



767

United States Department of the Interior
National Park Service

National Register of Historic Places
Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Big Creek Bridge 2

other names/site number _____

2. Location

street & number 2130 320th over Big Creek not for publication

city or town 3.5 miles northeast of Madrid vicinity

state Iowa code IA county Boone code 015 zip code 50156

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property meets does not meet the National Register criteria. I recommend that this property be considered significant nationally statewide locally. (See continuation sheet for additional comments.)
Patricia Chalkley DSHP 5-6-98
Signature of certifying official/Title Date
State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. (See continuation sheet for additional comments.)

Signature of certifying official/Title Date
State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

- entered in the National Register
 See continuation sheet
- determined eligible for the National Register
 See continuation sheet
- determined not eligible for the National Register
- removed from the National Register
- other, (explain):

Edson A. Beall 6-25-98

5. Classification

Ownership of Property

(Check as many boxes as apply)

- private
- public-local
- public-State
- public-Federal

Category of Property

(Check only one box)

- building(s)
- district
- site
- structure
- object

Number of Resources within Property

(Do not include previously listed resources in the count)

Contributing	Noncontributing	
0	0	buildings
0	0	sites
1	0	structures
0	0	objects
1	0	Total

Name of related multiple property listing

(Enter "N/A" if property is not part of a multiple property listing)

Highway Bridges of Iowa

Number of contributing resources previously listed in the National Register

0

6. Function or Use

Historic Functions

(Enter categories from instructions)

TRANSPORTATION/road-related

Current Functions

(Enter categories from instructions)

TRANSPORTATION/road-related

7. Description

Architectural Classification

(Enter categories from instructions)

other: concrete Marsh arch

Materials

(Enter categories from instructions)

foundation Concrete

walls

roof

other Concrete

Narrative Description

(Describe the historic and current condition of the property on one or more continuation sheets)

Located 3.5 miles northeast of Madrid, the Big Creek Bridge spans Big Creek in a rural Boone County setting that has changed little since the structure's period of significance. A description of the structure follows:

span number: 1 construction date: 1917
 span length: 50.0' construction cost: \$3170.00 (contract amount)
 total length: 53.0' current condition: good
 roadway wdt.: 18.0' alterations: none

superstructure: concrete, 6-panel, fixed Marsh arch
 substructure: concrete abutments and wingwalls
 floor/decking: concrete deck
 other features: tapered concrete arch ribs; concrete hangers, cast integrally with concrete floor beams; slotted concrete guardrails with paneled concrete bulkheads

Other than maintenance-related repairs and alterations noted above, the bridge remains essentially unaltered as it continues to carry vehicular traffic. The Big Creek Bridge today retains a high degree of integrity of location, design, setting, materials, workmanship, feeling and association.

8. Statement of Significance

Applicable National Register Criteria

(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing)

- A Property is associated with events that have made a significant contribution to the broad patterns of our history.
B Property is associated with the lives of persons significant in our past.
C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
D Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations

(Mark "x" in all the boxes that apply)

Property is:

- A owned by a religious institution or used for religious purposes.
B removed from its original location.
C a birthplace or grave.
D a cemetery.
E a reconstructed building, object, or structure.
F a commemorative property.
G less than 50 years of age or achieved significance within the past 50 years.

Narrative Statement of Significance

(Explain the significance of the property on continuation sheets.)

Areas of Significance

(Enter categories from instructions)

ENGINEERING

Period of Significance

1917

(The period of significance is derived from the original construction date.)

Significant Dates

1917 (construction date)

Significant Person

(Complete if Criterion B is marked above)

N/A

Cultural Affiliation

N/A

Architect/Builder

designer:

James B. Marsh, Des Moines IA

fabricator:

none

builder:

N.E. Marsh & Son Construction Company

9. Major Bibliographical References

Bibliography

(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- preliminary determination of individual listing (36 CFR 67) has been requested
previously listed in the National Register
previously determined eligible by the National Register
designated a National Historic Landmark
recorded by Historic American Buildings Survey
recorded by Historic American Engineering Record

Primary location of additional data:

- State Historic Preservation Office
other State agency
Federal agency
Local government
University
other
name of repository:

**United States Department of the Interior
National Park Service**

**National Register of Historic Places
Continuation Sheet**

Section Number 8 Page 1 Big Creek Bridge Boone County; Iowa

Consisting of a short-span fixed Marsh arch on concrete abutments and wingwalls, this bridge carries a gravel-surfaced county road over Big Creek in Garden Township, northeast of Madrid. This structure was designed in February 1917 by James Marsh, the Des-Moines-based civil engineer who designed and patented the rainbow arch configuration. A contract to build the Big Creek Bridge was awarded in April 1917 to the N.E. Marsh & Son Construction Company of Des Moines, Iowa, for \$3170.00. N.E. Marsh, James Marsh's brother, completed the structure later that year. It has functioned in place since that time, in unaltered condition.

This small-scale arch marks a noteworthy innovation in bridge design, an achievement engineered by James Marsh, the bridge's designer and patent holder. Marsh's design represented the hybridization of continuous concrete and segmental steel-arch designs. This marked a radical departure from standard engineering practice. Concrete can withstand a nominal amount of tension. For this reason, most previous concrete arches - both reinforced and mass arches in filled and open spandrel configurations - had been built with the arch below the deck, where the downward force of the deck could be carried in compression by the arch ribs and spandrel wall or columns. Marsh's suspended arch reversed this.

His arches, of course, acted in compression. But the hangers and floor beams carried the deck in tension. Furthermore, the novel treatment of the deck over sliding steel plates on the floor beams and the use of pin-connected, articulated steel hangers for the end panel points were devices more suited to steel construction than concrete. To make the concrete thus act against its nature, Marsh inserted large amounts of structural steel. His bridges may have looked like concrete spans, but the arch ribs and hangers carried such heavy and complicated reinforcing that they were, in reality, steel structures encased in concrete. Marsh designed his bridges with either tied (with the arches attached to the abutments at the floor beam level) or fixed (arches extending below the floor beams to the abutments) configurations. Aside from this, all of his rainbow arches were similar, varying only in span length, arch rise and number of hangers.

Marsh's invention did not foretell a new direction in reinforced concrete design. The industry would later turn to other, simpler slab and beam configurations as it developed more sophisticated reinforcing techniques in the 1930s and 1940s. The rainbow arch did, however, denote one of the more interesting early experiments in concrete engineering and represented the proliferation of concrete for road and bridge construction. It is not known how many Marsh arches were built in Iowa in the 1910s and 1920s: judging from county records, perhaps not more than one hundred. The large amount of reinforcing steel sheathed within a relatively thin skin of concrete has made them particularly vulnerable to rusting and spalling. As a result, only eleven are known to remain. One of seven Marsh arches in Boone County, the Big Creek Bridge is distinguished as a well-preserved example of an indigenous structural type.

**United States Department of the Interior
National Park Service**

**National Register of Historic Places
Continuation Sheet**

Section Number 9 Page 2 Big Creek Bridge Boone County; Iowa

Iowa Department of Transportation, Structure Inventory and Appraisal: Structure No. 076930.

Notice in **Boone News-Republican**, 29 March 1917.

Report of the State Highway Commission, 1917, page 39.

Nomination for the Raccoon River Bridge to the National Register of Historic Places, 29 March 1988, prepared by John A. Panning, Des Moines IA.

Iowa State Highway Commission, **Service Bulletin**, 28 April 1917, page 39.

Field inspection by Clayton Fraser, 17 July 1988.