NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

796

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 Beaver Creek Bridge

other names/site number

2. Location

street & number M Avenue over Beaver Creek ☐ not for publication

city or town 3.1 miles east of Perry ■ vicinity

state Iowa code IA county Dallas code 049 zip code 50220

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this X 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 X meets __ does not meet the National Register criteria. I recommend that this property be considered significant __ nationally X statewide __ locally. (__ See continuation sheet for additional comments.)

Patricia Ohlendorf SHPO 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:

Edson H. Beall 6-25-98

☑ 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):

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 3.1 miles east of Perry, the Beaver Creek Bridge spans Beaver Creek in a rural Dallas County setting that has changed little since the structure's period of significance. A description of the structure follows:

span number:	1	construction date:	1916
span length:	100.0'	construction cost:	$8075.00 (contract amount)
total length:	100.0'	current condition:	good
roadway wdt.:	18.4'	alterations:	none

superstructure: concrete, 9-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, the bridge remains essentially unaltered as it continues to carry vehicular traffic. The Beaver 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

1916

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

Significant Dates

1916 (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:
F.E. Marsh and 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:

10. Geographical Data

Acreage of Property less than one acre

UTM References
(Place additional UTM references on a continuation sheet)

1 15 413000 4633040
zone easting northing

2 _____
zone easting northing

Verbal Boundary Description
(Describe the boundaries of the property)

The nominated property is a rectangular-shaped parcel measuring 20 feet by 100 feet, which is centered on the UTM point(s) listed above. Included within this rectangular parcel are the bridge's superstructure, substructure, approach spans and floor system.

Boundary Justification
(Explain why the boundaries were selected)

The nominated structure includes the bridge's superstructure, substructure, floor system, any approach spans and the property on which they rest. These boundaries encompass, but do not exceed, all of the property that has been historically associated with the bridge.

11. Form Prepared By

name/title Clayton B. Fraser

organization Fraserdesign date 31 August 1994

street & number 1269 Cleveland Avenue telephone 303-669-7969

city or town Loveland state Colorado zip code 80537

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7½ or 15 minute series) indicating the property's location
A **Sketch map** for historic districts and properties having large acreage or numerous resources

Photographs

Representative **black and white photographs** of the property

Additional Items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO)

name/title Dallas County

street & number 415 River Street telephone 515-993-4289

city or town Adel state Iowa zip code 50003

Dallas County, like virtually all of Iowa's counties, adopted the state highway commission's standard designs for its concrete bridges in the 1910s. Most of the county's structures during these years were small-scale slabs or girders, but in 1916 the board of supervisors deviated from this trend on one important span - this concrete arch over Beaver Creek, east of Perry on the line between Beaver and Spring Valley Townships. For the Beaver Creek Bridge, the county purchased a design from Des Moines Engineer James B. Marsh. Marsh had received a patent for his innovative medium-span arch in 1912. Comprised of two tapered concrete arches that carried the roadway deck between them from hangers, his invention soon became known as the rainbow arch for its distinctive profile. In the patent application, Marsh described the components of the structure as "two abutments (which could be piers), a pair of arches disposed between and springing from the abutments, the floor carried by and between the arches and reaching from one abutment to the other where it alines [sic] with the parapets or rails along opposite sides of the floor line." 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, but is much stronger against compressive loading. Steel, on the other hand, can resist compressive forces, but is much more efficient in 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 walls or columns. Marsh's suspended deck reversed this.

His arches, of course, acted in compression. But the hangers and floor beams carried the deck in tension. Further, 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 their span length, arch rise and number of hangers. The Beaver Creek Bridge featured a 100-foot span, divided evenly between nine panels. In June 1916 the county contracted with Marsh's son Frank, who owned F.E. Marsh and Company of Jefferson, Iowa, to build the single-span arch for $8075.00.

Like virtually all of Marsh's bridges, the Beaver Creek Bridge used a standardized construction sequence. The abutments and piers of a typical rainbow arch were poured first, followed by the arch ribs, hangers and floor beams. Then the intermediate ties, floor slab, wall copings and rails were concreted. Once the formwork for the floor was removed, the intermediate hangers were coated. Because the hangers had to be under full dead load when they were

concreted, the forms were struck no less than 10 days or more than 21 days after the slab was poured. Pouring the guardrails completed the bridge.

Marsh had marketed his invention aggressively across the Midwest through his own company and through associate firms such as his son's. He claimed that his bridges were economical for relatively short-span applications. With the main structural members of the rainbow arch held above the roadway, he could point to greater waterway clearance than that provided by concrete deck arches. Marsh often submitted arch designs to state and county engineers as alternatives for steel trusses. The comparison was apt, given the large quantities of steel that made up his structures. Finally, with the arch regarded by many as the most aesthetic of bridge forms, Marsh could promote his spans as more attractive than their truss counterparts.

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, mark 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 no more than 100. 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. The Beaver Creek Bridge is distinguished as one of the longest of these - a well-preserved example of an indigenous structural type.

Iowa Department of Transportation, Structure Inventory and Appraisal: Structure No. 132400.

Dallas County Supervisors' Minutes, Book F, page 260 (1 June 1916), located at Dallas County Courthouse, Adel IA.

Iowa State Highway Commission, **Service Bulletin** 4:8 (August 1916), page 12.

Report of the State Highway Commission, 1916, pages 77, 185.

Field inspection by Clayton Fraser 12 March 1991.