Form No. 10-300 REV. (9/77)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY
RECEIVED JUL 16 1981
DATE ENTERED AUG 13 1981

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC
Navajo Steel Arch Highway Bridge

AND/OR COMMON
Grand Canyon Bridge

LOCATION

STREET & NUMBER
SW of Lee's Ferry
Rural
__NOT FOR PUBLICATION

CITY, TOWN
Lee's Ferry vic.
X VICINITY OF

CONGRESSIONAL DISTRICT
3

STATE	CODE	COUNTY	CODE
Arizona	04	Coconino	005

CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
__DISTRICT	X PUBLIC	X OCCUPIED	__AGRICULTURE	__MUSEUM
__BUILDING(S)	__PRIVATE	__UNOCCUPIED	__COMMERCIAL	__PARK
X STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDENCE
__SITE	**PUBLIC ACQUISITION**	**ACCESSIBLE**	__ENTERTAINMENT	__RELIGIOUS
__OBJECT	__IN PROCESS	__YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	X YES: UNRESTRICTED	__INDUSTRIAL	X TRANSPORTATION
		__NO	__MILITARY	__OTHER:

OWNER OF PROPERTY

NAME
Arizona Department of Transportation

STREET & NUMBER
206 South 17th Avenue

CITY, TOWN
Phoenix __ VICINITY OF

STATE
Arizona

LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC.
Coconino County Courthouse

STREET & NUMBER
N/A

CITY, TOWN
Flagstaff

STATE
Arizona

6 REPRESENTATION IN EXISTING SURVEYS

TITLE
Arizona Historic Engineering Site Inventory

DATE
May 18, 1978
__FEDERAL X STATE __COUNTY __LOCAL

DEPOSITORY FOR SURVEY RECORDS
History of Engineering Program, Texas Tech University

CITY, TOWN
Lubbock

STATE
Texas

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
__EXCELLENT	__DETERIORATED	X UNALTERED	X ORIGINAL SITE
X GOOD	__RUINS	__ALTERED	__MOVED DATE_____
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Navajo Bridge is a deck-type steel arch bridge built across the Colorado River in 1928. The site of the structure is six miles below Lee's Ferry and four miles below the mouth of Paria Creek. The overall length of the bridge, including the approach roadways, is 834 feet. The main span is 616 feet long, the two approach spans on the north rim are 84 feet each and the single approach span on the south rim is 50 feet long. The top of the arch is 467 feet above the Colorado River, while the rise of the main span, from bottom pin to roadway surface, is 103 feet. The roadway of the bridge is poured concrete instead of the traditional timber to avoid fire hazards and maintenance problems. It measures 18 feet between the curbs and the overall width of the bridge is 19' 6".

The bridge structure is composed of the main arch and the approach spans. The three-hinged main arch is composed of 22 panels, each one being 28 feet in length. These panels were designed for reversal of stresses for cantilever erection. The short approach spans are of very simple plate girder and/or vertical truss design.

Since its completion, the bridge has been maintained by the State of Arizona and is a preserved original structure. It presents the same appearance today as it did when it was dedicated in 1929.

8 SIGNIFICANCE

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW			
__PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION
__1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE
__1500-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	__SCULPTURE
__1600-1699	__ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL/HUMANITARIAN
__1700-1799	__ART	X ENGINEERING	__MUSIC	__THEATER
__1800-1899	X COMMERCE	__EXPLORATION/SETTLEMENT	__PHILOSOPHY	X TRANSPORTATION
X 1900-	__COMMUNICATIONS	X INDUSTRY	__POLITICS/GOVERNMENT	__OTHER (SPECIFY)
		__INVENTION		

SPECIFIC DATES 1928 BUILDER/ARCHITECT R.A. Hoffman/Kansas City Structural Steel Company

STATEMENT OF SIGNIFICANCE

The Navajo Bridge is an important historic engineering feat in Arizona's transportation history. The Navajo Bridge was the only bridge across the Colorado River between Topock, Arizona and Green River, Utah, a distance of 600 miles. It allowed a major interstate transportation route, U.S. 89, to be completed between Salt Lake City, Utah and Nogales, Arizona. Completion of the Navajo Bridge led to a substantial increase in north-south traffic between Utah and Arizona, greatly benefiting both regions. Moreover, the Navajo Bridge made it possible for travelers to approach the Grand Canyon from either the north or the south and to traverse the canyon. This had been impossible before, unless the traveler went via California, Nevada and Utah. The Navajo Bridge is also significant because, when completed, it was the highest steel arch bridge in the United States. It incorporated several novel engineering ideas and was a challenging and exhausting physical accomplishment.

The State of Arizona had contemplated constructing a bridge across the Colorado River as early as 1923. By October of 1924 the route for the construction of U.S. 89 and the location for a bridge had been surveyed. Originally, a suspension bridge was planned but the designers for the state, especially Bridge Engineer R.A. Hoffman, believed a larger, stronger structure was necessary. As a result, a deck-type steel arch bridge was designed by Hoffman. Construction bids were taken in 1927. The State of Arizona awarded the Kansas City Structural Steel Company the contract for construction and, following the approval of the U.S. Indian Service, the contract was let on June 17, 1927. The funding for the bridge came from the State of Arizona which allocated $240,000 and the Navajo Tribal Fund, which alloted $100,000 for its construction. Arizona contributed an additional $50,000 for peripheral work and concrete pouring, so the actual total cost of the bridge was $390,000.

Extraordinary logistical problems were encountered immediately. The construction site was 130 miles north of the railhead at Flagstaff, whence materials had to be hauled by truck. The Cameron Suspension Bridge, built across the Little Colorado River at Cameron, had to be re-decked and improved to handle the heavy traffic and roads had to be built to the site.

Excavations for foundations began on June 23, 1927 and were completed by November. Concrete arch-foundations were finished by April 5, 1928. The first steel was set on April 16, 1928 and the first half of the bridge was completed by June 15. By August 11, the other half of the bridge was finished. Less than four months of intense and dangerous labor were needed for the completion of the main span. Twelve hundred tons (50 carloads) of steel were used in the job. The main span was completed on August 12, 1928. By October 20, 1928, all approach spans and all the steel for the floor systems were in place. The concrete deck was poured by December 9, 1928.

(continued)

9 MAJOR BIBLIOGRAPHICAL REFERENCES

Arizona Department of Transportation. "Bridging the Grand Canyon of Arizona." MS. Special Collections, University of Arizona Library, Tucson.

Arline, Kenneth. "Where Man Shackled the Mighty Colorado." Phoenix Gazette. September 7, 1972.

(Continued)

10 GEOGRAPHICAL DATA ACREAGE NOT VERIFIED

ACREAGE OF NOMINATED PROPERTY 1.9 acres UTM NOT VERIFIED

QUADRANGLE NAME Lee's Ferry Southwest QUADRANGLE SCALE 15'

UTM REFERENCES

	ZONE	EASTING	NORTHING
A	12	443070	4074060
B	12	443555	4074085
C			
D			
E			
F			
G			
H			

VERBAL BOUNDARY DESCRIPTION

The boundaries of this nomination are along and 50 feet on either side of a line between points A and B. This will form a rectangle 834 feet long and 100 feet wide. The structure lies within this rectangle.

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
N/A			
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE

Don Abbe, Research Assistant

ORGANIZATION — DATE

History of Engineering Program — June 2, 1980

STREET & NUMBER — TELEPHONE

P.O. Box 4089, Texas Tech University — (806) 742-3591

CITY OR TOWN — STATE

Lubbock — Texas

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL X STATE ____ LOCAL ____

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE Ann A. Pritzlaff

TITLE State Historic Preservation Officer DATE 9 July 1981

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

for Beth Grosvenor DATE 8/13/81

KEEPER OF THE NATIONAL REGISTER

ATTEST: for Patrick Andrus DATE 8/12/81

CHIEF OF REGISTRATION

GPO 921-803

United States Department of the Interior
Heritage Conservation and Recreation Service

National Register of Historic Places Inventory—Nomination Form

During the construction of the bridge, several novel construction techniques were used. Because the bridge was to be cantilevered, the bracing for the top chords had to be very strong. Once the arch was complete, however, these chords would bear little loads. The massive steel braces for the top chords were designed to be box girders in the approach spans when the main span was completed. By doing this, little steel was wasted and a considerable amount of money was saved.

Another unusual technique was used to cure the concrete deck. A layer of sawdust several inches thick was placed on the deck and was continually soaked with water. This allowed the concrete to cure without using a tremendous volume of water, which would have to be trucked 130 miles from Flagstaff or pumped from the Colorado River. The sawdust retained the requisite amount of moisture for curing without causing the excessive waste of pouring millions of gallons of water directly onto the slab.

Safety rules and regulations were an issue in the building of the bridge. The state designed a rope net to be hung below the structure to catch falling bodies. The steel workers refused to allow it to be hung, saying the "mental hazards" of the net would be very dangerous to them. Their refusal, plus the cost and risk of moving the safety net, led to the dropping of the whole idea. Most workmen wore safety belts at all times, but the steel workers used no safety devices at all. One steel worker fell from the bridge and died, and three more workers were lost in an accident at Lee's Ferry. Many other workers were injured, with the degree of injury ranging from very minor to severe and disabling.

When the bridge was finally dedicated on June 14 and 15, 1929, the importance of the structure was not lost on the people of the Southwest. Governors from four states were in attendance: George H. Dern of Utah, Richard C. Fillon of New Mexico, Balser of Nevada and John C. Phillips of Arizona. They realized the economic impact the Navajo Bridge would have on their geographically rugged and generally untamed states.

The Navajo Bridge is an excellent example of a major project in the early days of road building in Arizona and the Southwest.

"Bridging the Colorado." Engineering News Record. November 1, 1928.

"Bridging the Grand Canyon with a 600-Foot Steel Arch." Engineering News Record. Vol. 100, No. 1, pp. 17-18.

"Colorado River Bridge Dedicated." Engineering News Record. June 27, 1929.

Davenport, Odessa. "Bridges from the Beginning." Arizona Highways. Vol. 12, No. 10 (October, 1937), pp. 15, 28, 31, 33; Vol. 12, No. 11 (November, 1937), pp. 6, 19, 36.

Hoffman, R.A. "Bridging the Grand Canyon of Arizona: The Highest Highway Bridge in the World." Arizona Highways. Vol. 3, No. 8 (November, 1928), pp. 5-8.

_____. "Closing the Arch of the Grand Canyon Bridge." Arizona Highways. Vol. 4, No. 10 (October, 1928), pp. 7-8, 15-19.

_____. "Grand Canyon Bridge Opens New Route Across Greatest of All Natural Barriers." Arizona Highways. Vol. 5, No. 5 (May, 1929), pp. 13-17, 57.

Lashmet, L.C. "Designing the Grand Canyon Bridge." Arizona Highways. Vol. 3, No. 9 (December, 1927), p. 6.

Official Program at the Dedication of Grand Canyon Bridge, Arizona June 14, 15, 1929.

Parlar, Earl M., Letter to W.C. Lefebre, State Engineer. Phoenix, Arizona. October 7, 1924.

"Steel Arch Highway Bridge Across the Colorado River." Engineering News Record. Vol. 100, No. 46, pp. 646-649.

Whitman, H.E.O. "Bridge Ceremony Marks Another Milestone in Man's Fight to Conquer Nature's Barriers." Arizona Highways. Vol. 5, No. 5 (May, 1929), pp. 9-10.

PREV. LISTED
8100 0134

HABS/HAER INVENTORY

See "HABS/HAER Inventory Guidelines" before filling out this card.

1. NAME(S) OF STRUCTURE
Navajo Bridge (Grand Canyon Bridge; Colorado River Bridge; ADOT: 0051
Lee's Ferry Bridge)

2. LOCATION
U.S. Highway 89 over the Colorado River; milepost: 537.88
12.9 miles southwest of Page; SE1/4 S34 T40N R7E
Coconino County, Arizona
005

3. DATE(S) OF CONSTRUCTION
1927-29

4. USE (ORIGINAL/CURRENT)
highway bridge / highway bridge

5. RATING
individually listed, NHRP: national signif.

6. CONDITION
good; sufficiency rating: 59.1 owner: Arizona Department of Transportation

7. DESCRIPTION

span number : 1
span length : 616.0'
total length: 834.0'
roadway wdt.: 18.0'

superstructure: riveted steel, 3-hinge spandrel-braced deck arch
substructure : concrete pedestals set on ledges blasted in stone walls
floor/decking : concrete deck over steel stringers
other features: lower chord: 2 built-up channels w/cover plate and double webbing; upper chord: 2 built-up channels w/batten plates; post and diagonal: 2 channels w/double webbing; lateral bracing: 4 angles w/ batten plates; strut: 4 angles w/ webbing; floor beam: I beam; steel lattice guardrails; commemorative plate: "1927-1928; State of Arizona; Navajo Bridge...Fabricated and Erected by Kansas City Structural Steel Co..."

8. HISTORICAL DATA

In 1923, the Arizona Highway Department began planning seriously for a bridge over the Grand Canyon of the Colorado River near Lee's Ferry. By October 1924, a connecting route (U.S. 89) had been surveyed and preliminary surveys made for the bridge. AHD engineers originally considered a suspension bridge like the Cameron Bridge, then a through arch like the Topock Bridge, but eventually AHD Bridge Engineer R.A. Hoffman designed this long-span steel deck arch. With funding provided by the state of Arizona ($290,000) and the Navajo Tribal Fund ($100,000), AHD contracted with the Kansas City Structural Steel Company in June 1927 to fabricate and erect the arch. The contractors combatted severe logistical problems to build the immense structure and by the following April had set the concrete foundations into the sheer canyon walls. The first steel was swung on April 16, 1928; the main span completed on June 14, 1929. Originally called the Grand Canyon or Lee's Ferry Bridge, it was renamed the Navajo Bridge in 1934. This remarkable structure has since carried highway traffic in an unaltered condition. Rehabilitation studies are currently underway.

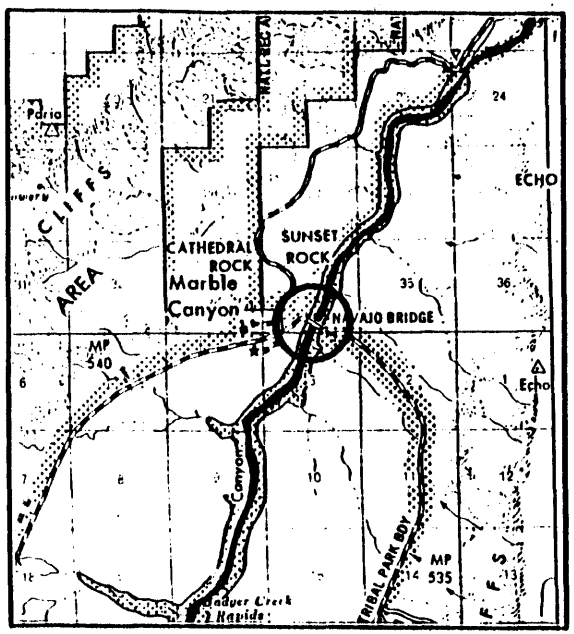
9. SIGNIFICANCE

The question of bridging the Colorado River between Topock, Arizona and Green River, Utah had intrigued engineers for years. When it was finally completed, the Navajo Bridge marked an important milestone of engineering design, logistical planning and construction supervision. It was the first steel deck arch erected in Arizona and is a nationally significant example of this uncommon structural type. As the only crossing of the Colorado River for 600 miles, the Navajo Bridge had a profound impact on the commerce and transportation of a rugged, remote and isolated section of Arizona. Its construction opened the state from the north, providing a much-needed tourist route to Grand Canyon National Park and the rest of the state. An extraordinary dramatic span high over the Grand Canyon - the highest in the country at completion - the Navajo Bridge is Arizona's most significant vehicular structure.

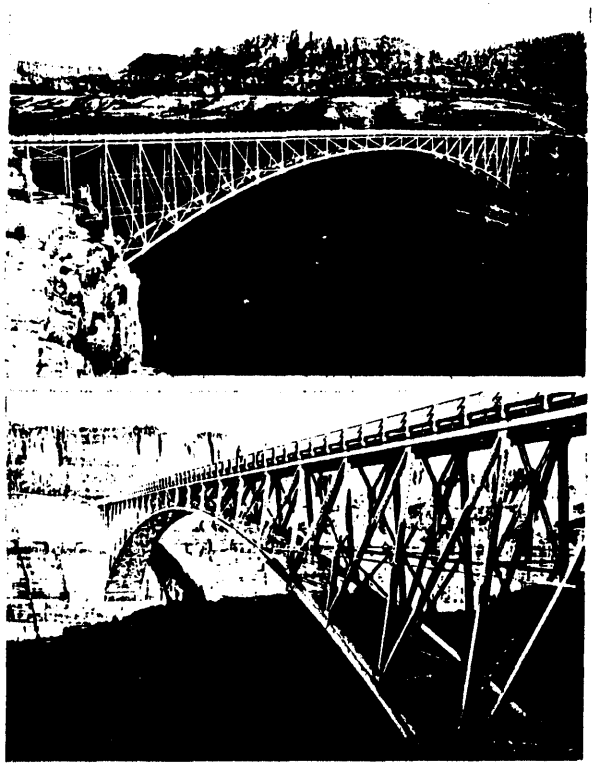
10. NAME(S) OF STRUCTURE

Navajo Bridge

11. PHOTOS (W/ FILM ROLL & FRAME NO.) AND SKETCH MAP OF LOCATION



LOCATION MAP
TAKEN FROM DEPARTMENT OF TRANSPORTATION GENERAL HIGHWAY MAP



12. SOURCES

Bridge Record, Arizona State Highway System: 0051; Structures Section, Arizona Department of Transportation, Phoenix AZ

"Bridging the Colorado," Engineering News Record, 1 November 1928; "Colorado River Bridge Dedicated," Engineering News Record, 27 June 1929; "Steel Arch Highway Bridge Across the Colorado River," Engineering News Record, v. 100, no. 46, pages 646-49; Ralph A. Hoffman, "Grand Canyon Bridge Opens New Route Across Greatest of All Natural Barriers," Arizona Highways, June 1929, pages 13-14; H.E.O. Whitman, "Bridge Ceremony Marks Another Milestone in Man's Fight to Conquer Nature's Barriers," Arizona Highways, June 1929, pages 9-10; W.R. Hutchins, "Hardships Encountered in Bridging the Grand Canyon," Arizona Highways, June 1929, pages 15-16, 57.

Field inspection by Clayton Fraser, 3 December 1986.

13. INVENTORIED BY:	**AFFILIATION**	**DATE**
Clayton B. Fraser	Fraserdesign Loveland Colorado	1 April 1987