

THE SURVEY

THE SURVEY: IDENTIFICATION AND EVALUATION OF DELAWARE'S HISTORIC BRIDGES

Introduction

In 1988 Delaware Department of Transportation (Delaware DOT) began a comprehensive update of its Historic Bridge Inventory. The Inventory was anticipated to be the initial stage in a project to catalog Delaware's historic bridges. Project goals were defined as follows:

- Inventory all historic bridges within defined parameters;
- Identify significant historic bridges and determine National Register eligibility;
- Produce publication on historic bridges in Delaware.

The project was conceived as a multi-disciplinary effort with input from an Advisory Committee throughout the project.

Research Design

The purpose of this project was the identification and evaluation of Delaware's historic highway bridges. The project was proposed to be completed in phases. Phase I, Historic Bridge Inventory Update, would be accomplished with tasks addressing data collection, field survey, data analysis, and historical research. Phase II, Historic Bridge Evaluation, would be accomplished with tasks addressing the development of criteria, application of the criteria, refinement and presentation of results. Phase III, Document Preparation, was to be completed at the end of Phases I and II. The project was a cooperative venture for P.A.C. Spero & Company (PACS) and Kidde Consultants, Inc.(Kidde). The Phase I field surveys were undertaken by Kidde Consultants staff, in cooperation with PACS, while all other aspects of the project were executed by PACS. Initially conceived as a comprehensive project, the project was broken into two distinct segments for completion under two separate agreements. Phases I and II were completed in early 1989. Phase III consisted of conducting additional research for the final document and the preparation of that document: this publication.

All phases were carefully co-ordinated to include revisions resulting from

comments and suggestions of Advisory Committee members.

It was anticipated that the inventory would reveal results similar to those encountered in other Mid-Atlantic historic bridge surveys: metal trusses throughout the state, stone bridges concentrated in the Piedmont region of nineteenth century turnpike construction, a number of movable bridges on navigable waters, some concrete arches, and a large number of commonly-built types in the concrete and steel girder bridge categories. The survey results were surprising in the scant representation for some categories: 6 historic metal trusses, 4 historic stone arches, 8 movable bridges; and the huge numbers of simple timber bridges surveyed.

Unlike other states where the inventory was restricted to specified bridge types, the Delaware historic bridge inventory included all bridges built prior to 1945. Hence, all known pre-1945 bridges were field surveyed. Initially, it was anticipated that although all bridges were to be inventoried, the bridges determined historically significant would correspond to those types generally accepted as historically significant during the 15-year tradition of surveying and evaluating historic bridges in the United States, e.g., metal trusses, stone arches, concrete arches,

metal arches, movable bridges, covered bridges. The characteristics from which historic significance would derive within those categories were date constructed; designer or builder of structure; technological significance of structure, including patents, span length, number of spans, detailing, and configuration; setting and the bridge's relationship to its environment; associated history; and integrity of setting and structure.

The individual integrity of the structure would be evaluated according to the structure type and the engineered durability of its structural materials. The wearing surface (roadway surface) and the floor system which supports it would be the most rapidly deteriorating portion of any structure, and in most cases would not require original materials. Thus, a metal truss, metal arch, or movable bridge would require an intact primary structural system, but could have replacement members in the floor system, or replacement railings yet retain its historic integrity.

By contrast, stone arch and concrete arch bridges are monolithic structures whose details are usually integral to the structure; thus simple modifications could affect their historic integrity. Structures of less durable materials, such as timber, have limited life spans and require case-by-case

evaluation of integrity.

The Survey Process and Results

Establishing the Parameters

A project initiation meeting was conducted prior to starting the inventory. Parameters were established for the project. It was determined that neither size nor type would be a determining factor in the inventory; bridges less than 20' long would be inventoried, as well as larger structures. With the aim of achieving a fully comprehensive and useful inventory, it was Delaware DOT's intent to catalog all the historic bridges in the state. Thus railroad bridges, and all types of bridges built prior to 1945, were included in the initial inventory phase.

A cut-off date was established at 1945, roughly contemporaneous with World War II, a period when highways and bridge programs suffered neglect due to the wartime effort. Also significant at that time was a rapidly changing technology in construction and manufacturing, resulting in the designs and practices commonly in use today.

At that meeting, the Advisory

Committee was established and schedules were set. The following served as Committee members:

- °Chuck Lightfoot, Delaware DOT;
- °Bill Brockenbrough, Delaware DOT;
- °Diane Bernardo, Delaware DOT;
- °Joan Larrivee, SHPO Office;
- °Charles Salkin, Dept. of Natural Resources;
- °Bob Wheeler, Federal Highway Admin.;
- °David Ames, University of Delaware.

Committee responsibilities were set forth as follows:

- Serve as source of guidance during course of project.
- Establish cooperation among agencies in reaching project goals.
- Recommend known sources of existing, available data.

Preliminary analysis

Lists of all structures constructed prior to 1945, including both highway bridges and railroad bridges were prepared by Delaware Department of Transportation staff. Computer printouts were generated which classified the structures by county and size. Two complete lists, one with structures longer than 20' and one with structures less than 20' long, were used in planning the field inventory. The division

by length, standard in state highway departments, is a long-standing classification by the Federal Highway Administration and currently pertains to eligibility for Federal funding; those bridges longer than 20' are eligible for funding.

A master index was prepared, categorizing structures by type. The total was 610 bridges; 405 were highway bridges and 205 were railroad bridges. The following property types were established:

- Stone Arch Bridges (SA)
- Metal Truss Bridges (MT)
- Steel Girder Bridges (SG)
- Concrete Bridges:
 - Concrete Arches (CA)
 - Concrete Slabs (CS)
 - Concrete Girders (CG)
 - Concrete Culvert (CC)
- Movable Bridges:
 - Bascule (BASC)
 - Swing (SW)
- Timber Bridges
 - Timber Beam (TB)
 - Timber-Concrete Slab (TS)
- Metal Arch (MA)

Field Inventory

It was decided that the field inventory would proceed on a county-by-county basis, beginning in Sussex County and ending in New Castle County. From the master index of all historic bridges built prior to 1945, county lists were prepared, including highway and railroad bridges.

The structures were plotted on county maps, or USGS quads when not readily identified on county maps (RR bridges).

A field inventory form was developed which would encompass all types of bridges to be encountered.

Training sessions were held for the field crew, members of Kidde Structures Division staff, and supervised field visits were successfully completed. The training format follows:

1. INTRODUCTION

Purpose of historic bridge survey: to record information which will facilitate the evaluation of historic significance.

Overview of historic bridge types, with slides and handouts, illustrating character-defining elements, and defining terms.

2. IMPLEMENTS OF HISTORIC BRIDGE SURVEY

- A. Survey forms
- B. Photographs
- C. Measurements

3. ELEMENTS OF FIELD SURVEY

- A. Record information
 - Sketch elevation
 - Sketch portal or deck view
 - Note composition, materials, member configuration
 - Note condition and obvious problem areas
- B. Photograph site
 - 1. B/W photographs
 - a. Purpose: to document superstructure, substructure and details; photographic quality should be sufficient for publication use.
 - b. Views should include:
 - superstructure overall
 - elevation - both sides
 - portal/deck - both sides
 - approaches - both sides
 - superstructure details: members,
 - connections, bearings
 - substructure overall: abutments, wing walls, piers

- substructure details
- noteworthy features
 - : architectural or ornamental details
 - : mason's marks on stonework
 - : other unusual details
- 2. Color slides
 - a. Purpose: to illustrate the resource for presentation
- C. Measure bridge
 - Length of superstructure
 - Width of superstructure - parapet to parapet
 - Height of superstructure
 - Thickness of parapet/railing

Each bridge was then surveyed in the field. Types were verified, inventory forms were filled out, and color slides and 35 mm black and white photographs were taken.

Data Analysis

The raw data from the field inventory was transferred to PACS staff, including field inventory sheets and all photographs. All inventoried bridges were reviewed, and compilation was begun. Each bridge was reviewed by photograph and inventory card. When required, additional field visits were conducted by PACS. Descriptions were written for all the bridges and were input on HAER Inventory cards.

Background research, including literature search, was undertaken to outline the contexts within which the bridges would be evaluated. Broad categories researched were general Delaware history, any known bridge history, general transportation history in Delaware, and Delaware Highway Department history. Brief narrative histories were written describing the three counties' roadway development.

As the data accumulated, bridges were organized for evaluation, as follows:

1. Highway bridges, owned by Delaware Department Of Transportation, to be evaluated for National Register (NR) eligibility: stone arch, timber, metal truss, movable, concrete, steel girder. Within these broad structure categories, groups were refined into sub-groups, by property type.

2. Railroad bridges, to be treated as inventoried historic resources but not evaluated for National Register eligibility, as they were not owned by Delaware DOT. They were categorized according to ownership: Conrail, Amtrak, CSX, Wilmington & Northern, Red Clay Valley. This information gives the SHPO a comprehensive representation of the historic resource in Delaware.

Evaluation of the Resources

Simultaneous with the mapping, cataloging and inventorying, criteria for analyzing the bridges were developed. As initially presented, these consisted of a list of ten resource-specific issues, supplementing the four National Register criteria. These were presented to the Advisory Committee, along with examples of the criteria other states had used.

Advisory Committee consensus resulted in adoption of expanded National Register criteria. The Delaware-DOT-owned surveyed bridges were evaluated for listing on the National Register of Historic Places according to Criteria A-D, as set forth in 36 CFR Part 60.6, and expanded to apply to engineering resources, as follows:

CRITERIA FOR EVALUATING DELAWARE HISTORIC BRIDGES

A bridge is eligible for the National Register of Historic Places, if it meets one of the following criteria:

(A) it is associated with events that have made a significant contribution to the broad pattern of our history.

A.1 reflects trends in the social, economic, industrial and transportation development of the locality, state, region, or nation.

A.2. is associated with historical crossings;

(B) it is associated with the lives of persons significant in our past.

B.1. is associated with the efforts of specific individual or groups significant in the history of the locality, region, state, or nation;

(C) it embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values;

C.1. is significant in the history of bridge engineering, in the history of bridge design principles, or in the development of bridge construction techniques;

C.2. is an example of bridges designed or built by renowned engineers, craftsmen, bridge companies, or contractors;

C.3. is a significant example of engineering solutions developed in response to conditions characteristic of the locality or region;

C.4. reflects traditional forms or construction techniques, or exemplifies innovative technological solutions;

C.5. retains sufficient integrity of design, materials, workmanship, association, setting and location to stand as a representative example of a specific bridge type which may survive in substantial numbers;

C.6. exemplifies a bridge type which is now rare, even though its integrity may be compromised to a greater degree;

C.7. possesses architectural or artistic distinction in overall design or detailing.

(D) it has yielded, or may be likely to yield, information important in history or prehistory.

Sussex was the first county inventoried and a trial application of the criteria commenced. After an initial presentation under the research design assumption of non-eligibility of commonly-built types, Advisory Committee input resulted in the following modification: Under Criterion C.5., above it was decided to include representative examples of the bridge types which were built in thousands across the nation.

Initially, as conceived in the research design, those bridges (typical steel girder and concrete slab bridges) were not proposed as potentially eligible. Advisory Committee consensus determined that these bridges should be included among the eligible bridges, and that they would be considered as a class. It was determined that although examples of these property types have little merit individually, they may be considered to embody the distinctive characteristics of their types: standardized, mass designed and produced steel, concrete and timber bridges. Additionally, they exemplify the engineered products of the Nation's growing, centralized transportation agencies of the early

twentieth century.

Representative examples of those types were chosen and recommended for National Register eligibility in response to Advisory Committee input. Those selected were determined excellent examples of their type. For steel beam and concrete beam and slab bridges, the structure had to be in excellent condition with all decorative features intact. For timber beam bridges, all original materials were required except for the deck. Variations in commonplace property types were also evaluated; among those variations were Delaware's combination bridge/water-control structures, a type which was commonly-built, but scantily represented among the extant bridges.

Results of the Evaluation

When the inventories were completed in all the counties, a list was compiled directly from the individual county presentations. The bridges on this list were presented to the Advisory Committee as a preliminary compilation on November 4, 1988. Analysis of the data from a statewide perspective continued, and the results were discussed in the final Committee presentation on December 16, 1988. Pursuant to the Advisory Committee's input as already described, bridges from two

broad groups were removed from the preliminary list:

1. Some representative examples of common bridge types: steel girder, concrete, and timber bridges. Examples of common bridge types considered NR eligible as representative examples of their types were in excellent structural condition (visibly), possessed fully-intact ornamentation, while those whose character-defining features were not excellent, due to configuration or condition, were considered ineligible.

2. Some Dupont Highway bridges. Initially all bridges associated with early Dupont Highway construction were included, regardless of configuration. Dupont Highway bridges associated with initial phases of construction were considered eligible only if elements from the historic periods were visible.

The county-by-county preliminary list numbered a total of 123; the final list numbered 80 bridges.

Potentially National Register Eligible Bridges

The 80 National Register eligible bridges comprise the following categories: stone arch (4); metal truss (6); movable (8);

concrete (29); steel girder (21); and timber (12). The eligible properties include bridge superstructure and substructure. The property boundary is defined as a rectangle with a width equal to the outside-to-outside bridge width and a length equal to the total structure length, the vertices of the rectangle being the four ends of the abutments.

The National Register eligible bridges are presented below by sub-group:

•Stone Arch Bridges -- 4

Sussex County -- 0
Kent County -- 1
New Castle County -- 3

•Movable Bridges -- 8 (2 swing/ 6 bascule)

Sussex County -- 3 (1 swing/ 2 basc)
Kent County -- 1 (bascule)
New Castle County: 4 (1 sw/ 3 basc)

•Metal Truss -- 6

Sussex County -- 0
Kent County -- 0
New Castle County -- 6

•Steel Girder Bridges -- 21

Sussex County -- 4
Kent County -- 4
New Castle County -- 13

•Concrete Arch Bridges -- 12

Sussex County -- 2
Kent County -- 2
New Castle County -- 8

•Concrete Slab Bridges -- 10

Sussex County -- 5
Kent County -- 1
New Castle County -- 4

•Concrete Frame Bridges -- 4

Sussex County -- 1
Kent County -- 0
New Castle County -- 3

•Concrete Girder Bridges -- 1

Sussex County -- 0
Kent County -- 0
New Castle County -- 1

•Concrete Culvert --2

Sussex County -- 2
Kent County -- 0
New Castle County -- 0

•Timber Beam Bridges -- 9

Sussex County -- 4
Kent County -- 2
New Castle County -- 3
-includes 2 NR listed covered bridges

•Timber Slab -- 3

Sussex County -- 2
Kent County -- 1
New Castle County -- 0

The repositories for all original survey records are:

Delaware DOT- photographs, slides, field notes and maps

Delaware SHPO- Locus forms, copies of HAER cards, and location information.

Library of Congress- HAER cards

Management Conclusions and Recommendations

The survey met the objectives of Phases I, II and III of the research design.

The design allowed for flexibility in the project through revisions resulting from close coordination with the Advisory Committee. This provision proved successful. During the course of the project, the Advisory Committee determined that it did not agree with one initial assumption of the research design, i.e. that some bridge types, as a class, would not be considered eligible and would not be evaluated for National Register eligibility. In the numerous meetings of the Advisory

Committee and the open discussion among its members, those specific concerns were addressed in a way that allowed inclusion of representative examples of commonly built bridges, as such examples were considered potentially eligible for the National Register by the committee.

This survey resulted in several contributions to Delaware's Comprehensive Historic Preservation Plan. It has greatly expanded the transportation context information in the Plan, particularly with respect to the historical development of Delaware's roads and the greater definition of bridge property types.

Based on this study, it was recommended by the SHPO that the state should make the evaluation of railroad bridges a high priority in the State Plan, in order to complete the definition of bridge types and the evaluation of all historic bridges in Delaware.

It is recommended that the 78 bridges be formally listed in the National Register of Historic Places by the SHPO; 2 covered bridges are already listed: Bridges 118 and 137. Delaware DOT is working on a programmatic Memorandum of Agreement with the SHPO in order to assure the preservation of Delaware's historic transportation heritage. The result will be an

agreement for the treatment of those bridges determined eligible for the National Register.

Organization of This Document

The 80 bridges are presented by type in the following section, Part II. Results of the Survey: Delaware's Historic Bridges. A complete, annotated list of them is provided in Appendix 1, while Appendix 2 contains charts of all the bridges which were inventoried. Copies of individual HAER Inventory cards for the eligible bridges are located in a separate volume.

The great majority of structures was built in the twentieth century. Since the development of the twentieth century road network was founded on its historic precursors, the history of early roadways is presented in Section III.1. Section III.2. presents the development of the twentieth century highway system.

THE BRIDGES

