frequency of determinations of eligibility for the National Register and preservation decisions for broad general structural groups:

1. For each of the bridge types inventoried, how many of the total were determined to be NR-eligible? (Question 3)
2. Among those NR-eligible bridges that have been included in bridge replacement or rehabilitation projects since the inventory was completed, how many of each type have been preserved and how many have not been preserved? (Question 4)

Responses to these questions were not universally rigorous, probably because to do so would, in many instances, have required an inordinate effort on the part of the responder. In the absence of any federal requirement that these kinds of data be tracked, few agencies were found to have done so. Thus, the responses were supplemented by data extracted from those state historic bridge inventories that have been published and that are in the collection of the Historic American Engineering Record in Washington, D.C. (*Eric DeLony, HAER, personal communication*) and by telephone follow-up with some of the agencies themselves. Data on at least some of the bridge categories were ultimately obtained from 29 states, as summarized in Tables 5-7.

Table 5 shows which of the general bridge types are most commonly represented among those inventoried and which of those inventoried are most commonly represented among those determined to be NR-eligible or listed. It includes all of the data that were collected from the 29 contributing states. The most interesting observation is that metal trusses, for which 26 of the 29 states included data, appear to be the most commonly inventoried structural form, accounting for more than one-third of those reported (35.6 percent). The only other structural forms that approach metal trusses in their inventory frequency are concrete beams, stringers and girders (25.7 percent) and steel beams, stringers and girders (20.8 percent). Metal trusses also account for more than one-half of those found to be NR-eligible or listed, about 5 to 6 times the frequency reported for the next highest types, respectively concrete arches (11.1 percent), concrete beams, stringers and girders (9.4 percent), and steel beams, stringers and girders (8.5 percent).

Table 6 reports the number of NR-eligible/listed bridges expressed as a percent of the bridges inventoried for each of the general bridge types, arranged in order of decreasing NR-eligibility/listing frequency. Because only 28 of the 29 contributing states provided data that could be used in Table 6, the total numbers given for inventoried and NR-eligible/listed bridges are less than those given for the same categories in Table 5. Table 6 indicates clearly that the preservation interest in certain types of bridges, as judged by their eligibility frequency, is substantially higher than it is for others. For instance, the long-span forms (suspension bridges, steel arches and cantilevered trusses), which have the highest NR-eligibility rate, are distinctive because they are relatively uncommon in most areas, can be visually spectacular, tend to have strong associative values, and are more costly to replace than other forms. Bascule, swing, and lift bridges, which have the second highest eligibility rate, are typically less visually appealing than the long spans but share their other attributes, although perhaps to a lesser extent. Timber trusses score high because they include a large number of covered bridges, which have been part of the national nostalgia for decades and which have their own advocacy communities. Most of the rigid frames are reinforced concrete and many are contributing elements of parkways or parks that are, in themselves, identified as historical resources. Stone (and brick) masonry arches, which are among the oldest of our structural forms, evoke the same sense of a rural past as do covered bridges but many of them have not been well

TABLE 5

INVENTORY AND NATIONAL REGISTER ELIGIBILITY FREQUENCIES FOR HISTORIC BRIDGES

	Inventoried			NR-Eligible & Listed		
General Structural Group	Number of States Reporting	Number	Percent of Total	Number of States Reporting	Number	Percent of Total
Metal Trusses	26	10,996	35.6	28	2,064	52.2
Concrete Arches	20	1,737	5.6	21	441	11.1
Concrete Beam, Stringer and Girder	16	7,928	25.7	17	374	9.4
Steel Beam, Stringer and Girder	16	6,414	20.8	17	338	8.5
Masonry Arches	14	459	1.5	16	218	5.5
Timber Trusses	12	332	1.1	12	155	3.9
Movable (bascule, swing, lift)	13	277	0.9	15	134	3.4
Long Span (suspension, metal arch, cantilevered truss)	14	145	0.5	14	94	2.4
Rigid Frame (concrete and steel)	8	162	0.5	11	85	2.1
Timber Stringer	8	1,773	5.7	8	44	1.1
Trestle (timber and steel)	3	11	0.0	5	6	0.2
Aluminum Stringer	1	1	0.0	1	1	0.0
Concrete Culverts	4	602	2.0	4	1	0.0
Tunnels and Snowsheds	1	1	0.0	1	1	0.0
Totals		30,838	99.9		3,956	99.8

Based on Questionnaire responses from 29 states.

TABLE 6

NATIONAL REGISTER ELIGIBILITY PATTERNS FOR HISTORIC BRIDGES

General Structural Group	States Reporting	Number Inventoried	NR-Eligible & Listed Number	NR-Eligible & Listed Percent
Long span (suspension, metal arch, cantilevered truss)	14	145	94	64.8
Movable (bascule, swing, lift)	13	277	132	47.6
Timber Truss	12	332	155	46.7
Rigid Frame (concrete and steel)	8	162	63	38.9
Masonry Arch	14	459	165	36.0
Concrete Arch	20	1,737	426	24.5
Metal Truss	26	10,996	1,999	18.2
Steel Beam, Stringer and Girder	15	6,414	316	4.9
Concrete Beam, Stringer and Girder	16	7,928	352	4.1
Timber Stringer	8	1,773	44	2.5
Culvert (concrete, steel, and stone masonry)	4	602	1	0.2
Totals		30,825	3,747	

Based on Questionnaire responses from 28 states that provided information on both the numbers inventoried and the numbers determined NR-eligible or listed.

maintained and are in poor condition. Others have been subsumed by additions or altered by grouting of their exposed surfaces to the point where the original material or form is hardly detectable. Concrete arches, which occur in both through and deck forms, and with either open or closed spandrels, can be visually striking but many of them are badly damaged by reinforcement corrosion and by freezing and thawing, progressive conditions that are difficult and costly to arrest and repair. Also, one of the most important technological elements contributing to the significance of these bridges is their metal reinforcing system and that cannot be seen. Metal trusses have probably received more attention by the preservation community than the other types because they exist in such large numbers and in such an interesting array of variants. Yet, few are without damage either from corrosion of their metal parts or from collision. Bridges supported by steel, concrete or timber beams, stringers, or girders exist in very large numbers in most parts of the country but, because they tend to be structurally simple and visually unremarkable, they have not attracted wide preservation interest. They are also shorter lived due to the ease with which they can be replaced. Culverts have been omitted from most inventories, although one in Arkansas has been declared to be NR-eligible (*20*).

The foregoing discussion, supported by the statistics of Table 6, suggests that preservation interest, as measured by the frequency of NR-eligibility, is greatest for those structural forms that have the greatest visual impact by virtue of their size and structural complexity. It is minimal for those forms that are smaller and structurally simpler,

TABLE 7

PRESERVATION PATTERNS FOR HISTORIC BRIDGES THAT HAVE BEEN INCLUDED IN REPLACEMENT OR REHABILITATION PROJECTS

General Structural Group	States Reporting	Number NR Eligible	Preserved Number	Preserved Percent	Destroyed Number	Destroyed Percent	Preservation Success Rates (%)
Long Span	10	41	23	56.1	3	7.3	88.4
Masonry Arch	11	134	52	38.8	0	0.0	–
Movable	8	76	29	38.2	5	6.6	85.3
Concrete Arch	15	236	85	36.0	19	8.0	81.7
Rigid Frame	7	63	21	33.3	3	4.8	87.5
Metal Truss	19	895	213	23.8	181	20.2	54.1
Timber Truss	12	140	29	20.7	6	4.3	82.8
Timber Stringer	4	42	6	14.3	0	0.0	–
Steel Beam, Stringer and Girder	10	83	10	12.0	10	12.0	50.0
Concrete Beam, Stringer and Girder	12	205	23	11.2	9	4.4	71.9
Culvert	1	1	0	0.0	0	0.0	–
Totals		1,916	491		236		67.5

Based on Questionnaire responses from 22 states that provided information on both the numbers of NR-eligible bridges and the numbers preserved and not preserved.

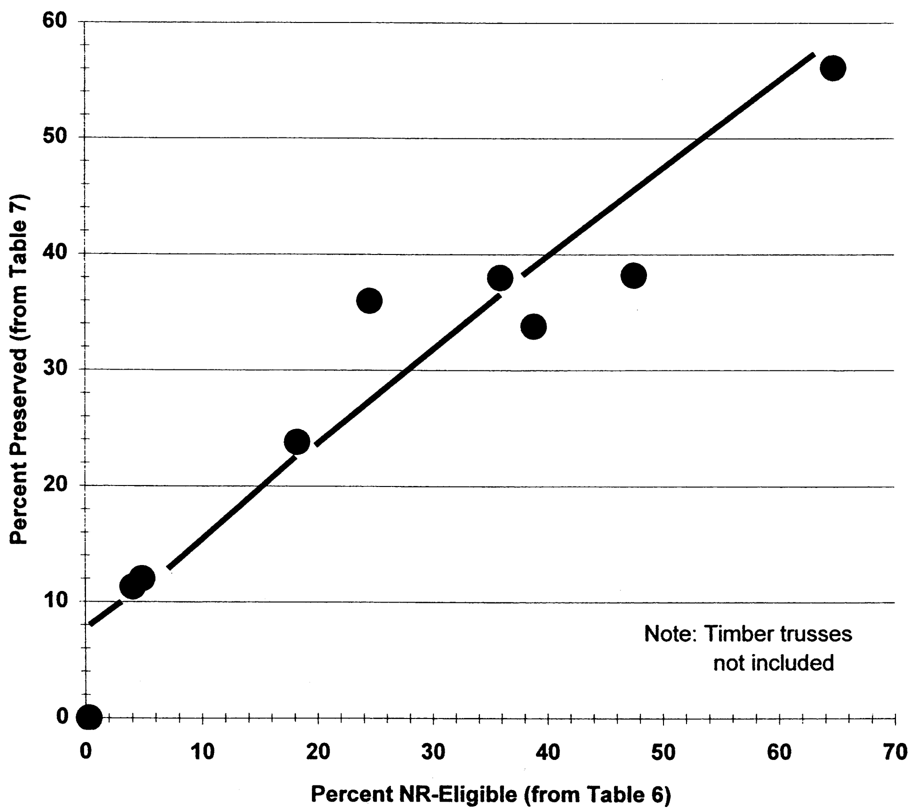

FIGURE 4 Eligibility for National Register of Historic Places versus preservation success.

Table 7 presents the results of preservation decisions for NR-eligible and listed bridges that have actually been included in replacement or rehabilitation projects. For each of the general structural types, the number and percent of bridges preserved, according to the definition on page 4, is given in the fourth and fifth columns. Corresponding values for those bridges not preserved (i.e., destroyed) is given in the sixth and seventh columns. Also, preservation success rates, defined as the number of bridges destroyed divided by the sum of the number destroyed plus the number preserved, have been calculated and these are given in the eighth column. The most interesting observation to be made from Table 7 is the relationship between the pattern of preservation success, represented by the fifth column of Table 7, and the pattern of NR-eligibility, represented by the fifth column of Table 6. This relationship, described graphically in Figure 4, indicates that those general bridge types that are more frequently the object of preservation interest, as measured by their frequency of NR-eligibility and listing, are also the types for which the greatest preservation success is being experienced. This inference is important because it reveals an underlying consistency between what is valued and what is being preserved. While the high degree of correlation between the two variables lends support to this conclusion, it should nevertheless be viewed as tentative in consideration of the modest data base from which it is drawn and in view of the preceding discussion about the effect of regional differences on preservation patterns. Even so, Figure 4 offers an appealing working hypothesis to explain present patterns of bridge preservation.

Another interesting observation to be made from Table 7 derives from the pattern of preservation failure represented by the eighth column. The preservation success rate for all structural forms combined is estimated by this sample to be 67.5 percent, which means that about one of every three NR-eligible or listed bridges fails to be preserved once it is included in a replacement or rehabilitation project. The relatively low preservation success rate for metal truss bridges (54.1 percent), when combined with the earlier observation that that form constitutes about one-half of all NR-eligible or listed bridges (Table 5), suggest that three-quarters of the bridges that fail to be preserved are metal trusses. In other words, for every twelve NR-eligible or listed bridges that have come up for replacement or rehabilitation, four have failed to be preserved and three of those that have failed have been metal trusses. While these data are silent as to the reasons why one out every three bridges chosen for NR listing fails to be preserved, it is clear that NR selection processes should be scrutinized to assure that factors relating to preservability are being identified during the inventory process, at least to the extent possible, and that this information is being used when assessing NR eligibility. This admonition is particularly appropriate for metal truss bridges because of their disproportionate representation among those bridges not preserved. Not to do so, may place an unnecessary burden on highway agencies to administer Section 106 and 4(f) compliance proceedings for structures that have little ultimate chance of being preserved.