## HISTORIC PROPERTY INVENTORY FORM

HISTORIC

BRIDGE

# INVENTORY

# Dead Indian Canyon Bridge

#### PROPERTY IDENTIFICATION

county milepost location	Coconino 0.00 13.2 mi W of Desert View	inventory number inventory route feature intersected	00032 abd. US 64 Dead Indian Canyon	
city/vicinity	Desert View	structure owner	Arizona Department of Transportation	
USGS quad	Hellhole Bend	UTM reference	12.442160.3976693	
STRUCTURAL INFO	RMATION			
main span number	3	main span type	3 09	
appr. span number	0	appr. span type		
degree of skew	0	guardrail type	0	
main span length	116.0	superstructure	steel rigid-connected Warren deck truss	
structure length	301.8	substructure	concrete abutments, wingwalls and pier pedestals w/ braced steel piers	
roadway width	24.0	floor/decking	concrete deck over steel stringers	
structure width	26.0	other features	upper / lower chord: 2 channels w/ cover plate and lacing or batten plates; diagonal: wide flange; lateral brace: l angle; floor beam: I- beam; welded steel baluster guardrails	
HISTORICAL INFOR	RMATION			
construction date	1934	designer/engineer	US Bureau of Public Roads	
project number	RG391(A)	builder/contractor	Vinson & Pringle, Phoenix AZ	
info source:	ADOT bridge records	alteration date(s)		
		alterations		
NATIONAL REGIST	ER EVALUATION			
		For additional inform National Register M	nation, see "Vehicular Bridges in Arizona 1880-1978" Iultiple Property Documentation Form	
inventory score	77	NRHP eligibility	listed	
interstate exemptio	n _	NRHP criteria	A <u>x</u> B C <u>x</u>	
program comment	-	signif. statement	well-preserved example of uncommon structural type, located on important route	
FORM COMPLETED	D BY			
Clayton B. Fraser, Principal			FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537	

l October 2018



date of photo.: March 2018

view direction: northwest north photo no.: DSCF6542 DSCF6552

When the National Park Service established the Grand Canyon National Park in 1919, no road extended westward from the Cameron Trading Post into the park. Access to the park was by way of a circuitous wagon road through the Navajo Reservation, which discouraged park visitation. During the early 1930s, to correct this problem, the Arizona Highway Department and the U.S. Bureau of Public Roads undertook an extensive road building effort that would provide automobile access from the east to Grand Canyon National Park's south rim. In 1929 the Navajo Bridge [00051] was completed over the Colorado River, opening Arizona from the north. The following year AHD contracted for Federal Aid Project 95-B—the state's largest highway construction project to date—covering 95 miles between the bridge and Cameron. The BPR later built the Cameron-Desert View approach to the park, naming the 31-mile route the NavaHopi Highway.

About 13 miles east of Desert View, the route crossed Dead Indian Canyon, a broad, rocky chasm on the northern periphery of the Gray Mountains. For this crossing, BPR engineers delineated a rigid-connected steel deck truss supported by braced steel piers. The structure was comprised of three Warren truss spans, with built-up box beams for the upper and lower chords, a concrete deck and welded steel guardrails. In keeping with the Rustic Style then in use by the Park Service, the bridge featured decorative stone veneer on the concrete abutments and wingwalls. The Bureau of Public Roads awarded a contract for the bridge's construction on August 31, 1933, to Vinson and Pringle for \$45,000. The Phoenix-based contractors had completed the steel erection by January and in May had completed the structure. Now designated State Highway 64, the original NavaHopi Highway still provides important access to the park, although in a realignment the bridge has been abandoned in place. It stands today in unaltered condition.

#### SIGNIFICANCE STATEMENT

The significance of the Grand Canyon to Arizona has been well documented in commercial and developmental terms. As an important crossing in a major access road to the park, the Dead Indian Canyon Bridge is historically important, at least on a regional basis. In a real sense it formed the final link in the route opened five years earlier by the nationally significant Navajo Bridge. Technologically, although the bridge displays typical medium-span truss design, it is distinguished as a well-preserved example of truss bridge construction, uncommon in Arizona. Moreover, the stonework ties the bridge with the Rustic Style in an uncommon exercise of bridge aesthetics. Abandoned and in pristine condition, the Dead Indian Canyon Bridge is one of Arizona's more spectacular vehicular trusses.

	HISTORICAL SIGNIFICANCE	NATIONAL REGISTER CRITERIA
represents the work of a master	associated with significant persons	x Criterion A
possesses high artistic values	x associated with significant events or	patterns Criterion B
represents a type, period or method of construction	contributes to historical district	Criterion C
NATIONAL REGISTER ELIGIBILITY	AREA OF SIGNIFICANCE: Tran	nsportation; Engineering
individually eligible <u>x</u> yes <u>no</u>	period of significance: 1934	-1978
contributes to district yesx no	THEME(S): Tran	nsportation: Highways



LOCATION MAP

## HISTORIC PROPERTY INVENTORY FORM



BRIDGE

# INVENTORY

# Navajo Bridge

PROPERTY IDENTIF	FICATION		
county milepost location city/vicinity USGS quad	Coconino 537.88 13.8 mi N Jct US89 Marble Canyon Navajo Bridge	inventory number inventory route feature intersected structure owner UTM reference	00051 US 89 A Colorado River Arizona Department of Transportation 12.443700.4074823
main span number appr. span number degree of skew main span length structure length roadway width structure width	1 8 0 616.0 834.0 18.0 20.4 RMATION	main span type appr. span type guardrail type superstructure substructure floor/decking other features	311 309 6 steel three-hinge spandrel-braced deck arch concrete pedestals set on ledges blasted in stone walls concrete deck over steel stringers lower chord: 2 channels w/ cover plate and double lacing; upper chord: 2 channels w/ batten plates; floor beam: I-beam; steel lattice guardrails
construction date project number info source: NATIONAL REGIST	1929 FAP 95-D ADOT bridge records ER EVALUATION	designer/engineer builder/contractor alteration date(s) alterations	Arizona Hiahway Department Kansas City Structural Steel Co., Kansas City <sup>1957</sup> 1995 approach spans strengthened; twin structure built
inventory score interstate exemptio program comment FORM COMPLETED	91 m _ -	For additional inform National Register M NRHP eligibility NRHP criteria signif. statement	mation, see "Vehicular Bridges in Arizona 1880-1978" Iultiple Property Documentation Form listed A <u>x</u> B <u>C x</u> Arizona's most technologically significant highway bridge
Clayton B. Fraser, Principal			FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018







date of photo.: March 2018 view direction: northwest north photo no.: DSCF6465 DSCF6470

In 1923 the Arizona Highway Department began planning for a bridge over the Grand Canyon of the Colorado River near Lee's Ferry. By October 1924 a connecting route (U.S. Highway 89) had been surveyed and preliminary surveys made for the bridge. Engineers originally considered a suspension bridge like the Cameron Bridge, then a through arch like the Topock Bridge, but eventually AHD Bridge Engineer Ralph 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 combated 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 until the recent construction of a parallel span carried highway traffic in unaltered condition. Today it functions as a pedestrian bridge.

#### SIGNIFICANCE STATEMENT

Construction of the Navajo Bridge marked a major event in Arizona history. After the highway linking it with Flagstaff was completed two years later, it played a pivotal role in the development of a vast region that covered two states. As the only crossing of the Colorado River for some 600 miles, the bridge has had a profound impact on the commerce and transportation of this rugged and remote part of Arizona. Its construction opened the state from the north, providing a valuable tourist route to Grand Canyon National Park and the rest of the state. As Ralph Hoffman himself averred, the design of the Navajo Bridge contained little in the way of engineering innovation. Iron and steel deck arches had been part of the repertoire of civil engineers since the erection of the first all-iron bridge in 1779.

Despite this, the Navajo Bridge did mark an important milestone of engineering design, logistical planning and construction supervision. It was the first steel deck arch built in Arizona and a nationally prominent example of this uncommon structural type. What makes this bridge technologically noteworthy is its immense scale, its inspired logistical planning and its breathtaking span over one of the most spectacular bridge sites in America. Although Hoffman was concerned primarily with functional aspects of the Navajo Bridge and not its appearance, this handsomely proportioned structure ranks among the country's most dramatic vehicular spans. Flying high over an arm of the Grand Canyon, the Navajo Bridge is Arizona's most aesthetically and functionally successful example of civil engineering.

#### NATIONAL REGISTER ELIGIBILITY

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values represents a type, period or method of construction	HISTORICAL SIGNIFICANCE associated with signification associated with signification contributes to historication	ant persons ant events or patterns I district	x     Criterion A        Criterion B        Criterion C
NATIONAL REGISTER ELIGIBILITY         individually eligible       x       yes       no         contributes to district       yes       x       no	AREA OF SIGNIFICANCE: PERIOD OF SIGNIFICANCE: THEME(S):	Transportation; Eng 1929-1978 Transportation: Hig	ineering hways



HISTORIC

BRIDGE

# INVENTORY

# Pumphouse Wash Bridge

PROPERTY IDENTIF	ICATION			
county milepost location city/vicinity USGS quad	Coconino 387.35 14.2 mi S of Jct I-40 Munds Park Mountainaire	inventory number inventory route feature intersected structure owner UTM reference	00079 SR 89 A Pumphouse Wash Arizona Department of Transportation 12.432904.3876037	
STRUCTURAL INFO	RMATION			
main span number appr. span number degree of skew main span length structure length	5 0 22 40.0 160.0	main span type appr. span type guardrail type superstructure substructure	302 9 steel I-beam stringer concrete abutments, wingwalls and pier	
roadway width structure width	28.0 31.6	floor/decking other features	pedestals with braced steel piers concrete deck over steel stringers curved roadway over angled spans; decorative Jersey barrier guardrails with blind arcades	
construction date project number info source:	1931 FHP 7-C ADOT bridge records	designer/engineer builder/contractor alteration date(s) alterations	US Bureau of Public Roads Charles G. Willis & Sons, Los Angeles CA 1986 guardrails replaced with like-kind concrete	
NATIONAL REGIST	ER EVALUATION			
		For additional information, see "Vehicular Bridges in Arizona 1880-1978" National Register Multiple Property Documentation Form		
inventory score interstate exemptio program comment	39 n _ -	NRHP eligibility NRHP criteria signif. statement	listed A B C _x aesthetically distinguished example of common structural type	

### FORM COMPLETED BY

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018



date of photo.: May 2018 view direction: southeast northeast photo no.: DSCF5032 DSCF5036

FRASERDESIGN 2018

For years Oak Creek Canyon north of Sedona was traversed over a narrow, winding dirt road. In 1930 the U.S. Bureau of Public Roads undertook an extensive upgrading of the highway as part of Forest Project 7. BPR staff engineers designed the highway and its drainage structures, dividing the construction into three intermediate sections. In December BPR awarded the first construction contract to road contractors C.G. Willis and Sons for an estimated \$187,000. Designated as Section C, this 2.89-mile segment extended from the top of Oak Creek Canyon Hill, about 13 miles south of Flagstaff, to just beyond the crossing of Pumphouse Canyon. In addition to the roadwork, the project entailed the erection of a substantial bridge that curved over Pumphouse Wash at the base of the hill.

As delineated by BPR engineers in October 1930, the Pumphouse Wash Bridge consisted of five spans of steel stringers supported by steel four-legged piers on concrete/stone pedestals. Angled to form a broad curve under the curved roadway, the longest simply supported span extended 40 feet. The bridge's superstructure carried a 28-foot-wide concrete deck, bounded on the sides by slotted concrete guardrails. It would contain over 250 cubic yards of concrete in the pedestals and deck, 37,500 pounds of reinforcing steel and some 147,000 pounds of superstructural steel. Late in 1930 the contract to build the bridge was awarded to Charles G. Willis & Sons of Los Angeles. Under the supervision of BPR Resident Engineer E.J. McCracken, the contractors completed this section of highway—including the Pumphouse Wash Bridge—on October 24, 1931. The bridge has remained in place since, undergoing a rehabilitation and replacement of the guardrails by the Arizona Department of Transportation in 1986.

#### SIGNIFICANCE STATEMENT

With its five steel spans carried high above a picturesque mountain streambed on steel piers, the Pumphouse Wash Bridge is beautifully sited along one of Arizona's most scenic routes, the Oak Creek Highway. Though technologically unadventurous, the structure is distinguished as the most handsome of the state's steel stringer vehicular bridges, with its distinctive curved roadway laid over angled spans of stringers on four-leg bents. Its rehabilitation has been sensitively handled, involving replacement of the original doghouse concrete guardrails with Jersey barriers featuring blind arcades.

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values represents a type, period or method of construction	HISTORICAL SIGNIFICANCEassociated with significant personsassociated with significant events or patternscontributes to historical district	NATIONAL REGISTER CRITERIA Criterion A Criterion B x Criterion C
NATIONAL REGISTER ELIGIBILITY individually eligible <u>x</u> yes <u>no</u> contributes to district <u>yes</u> <u>x</u> no	area of significance: Engineeri: period of significance: 1931-1978 theme(s): Transporte	ng ation: Highways



STATE OF ARIZONA

HISTORIC

### HISTORIC PROPERTY INVENTORY FORM

INVENTORY

# W.W. Midgley Bridge

BRIDGE

#### PROPERTY IDENTIFICATION

county milepost location city/vicinity USGS quad STRUCTURAL INFC	Coconino 375.66 1.6 mi E of Jct SR 179 Sedona Munds Park RMATION	inventory number inventory route feature intersected structure owner UTM reference	00232 SR 89 A Wilson Canyon Arizona Department of Transportation 12.432163.3860567
	,		011
main span number		main span type	402
appr. span number	0	appr. span type	402
degree of skew	0	guardrail type	
main span length	240.0	superstructure	steel two-hinge spanarel-braced deck arch
structure length	3/4.0	substructure	stone masonry wingwalls
roadway width	24.0	floor/decking	concrete deck over steel stringers
structure width	27.2	other features	lower chord: 2 channels w/ double lacing; upper chord: 2 channels w/ double lacing; post: 2 channels w/ double lacing / wide flange; strut / lateral bracing: 2 angles w/ lacing; floor beam: I-beam
HISTORICAL INFOR	RMATION		
construction date	1939	designer/engineer	US Bureau of Public Roads
project number	AFP 7-B(1)	builder/contractor	Lewis Brothers, Phoenix AZ
info source:	ADOT bridge records	alteration date(s)	
		alterations	
NATIONAL REGIST	ER EVALUATION		
		For additional inform National Register N	nation, see "Vehicular Bridges in Arizona 1880-1978" ultiple Property Documentation Form
inventory score	70	NRHP eligibility	listed
interstate exemptio	n _	NRHP criteria	A B C
program comment	-	signif. statement	outstanding, large-scale example of rare structural type
FORM COMPLETE	OBY		
Clayton B. Fraser, Principal			FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018



date of photo.: May 2018

view direction: west south

photo no.: DSCF5044 DSCF5038

Structure No. 00232

In 1930 the U.S. Bureau of Public Roads undertook an extensive upgrading of the Oak Creek Highway between Sedona and Flagstaff in Coconino County. Funded as Arizona Forest Project 7, the construction was divided into several intermediate sections and let under a series of contracts during the early 1930s. The final link to complete the new highway was the erection of a major bridge over Wilson Canyon near Sedona. For this location, BPR engineers designed this medium-span steel deck arch, which resembled a scaled-down version of the immense Navajo Bridge [**00051**], completed in 1929. As delineated by BPR, the proposed structure was a two-hinge, spandrel-braced deck arch that extended 240 feet between the reinforced concrete arch pedestals. The two steel arch ribs were comprised of a built-up box beam made of twin channels with double lacing on top and bottom. These supported a series of W-beam and built-up columns upon which the I-beam steel floor beams rested. The floor beams in turn supported a reinforced concrete deck bounded on the edges by steel guardrails.

Early in 1938 the Bureau of Public Roads contracted with Lewis Brothers under Project AFP 7-B(1) to place the foundations and erect the arch. The Phoenix-based contractors began the excavation in the canyon walls for the arch pedestals on March 24, 1938, and pushed the construction throughout the summer under the supervision of BPR Resident Engineer V.G. Watson. The Lewis crew completed the steel structure on October 31. Dedicated in honor of local personage W.W. Midgley, who ranched cattle in the area in the 19<sup>th</sup> century, the Midgley Bridge has since carried traffic on U.S. Highway 89 Alternate. The superstructure remains unaltered, though steel Thrie beams have more recently been installed onto the original guardrails.

#### SIGNIFICANCE STATEMENT

A number of long-span steel arches have been built on Arizona's roads, beginning with the breathtakingly lightweight through arch over the Colorado River at Topock [**priv.**], and including the Navajo Bridge [**00051**], the Salt River Canyon Bridge [**00129**], the twin arches in Navajo County [**00215**], and a series of later structures. Of the deck arches, only the Navajo Bridge and the Midgley Bridge feature spandrel-braced arch configurations; the others have plate girder ribs. Although it suffers in comparison with the nationally significant Navajo Bridge, the Midgley Bridge is technologically significant as a well-preserved and picturesquely sited example of what is considered an esoteric and inherently dramatic structural type. The bridge is historically noteworthy as the final link on the Oak Creek Highway between Sedona and Flagstaff, a beautiful and popular secondary route in central Arizona.

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values represents a type, period or method of construction	HISTORICAL SIGNIFICANCEassociated with significant personsassociated with significant events or pattern:contributes to historical district	NATIONAL REGISTER CRITERIA <u>x</u> Criterion A s Criterion B <u>x</u> Criterion C
NATIONAL REGISTER ELIGIBILITY individually eligible <u>x</u> yes <u>no</u> contributes to district <u>yes x</u> no	AREA OF SIGNIFICANCE: Transpor Period of significance: 1939-1978 Theme(s): Transpor	rtation; Engineering rtation: Highways





## HISTORIC PROPERTY INVENTORY FORM



BRIDGE

# INVENTORY

## Water Holes Canyon Bridge

PROPERTY IDENTI	FICATION			
county milepost location city/vicinity USGS quad	Coconino 542.00 17.9 mi N Jct US 89A Page Lees Ferry	inventory number inventory route feature intersected structure owner UTM reference	00508 US 89 <sup>1</sup> Water Holes Canyon Arizona Department of Transportation 12.454670.4076890	
STRUCTURAL INFO	DRMATION			
main span number appr. span number degree of skew main span length structure length roadway width structure width	1 2 0 53.0 139.0 34.0 39.0	main span type appr. span type guardrail type superstructure substructure floor/decking other features	1 07 104 6 concrete parabolic rigid frame concrete abutments and wingwalls concrete deck steel Thrie beam guardrails	
HISTORICAL INFOR	RMATION			
construction date project number info source:	1957 USBR ADOT bridge records	designer/engineer builder/contractor alteration date(s) alterations	US Bureau of Reclamation Merritt-Chapman & Scott, New York NY ca1980 Thrie beam guardrails installed	
NATIONAL REGIST	ER EVALUATION			
		For additional information, see "Vehicular Bridges in Arizona 1880-1978" National Register Multiple Property Documentation Form		
inventory score interstate exemptic program comment	54 m _ -	NRHP eligibility       eligible         NRHP criteria       A       B       C       x         signif. statement       outstanding example of uncommon structural type, altered		

### FORM COMPLETED BY

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018



date of photo.: March 2018

view direction: south west

photo no.: DSCF6490 DSCF6510

As early as the 1910s, the U.S. Reclamation Service (predecessor to the Bureau of Reclamation) had begun planning a major dam over the Colorado River in the vicinity of John Lee's ferry. The project was studied intermittently and debated heatedly over the following years, until in April 1956 President Eisenhower signed the enabling legislation for the Colorado River Storage Project—the centerpiece of which would be the immense Glen Canyon Dam. Reclamation engineers immediately began finalizing the design of the dam and appurtenant structures. In April 1957 they received bids for the dam's construction, and awarded the contract to Merritt-Chapman & Scott for some \$118 million. In order to gain access to the remote northern Arizona site, they first graded a 25-mile-long highway from Bitter Springs to the river. The paved road and its drainage structures were completed by Christmas 1957.

One of the larger structures on the route was a bridge that spanned Water Holes Canyon 18 miles north of the junction with U.S. Highway 89A. For this, Reclamation engineers delineated a three-span concrete rigid frame structure, with angled pedestals that extended from solid-rock foundations to join rigidly with the concrete deck. The Water Holes Canyon Bridge featured all-concrete construction, with concrete substructure, deck and guardrails. It was completed in 1957 with the adjacent roadway. The dam was dedicated in September 1966 and the access road became part of U.S. Highway 89. The Water Holes Canyon Bridge has carried relatively light traffic since then, with the replacement of its guardrails with steel Thrie beams as the only alteration of note.

#### SIGNIFICANCE STATEMENT

As an integral crossing on a regionally important route associated with the construction of one of the West's most famous (and reviled) dams, the Water Holes Canyon Bridge enjoys a degree of historical significance for its contribution to northern Arizona transportation. The structure is technologically important as a well-preserved example of concrete rigid frame bridge construction. The Arizona Highway Department erected a number of concrete rigid frame bridges in the 1930s, but none like this adventurous structure designed by the Bureau of Reclamation. The Water Holes Canyon Bridge is unique among Arizona's historic structures in its angled and curved form, its handsome proportions and its method of construction.

TECHNOLOGICAL SIGNIFICANCE	HISTORICAL SIGNIFICANCE	NATIONAL REGISTER CRITERIA
represents the work of a master	associated with significant person	s <u>x</u> Criterion A
possesses high artistic values	associated with significant events	or patterns Criterion B
x represents a type, period or method of construction	contributes to historical district	_x Criterion C
NATIONAL REGISTER ELIGIBILITY individually eligible <u>x</u> yes <u>no</u> contributes to district <u>yes x</u> no	AREA OF SIGNIFICANCE: Er PERIOD OF SIGNIFICANCE: 19. THEME(S): Tr	ıgineering 57-1978 ansportation: Highways



LOCATION MAP

STATE OF ARIZONA

HISTORIC

## HISTORIC PROPERTY INVENTORY FORM

BRIDGE INVENTORY

# Glen Canyon Bridge

PROPERTY IDENTIF	FICATION		
county	Coconino	inventory number	00537
milepost	549.54	inventory route	US 89
location	25.4 mi N Jct US 89A	feature intersected	Glen Canyon
city/vicinity	Page	structure owner	Arizona Department of Transportation
USGS quad	Page	UTM reference	12.456960.4087815
main span number	1	main span type	311
appr. span number	3	appr. span type	402
degree of skew	0	guardrail type	1
main span length	1030.0	superstructure	steel two-hinge spandrel-braced deck arch
structure length	1271.0	substructure	concrete abutments and wingwalls
roadway width	30.0	floor/decking	concrete deck
structure width	41.0	other features	steel guardrails
construction date	1958	designer/engineer	US Bureau of Reclamation
project number	USBR DC-4800	builder/contractor	Merritt-Chapman & Scott, New York NY
info source:	ADOT bridge records	alteration date(s)	1976 2000
NATIONAL REGIST	ER EVALUATION	alterations	deck replaced; superstructural steel repaired
		For additional information, see "Vehicular Bridges in Arizona 1880-1978"	
inventory score interstate exemptio program comment	69 n _ -	NRHP eligibility NRHP criteria signif. statement	eligible A _x B C _x outstanding example of uncommon structural type; major crossing of major watercourse

### FORM COMPLETED BY

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018



date of photo.: April 2018

view direction: east north

photo no.: DSCF6484 DSCF6486

FRASERDESIGN 2018

As early as the 1910s the U.S. Reclamation Service (predecessor to the Bureau of Reclamation) had begun planning a major dam over the Colorado River in the vicinity of John Lee's ferry. The project was studied intermittently and debated heatedly over the following years, until in April 1956 President Eisenhower signed the enabling legislation for the Colorado River Storage Project—the centerpiece of which would be the immense Glen Canyon Dam. Reclamation engineers immediately began finalizing the design of the dam and appurtenant structures. In April 1957 they received bids for the dam's construction, and awarded the contract to Merritt-Chapman & Scott for some \$118 million. In order to gain access to the remote northern Arizona site, they first graded a 25-mile-long highway from Bitter Springs to the river. The paved road and its drainage structures were completed by Christmas 1957. At the damsite, the contractors began work on a long-span steel arch bridge that would span the canyon immediately below the proposed dam. They first erected a cableway to carry men, equipment and bridge parts across the canyon, then began work on the arch seats set into the cliffsides. As had been done on the Navajo Bridge 30 years earlier, the contractor erected the arch from the two sides, cantilevering the massive arms in sections toward the middle. Work continued on the bridge through the winter and spring of 1958. On August 6, the final chord section was lowered into place on the arch, and the superstructure was complete. The Glen Canyon Bridge was formally dedicated on February 29,1959, in a gala event that drew thousands of spectators from Arizona and Utah. Spanning over 1,000 feet high some 700 feet above the Colorado River (higher than any other bridge in the United States), the Glen Canyon Arch was immense. It featured a two-hinge design with a spandrel-braced arch, concrete deck and steel beam guardrails. Other than the installation of chain link fences flanking the sidewalks, the bridge remains unaltered.

#### SIGNIFICANCE STATEMENT

As an integral crossing on a regionally important route associated with the construction of one of the West's most famous (and reviled) dams, the Glen Canyon Bridge enjoys a degree of historical significance for its contribution to northern Arizona transportation. The structure is technologically important as a well-preserved example of large-scale bridge construction. A number of massive steel arches and cantilevered steel deck trusses were built in Arizona in the 1940s and 1950s, most of which are impressively scaled spans placed in dramatic settings. A handful of these remain: the Queen Creek Viaduct in Pinal County and the Pinto Creek Bridge [00351] in Gila County representing the arches, and the Guthrie Bridge [00352], the Hell Canyon Bridge [00483] in Yavapai County, and the Cameron Bridge [00532] in Coconino County representing the trusses. These were the state's most striking bridges of post-War period. Unfortunately, all of the trusses have been demolished.

TECHNOLOGICAL SIGNIFICANCE	HISTORICAL SIGNIFICANCE	NATIONAL REGISTER CRITERIA
represents the work of a master	associated with significant persons	Criterion A
possesses high artistic values	associated with significant events or patterns	Criterion B
represents a type, period or method of construction	contributes to historical district	_x_ Criterion C
NATIONAL REGISTER ELIGIBILITY	area of significance: Engineer	ing
individually eligible x yes no	period of significance: 1958-1978	
contributes to district yes no	THEME(S): Transport	tation: Highways



LOCATION MAP

## HISTORIC PROPERTY INVENTORY FORM



BRIDGE

# INVENTORY

## Walnut Canyon Bridge

PROPERTY IDENTI							
county milepost location	Coconino 0.00 1.2 mi NW of W	Vinona	inventory number inventory route feature intersected	09225 abd. Towns Walnut Ca	send-Win nyon	10na Highwa	ý
city/vicinity USGS quad	11 Winona Winona		structure owner UTM reference	Coconino ( 12.461665.38	County 396610		
STRUCTURAL INFO	RMATION						
main span number appr. span number degree of skew main span length structure length roadway width structure width HISTORICAL INFOR	1 0 0 100.0 124.0 19.0 22.0 RMATION		main span type appr. span type guardrail type superstructure substructure floor/decking other features	310 0 steel rigid-c concrete de steel lattice	connected outments eck over s guardrai	d Parker throu and wingwa steel stringers ls w/ concrete	ugh truss Ils 9 curbs
construction date project number info source:	1924 ADOT bridge r	ecords	designer/engineer builder/contractor alteration date(s) alterations	US Bureau c1950 stiffening p traffic	of Public Iates add	Roads ed to truss; br	idge closed to
NATIONAL REGIST	ER EVALUATION						
			For additional inform National Register M	nation, see "Ve ultiple Property	hicular Bridg Documenta	ges in Arizona 188 tion Form	0-1978"
inventory score interstate exemptic	53 m _		NRHP eligibility NRHP criteria	listed A	В	C _x	

signif. statement

### FORM COMPLETED BY

program comment

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018

structural type

well-preserved example of uncommon



date of photo.: March 2018 view direction: northwest northeast photo no.: DSCF6556 DSCF6558

FRASERDESIGN 2018

In 1922 the U.S. Bureau of Public Roads undertook two major road building projects in Arizona, using appropriations from the federal Forest Highways Fund. The first involved a 15½-mile section of the Prescott-Phoenix Highway in the Prescott National Forest between Prescott and White Spar. The second involved a 23½-mile portion of the Flagstaff-Winslow Highway (later U.S. Highway 66), which stretched between Flagstaff and Angel through Coconino National Forest. The largest structure involved on the Flagstaff-Angel project was a bridge over Walnut Creek, a mile north of Winona. For this, BPR engineers in Phoenix designed a rigid-connected through truss with a 100-foot span.

The Walnut Creek structure used a standard 100-foot-long, steel Parker web configuration, with built-up box beams for the upper chords and batten-plated angles for the lower. The truss was supported by reinforced concrete abutments and wingwalls. It carried a concrete deck on steel I-beams, which was bounded on both sides by steel lattice guardrails. The drawings were completed by June 1924 and the bridge itself later that year. The highway was subsequently realigned, and the bridge continued service as a county-road structure. It has more recently been abandoned in place with the construction of a replacement span, and the 1924 structure stands closed and unaltered condition.

#### SIGNIFICANCE STATEMENT

In addition to the \$75 million per annum appropriated by Congress for federal highways in the early 1920s, some \$6.5 million was appropriated for construction of forest highways in the country's national forests. Based upon the appropriation, Arizona received \$216,507 in 1922. The Forest Highway funds could be used for local as well as state roads. The Walnut Canyon Bridge later became part of U.S. Highway 66—the major east-west transcontinental route across northern Arizona—and is historically significant as an early component of this important route. Technologically, the bridge is important as one of only four such Parker trusses identified by the inventory.

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values represents a type, period or method of construction	HISTORICAL SIGNIFICANCEassociated with significant personsassociated with significant events or patternscontributes to historical district	NATIONAL REGISTER CRITERIA          x       Criterion A         G       Criterion B         x       Criterion C
NATIONAL REGISTER ELIGIBILITY individually eligible <u>x</u> yes <u>no</u> contributes to district <u>yes x</u> no	area of significance: Transpor period of significance: 1923-1978 theme(s): Transpor	tation; Engineering tation: Highways



LOCATION MAP

STATE OF ARIZONA

### HISTORIC PROPERTY INVENTORY FORM



# INVENTORY

# Cameron Suspension Bridge

PROPERTY IDENTI	FICATION		
county milepost location city/vicinity USGS quad	Coconino 466.88 0.1 mi N of Cameron Cameron Cameron North	inventory number inventory route feature intersected structure owner UTM reference	private abd. US 89 Little Colorado River Questar Southern Trails Pipeline 12.462830.3970405
main span number appr. span number degree of skew main span length structure length roadway width structure width	1 0 660.0 680.0 14.2 17.0	main span type appr. span type guardrail type superstructure substructure floor/decking other features	313 0 steel suspension bridge w/ fixed steel towers concrete pier pedestals and deadmen aluminum grate over steel stringers main suspension cable: 7 woven steel cables clamped together; cast steel cable cradles; round steel eyebar suspenders; steel lattice guardrails; pin-connected Pratt through stiffening truss
HISTORICAL INFOR	RMATION		
construction date project number info source: NATIONAL REGIST	1911 ADOT bridge records ER EVALUATION	designer/engineer builder/contractor alteration date(s) alterations	W.H. Code Midland Bridge Company, Kansas City MO 1947 1959 deck replaced; bridge abandoned in place and pipeline added
		For additional infor	mation, see "Vehicular Bridges in Arizona 1880-1978"
inventory score interstate exemptic program comment FORM COMPLETEI	89 m _ -	National Register M NRHP eligibility NRHP criteria signif. statement	fultiple Property Documentation Form listed A <u>x</u> B <u>C x</u> one of Arizona's most historically and technologically significant vehicular spans
Clayton B. Fra	ser, Principal		FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537

1 October 2018



date of photo.: March 2018

view direction: north northeast photo no.:

photo no.: DSCF6518 DSCF6524

In the early 1900s the U.S. Indian Irrigation Service and the Office of Indian Affairs made a concerted effort to improve commerce on the extensive Navajo and Hopi Reservations in northeastern Arizona Territory. Key to this was a proposed bridge over the Little Colorado River to link the reservations with Flagstaff. OIA contracted with the Midland Bridge Company of Kansas City, Missouri, to engineer and build the long bridge. The canyon at this location was both wide and deep with steep-sided walls, requiring a single-span structure that could be erected without falsework. To solve the problem, Midland Chief Engineer W.H. Code designed this 660-foot-long steel suspension structure.

The main suspension cables were comprised of seven woven steel cables clamped together, which were tied into massive concrete deadmen at the four corners. These cables passed over cast steel cradles at the tops of the braced steel towers. The suspended span was stiffened by a pin-connected Pratt through truss with a roadway width of 14 feet. Midland erected the Cameron Bridge in 1911. Named after U.S. Senator Ralph Cameron, the Cameron Bridge soon spawned a trading post and small settlement. In 1937 the bridge almost collapsed under the weight of a sheep herd. Although its back stays and suspenders were damaged, the structure continued to carry traffic with only deck and stringer replacement until its replacement in 1959. The Cameron Bridge was subsequently purchased by the Four Corners Pipeline Company and now carries a natural gas pipeline without further alteration.

#### SIGNIFICANCE STATEMENT

The Cameron Bridge has had a profound impact on the commerce and transportation of a rugged, remote and isolated section of Arizona. Its construction marked an important contribution to the region's economy by the Office of Indian Affairs and opened the Navajo Reservation and the remainder of the region to traffic from the south. As a pivotal part of the north-south territorial highway, the bridge provided an important entrance to Grand Canyon National Park from the populated areas of Arizona and proved pivotal in the later construction of the nationally significant Navajo Bridge [00051] over the Colorado River. Because of their exotic nature and expensive erection costs, suspension bridges were infrequently built in Arizona and the country. The Cameron Bridge is notable as the older of the two vehicular suspension bridges remaining in the state—a significant hybrid of suspension and truss engineering. One of the few bridges remaining from Arizona's territorial period, the Cameron Bridge over the Little Colorado is one of the state's most historically and technologically significant early spans.

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values represents a type, period or method of construction	HISTORICAL SIGNIFICANCE associated with significant persons associated with significant events or patterns contributes to historical district	NATIONAL REGISTER CRITERIA          x       Criterion A         Criterion B         Criterion C
NATIONAL REGISTER ELIGIBILITY individually eligible <u>x</u> yes <u>no</u> contributes to district <u>yes x</u> no	area of significance: Transportat period of significance: 1911-1978 theme(s): Transportat	tion; Engineering tion: Highways



LOCATION MAP

### HISTORIC PROPERTY INVENTORY FORM

HISTORIC

BRIDGE

# INVENTORY

## Canyon Diablo Bridge

PROPERTY IDENTIF	FICATION			
county milepost location city/vicinity USGS quad	Coconino 0.00 at Two Guns Two Guns Meteor Crater	inventory number inventory route feature intersected structure owner UTM reference	private abd. US 66 Canyon Diablo private 12.491290.3885865	
STRUCTURAL INFC	RMATION			
main span number appr. span number degree of skew main span length structure length roadway width structure width	1 0 128.0 146.0 16.0 18.0	main span type appr. span type guardrail type superstructure substructure floor/decking other features	<pre>111 0 concrete filled spandrel Luten arch concrete abutments and wingwalls concrete deck over earth fill paneled concrete parapet wall (upstream); pierced concrete parapet wall (downstream); plain, tapered cantilever brackets</pre>	
HISTORICAL INFOR	RMATION			
construction date project number info source:	1915 ADOT bridge records	designer/engineer builder/contractor alteration date(s) alterations	Topeka Bridge & Iron Company Topeka Bridge & Iron Company, Topeka KS	
NATIONAL REGIST	ER EVALUATION			
		For additional information, see "Vehicular Bridges in Arizona 1880-1978" National Register Multiple Property Documentation Form		
inventory score interstate exemptio program comment	79 n _ -	NRHP eligibility NRHP criteria signif. statement	listed A <u>x</u> B C <u>x</u> well-preserved Luten arch, located on important route	

### FORM COMPLETED BY

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018



date of photo.: March 2018

view direction: south northwest photo no.: DSCF6490 DSCF6498

Canyon Diablo historically formed a barrier to the Atchison Topeka & Santa Fe Railroad, delaying its construction progress across northern Arizona in 1881 as the track-building crew waited for delivery of timbers to build a trestle here. The Santa Fe Highway, which loosely followed the railroad, also encountered this rocky chasm just west of Two Guns in Coconino County. In 1914 Arizona State Engineer Lamar Cobb selected and surveyed the site for a bridge over the canyon and purchased plans and specifications for a long-span concrete arch from the Topeka Bridge & Iron Company of Kansas for \$500. Topeka designed a standard 128-foot Luten arch similar to the one the company had completed over Canyon Padre earlier that year.

Like the Canyon Padre structure [**abd**.], the Canyon Diablo bridge featured a 16-foot-wide roadway that cantilevered over the arch's spandrels on both sides. The arch sprang from concrete abutments and featured Luten's trademark elliptical profile. The volatile nature of the watercourse was illustrated by the concrete parapet walls; the downstream wall was pierced with slots, while the upstream wall was solid to protect the roadway from floodwaters. Late in 1914 the state engineer's office let the construction contract to the lowest bidder, Thomas Maddock of Williams, Arizona, for \$9,000. Using concrete and reinforcing steel supplied by the state, Maddock built the Canyon Diablo Bridge that winter. It was opened to traffic on March 17, 1915. Maddock himself later succeeded Cobb as the Arizona State Engineer. The Canyon Diablo Bridge and the adjacent roadway carried mainline traffic until the highway was rerouted in the 1930s. The bridge now stands abandoned in unaltered condition.

#### SIGNIFICANCE STATEMENT

The Canyon Diablo Bridge is historically noteworthy for its association with US 66. Alternately known as the Santa Fe Highway (in Arizona) and the National Old Trails Highway (its national designation), the road has served historically as the principal east-west transcontinental route across northern Arizona. Only the Ocean-to-Ocean Highway, which passed through Yuma, Phoenix and Safford, carried more traffic in the state. Built in the 1910s when the highway was in its formative stage, the Canyon Diablo Bridge was an integral part of this significant route. Technologically, the bridge is distinguished as the second Luten arch built in Arizona, predated only a year by the Canyon Padre Bridge. The State of Arizona built long-span Luten arches at several major river crossings in the 1910s, before this patented structural type fell from favor with civil engineers. Though now abandoned, the Canyon Diablo Bridge is an important early example of vehicular bridge construction in Arizona using a proprietary design.

TECHNOLOGICAL SIGNIFICANCE	HISTORICAL SIGNIFICANCE	NATIONAL REGISTER CRITERIA
represents the work of a master	associated with significant persons	_x Criterion A
possesses high artistic values	$\underline{x}$ associated with significant events or patterns	Criterion B
represents a type, period or method of construction	contributes to historical district	_x_ Criterion C
NATIONAL REGISTER ELIGIBILITY	AREA OF SIGNIFICANCE: Transporte	ation; Engineering
individually eligible <u>x</u> yes <u>no</u>	period of significance: 1915-1978	
contributes to districtyes no	THEME(S): Transporte	ation: Highways



#### LOCATION MAP

CANYON DIABLO BRIDGE

491000m E.

490000mE.

489000mE.

492000mE.

38 88000m N

38 87000m N.

38 B6000m N.

38 B5000m N.

38 84000m N.

38 83000m N.

WGS84 Zone 12S 493000m E.

## HISTORIC PROPERTY INVENTORY FORM

# HISTORIC

BRIDGE

# INVENTORY

## Canyon Padre Bridge

PROPERTY IDENTIF	FICATION			
county milepost location city/vicinity USGS quad	Coconino 0.00 21.8 mi East Flagstaff Twin Arrows Angell	inventory number inventory route feature intersected structure owner UTM reference	abd. abd. US 66 Canyon Padre Coconino County 12.473840.3891080	
STRUCTURAL INFO	RMATION			
main span number appr. span number degree of skew main span length structure length roadway width structure width	1 0 0 125.0 147.8 15.5 18.0	main span type appr. span type guardrail type superstructure substructure floor/decking other features	111 0 concrete filled spandrel Luten arch concrete abutments and wingwalls concrete deck over earth fill moulded concrete guardrails w/ paneled bulkheads and moulded, precast balusters; coved cantilever brackets	
HISTORICAL INFOR	RMATION			
construction date project number info source:	1914 ADOT bridge records	designer/engineer builder/contractor alteration date(s) alterations	Topeka Bridge & Iron Company Topeka Bridge & Iron Company, Topeka KS	
NATIONAL REGIST	ER EVALUATION			
		For additional information, see "Vehicular Bridges in Arizona 1880-1978" National Register Multiple Property Documentation Form		
inventory score interstate exemptio program comment	84 n _ -	NRHP eligibility NRHP criteria signif. statement	listed A _x B C _x Arizona's first Luten arch, located on important route	

### FORM COMPLETED BY

Clayton B. Fraser, Principal

FRASERdesign 5700 Jackdaw Drive Loveland, Colorado 80537 1 October 2018





date of photo.: March 2018

view direction: south southwest

photo no.: DSCF6421 DSCF2431

The Santa Fe Highway in northern Arizona crossed rugged Canyon Padre about 22 miles east of Flagstaff. Though not particularly deep or wide, this canyon in Coconino County formed a major topographical impediment to traffic. In 1913 Arizona State Engineer Lamar Cobb acted to bridge it. That year Division Engineer J.S. Barlow and Coconino County Engineer E. Ray Lamport located and surveyed a bridge site, delineating a 136-foot span for this crossing. The state engineer's office in July advertised for competitive proposals and designs. The Topeka Bridge & Iron Company of Kansas, western representative of Daniel Luten's National Bridge Company, was awarded the construction contract for \$7,900. Topeka Bridge designed a 140-foot Luten arch with a 16-foot-wide roadway that cantilevered over the arch's spandrels on both sides. As delineated by Luten, the arch sprang from concrete abutments and featured Luten's trademark elliptical profile. Its deck was flanked on both sides by concrete guardrails with cast concrete balusters.

A Topeka Bridge crew began substructural excavation for the bridge in September 1913. Under the direction of Assistant Engineer W.H. Carruthers, the men completed the job in April 1914. Although its tightly curved approaches were dangerous, the Canyon Padre Bridge carried mainline traffic on the highway until its replacement in 1937. It now carries sparse local traffic on the Navajo Indian Reservation.

#### SIGNIFICANCE STATEMENT

In the ten years after securing a patent in 1900, Daniel B. Luten built some 4,000 Luten—or horseshoe—arches across the United States. Though not one of Luten's larger customers, the State of Arizona did contract for design and/or construction of about a dozen of his long-span arches in the 1910s and early 1920s. The Canyon Padre Bridge is distinguished as the state's first Luten arch, designed by Luten himself and erected by his western firm, the Topeka Bridge & Iron Company. Additionally, the bridge is historically important as an intact portion of a nationally significant route. Alternately known as the Santa Fe Highway (in Arizona) and the National Old Trails Highway (its national designation), it has served historically as the principal east-west transcontinental route across northern Arizona. Although its guardrails are deteriorated somewhat from repeated collisions, the Canyon Padre Bridge accrues an additional degree of integrity of setting from the fact that the adjacent roadway is relatively unimproved. The highway was rerouted before it was paved along this stretch, leaving the road and bridge in essentially original condition. The Canyon Padre Bridge is among a small number of early structures that convey a feeling of what it was like to travel Arizona's state highways in the 1920s and 1930s.

TECHNOLOGICAL SIGNIFICANCE represents the work of a master possesses high artistic values	HISTORICAL SIGNIFICANCEassociated with significant personsassociated with significant events ofassociated with significant events of	NATIONAL REGISTER CRITERIA          x       Criterion A         patterns       Criterion B         x       Criterion C
represents a type, period or method of construction NATIONAL REGISTER ELIGIBILITY	AREA OF SIGNIFICANCE: Tra	Criterion C nsportation; Engineering
individually eligible <u>x</u> yes no	period of significance: 1914 theme(s): Tra	1-1978 nsportation: Highways



LOCATION MAP