Form No. 10-300 (Rev. 10-74) Senators: Ted Stevens/Mike Gravel; Congressman: Don Young

PH035-1440

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DATA SHEET

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

FOR NPS USE ONLY	
RECEIVED	FEB 24 1977
DATE ENTERED	SEP 15 1977

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

1 NAME

HISTORIC ** Susitna River Bridge (AHRS SITE NO. TLM-006)

AND/OR COMMON Gold Creek Bridge

2 LOCATION

N of Gold Creek

STREET & NUMBER ARR Mile 264.1

__NOT FOR PUBLICATION

CITY, TOWN Gold Creek X VICINITY OF

CONGRESSIONAL DISTRICT At Large

STATE Alaska CODE 02 COUNTY Yukon-Koyukuk Dov. CODE 290

3 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:

4 OWNER OF PROPERTY

NAME Alaska Railroad
U.S. Department of Transportation (907) 265-2411

STREET & NUMBER Pouch 7-2111

CITY, TOWN Anchorage __ VICINITY OF STATE Alaska 99501

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC. Alaska Railroad
U.S. Department of Transportation (907) 265-2411

STREET & NUMBER Pouch 7-2111

CITY, TOWN Anchorage STATE Alaska 99501

6 REPRESENTATION IN EXISTING SURVEYS

TITLE Alaska Heritage Resources Survey (AHRS)

DATE April 8, 1975 __FEDERAL X STATE __COUNTY __LOCAL

DEPOSITORY FOR SURVEY RECORDS Alaska Division of Parks, 323 E. 4th Avenue

CITY, TOWN Anchorage STATE Alaska 99501

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
X EXCELLENT	__DETERIORATED	__UNALTERED	X ORIGINAL SITE
__GOOD	__RUINS	X ALTERED	__MOVED DATE______
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

This bridge is at Mile 264.1 on the Alaska Railroad, where the right-of-way crosses the Susitna River at the head of navigation on that river. As one faces north, toward the right hand side of the bridge, the river approaches from the east, while on the left it proceeds in a generally southerely direction to the point where it empties into Cook Inlet.

The bridge design embodied a quarter-mile of track over its bridge and trestlework, with the principal section a 504-foot through-truss span over the main river channel. The quarter mile of track was divided into seven distinct parts. Traveling from south to north, there was, first, 392 feet of approach trestlework. This was succeeded by bridge spans of 70, 121, 504, 121, and 70 feet respectively. Then, at the north end, a short 28 feet of trestle, as the road passed from the river onto the bank. From time to time the sections of the bridge have been upgraded so that they now are all of steel construction, in succession, a 42-foot trestle, 70-foot thru girder, 70-foot thru girder, 504-foot truss, 70-foot thru girder, and 42-foot trestle.

The main span was of all-steel construction. However, timber was used on all approach spans, due to the high price of bridge steel at the time and the need for economy. The main piers were designed and built to sustain 200-foot steel approach spans, with the idea that at some future time such spans could be installed in place of the original combinations of timber constuction.

Work on the piers was begun May 22, 1920. The final steel was erected on February 2, 1921, and the first train crossed over on February 6, 1921. In 1935, the wooden trestles in the north approach were replaced by seventy-foot steel plate girder spans, and additional steel replacements were installed and piers shored up during the 1950's and 1960's. Successive up-gradings of the structural fabric and members has adhered to the principals of the original design.

<u>Summary</u>

Dates of construction: 1920-1921 (504' Span)
Manufacturer: American Bridge Company, Gary, Indiana
Engineer: Col. Frederick Mears, USA, Chief Engineer
Walter E. Angier, C.E., Consulting Engineer
F.A. Hanson, Construction Engineer
W.J.H. Fogelstrom, Bridge Engineer
Association with Railroad: Alaska Railroad
Substructure: Concrete and Steel
Material of Abutments and Piers: Concrete
Superstructure: Steel
Type of Truss: Through-truss

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	_COMMERCE	_EXPLORATION/SETTLEMENT	_PHILOSOPHY	_TRANSPORTATION
X 1900-	_COMMUNICATIONS	_INDUSTRY	_POLITICS/GOVERNMENT	_OTHER (SPECIFY)
		_INVENTION		

SPECIFIC DATES 1920-1921 (504' Span) BUILDER/ARCHITECT Col. Frederick Mears, Chief Engineer
Walter E. Angier, C.E., Consulting Engineer
F.A. Hanson, Construction Engineer
W.J.H. Fogelstrom, Bridge Engineer

STATEMENT OF SIGNIFICANCE

The successful completion of this structure marked completion of the first of a series of major bridges required for construction of the Alaska Railroad between the Tanana Valley and a warm-water port on the south-central coast. Construction of the foundation piers for erection of the bridge presented difficult and unforeseeable technical problems in Arctic construction, never before encountered during a major construction project. The solutions decided upon and put into practice in the field were innovations that became standard procedure in Arctic engineering and construction technology. These techniques were utilized in construction of the remaining major bridges of the Alaska Railroad, and have been reinvented during construction of the Trans-Alaska Oil Pipeline from Prudhoe Bay to Valdez.

Historical Narrative:

The planners of the Alaska Railroad surveyed alternate routes from Anchorage north to Fairbanks so as to choose the most desirable routing both for original construction and for long term maintenance of the line. Passing north from the Matanuska Valley there was no way that the railroad could avoid some route through the Alaska Mountain Range, a northern prolongation of the Rocky Mountain System. There are many streams and valleys on the flanks of that range, while slopes go on up to the heights of Mt. McKinley and Mt. Foraker.

For many miles the route selected followed the Susitna River, clinging to its eastern bank, until the crossing was made, bridging the river 264.1 rail miles north of Seward, where the first of the major clear span steel bridges was constructed on the line north of Anchorage.

The engineers attempted to ascertain all possible facts, so that allowances could be made for unforeseen problems when they arose. Standard pre-construction studies were conducted and results and measurements recorded, so that the engineers would have all available information and data at their fingertips to anticipate problems that the Alaska winters and spring break-ups would probably bring.

The railroad planners took into account the effects of the wind on the bridge structure, as it would be affected unladen and with a train crossing load. For study of the foundation required, test borings were put down 60 and 70 feet into the bed of the river, showing underlying strata consisting of compact sand, gravel, and big boulders.

9 MAJOR BIBLIOGRAPHICAL REFERENCES

See Continuation Sheet

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY less than 1 acre

UTM REFERENCES

	ZONE	EASTING	NORTHING		ZONE	EASTING	NORTHING
A	0 6	3 6 2 5 7 5 (600)	6 9 6 2 4 5 0	B			
C				D			

VERBAL BOUNDARY DESCRIPTION

Not Applicable

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

STATE	CODE	COUNTY	CODE
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE
Alfred Mongin, Architectural Historian

ORGANIZATION
Alaska Division of Parks

DATE
December 14, 1976

STREET & NUMBER
323 East 4th Avenue

TELEPHONE
(907) 274-4679

CITY OR TOWN
Anchorage

STATE
Alaska 99501

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 Russell W Cahill

TITLE SHPO

DATE 2/8/1977

FOR NPS USE ONLY

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

DATE 8/12/77

~~DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION~~ ~~KEEPER OF THE NATIONAL REGISTER~~

ATTEST: Charles A Herrington

DATE 9.7.77

~~KEEPER OF THE NATIONAL REGISTER~~

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The subsurface situation was judged to be of such a kind that the sinking of piles beneath the foundation layers of the piers would be unnecessary. One of the problems considered most difficult was the effect of river ice on the bridge piers.

There is, naturally, plenty of ice in Alaska, especially in the winter time. A large volume comes down the Susitna River and swirls past the bridge site during spring break-up. The planners believed that the ice break-up in the spring occurred before the ice had softened. Great pieces of solid ice swung down the river, jamming themselves into islands, bars and shore, as the river negotiated its turns and twists. The ice piled up and restrained the river. The water level rose and produced increased pressure against the ice jams. After a time, the ice might yield and then rush on to get into another jam farther downstream. The engineers questioned what would happen to bridge piers exposed to jams and rushes. They appeared to have given little attention to the possibility of using timber piers. Concrete, it seems, was thought hardly certain to be equal to the job of withstanding perfectly the harsh scouring action of an ice jam against the pier. Such action would not be confined to high water, but to surfaces all the way down to river bottom.

Concrete piers were decided upon. Obviously the belief was that they would be equal to any force, if they were sufficiently massive. Steel-rod reinforcing of structural concrete had been introduced less than ten years earlier, but that technique appears to have not been considered for use here.

Consideration was given to spanning the main channel of the river by two center spans, each 250 feet long. The two span concept was considered in competition with a single 500 foot span. The former would have required not only three piers, but one would have been near the center of the river channel, in a position of maximum danger from ice buffeting. The cost was less for construction of the single span, and that was the design selected.

The end of steel tracks being laid was still a score of miles to the south when work was started toward pier construction for the Susitna River Bridge on May 22, 1920. A temporary trestle was put across the river parallel to the bridge site, and track was laid on it, facilitating movement of freight onward and delivery of construction materials to the north bank of the river. By September track construction advanced north to the bridge site.

In September 1920 the south pier was completed and work on the north pier begun when the south pier suffered a partial failure. The failure was at first attributed to poor materials. This first conclusion proved inaccurate.

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A method of dry construction had been employed for construction of the south bridge pier. The wall consisted of Wakefield piles.* These piles, when properly driven into the river bed, created a wooden diaphragm everywhere interlocked. In pouring the concrete for the piers, within these cofferdams, difficulty was experienced from more than one direction. At the bridge site, there was a gravel bank, with intermingled sand. Though the sand was defficient in relative amounts that was something that could be corrected. Nevertheless, there occurred a partial failure of one of the piers. The failure was at first ascribed to the presence of humus in the aggregate; then to a combination of poor quality of cement, the presence of humus, and to the low temperature for setting the concrete, the latter most dangerous to successful setting and curing of the material.

The root problem, however, was one unique to the character of the sub-river-bottom strata. The cofferdam presented a water-free area, which put the river bed, consisting of porous material, under a 22-foot head of water. This meant an upward pressure over the bottom surface of at least 9 1/2 pounds per square inch, from the fluids in the porous sub-strata. It was found to be practically impossible to successfully place concrete against this ambient sub-strata pressure.

By November the river temperature was down almost to the freezing point. The river bottom area to be covered by concrete was large. Failure loomed as a distinct possibility. The traditional river pier construction method, using piping or buckets to place the concrete under water--much as had been done successfully for the Brooklyn Bridge piers and the foundations for the "Million Dollar Bridge" on the Copper River Railroad--was considered and was discarded as impracticable and unworkable. It then was determined to take a fresh approach toward solving the concrete pouring problem.

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* The Wakefield pile was made by spiking three planks of equal width together. The outer planks were set exactly opposite each other, the center one displaced perhaps two or three inches, though kept parallel. The unit would then have a tongue of one edge and a groove of identical size on the other. By driving such units one after the other, in a circle, with the tongue of the new pile in the groove of the pile last driven, a continous wall was created that was virtually watertight.

The interlocking steel sheet pile was already driving the wooden pile out of service. The steel substitute could be made tighter and be driven to much greater advantage because of its superior strength and the knife-like edge on the bottom. However, the engineers used the Wakefield pile at this crossing in Alaska, possibley because timber was at hand and relatively cheap.

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As the river water temperature lowered toward the freezing point, the subsurface strata froze, eliminating the ambient pressure from sub-surface-strata water in the river bed. The space enclosed by the cofferdams was warmed by means of steam coils. The sand and gravel mix was heated by steam coils, and heated water was used for mixing the concrete, which was poured hot. The concrete for repouring the south pier was poured while the outside air varied from 2 degrees below zero to 48 degrees above. When the north pier was poured the air temperature readings varied from 12 degrees below zero to 34 degrees above. The procedure worked. This technique of pouring hot concrete during sub-zero weather is still in general use in Artic construction. A corallary technique of freezing large dam formations for stability was employed ten years later during major dam construction in the American west. Whether that resulted from this stabilizing technique is conjectural, but would be a logical development.

As pier construction was successfully completed, erection of the main span was carried forward. Riveting of the superstructure was being accomplished on one day when the temperature in the morning was 42 degrees below zero, and rose to a high of 12 degrees above zero that afternoon. The first train crossed the bridge on February 6, 1921, and all major construction was completed ten days later, on February 16.

The piers for the other major bridges on the railroad north of here were all set at the same season of the year, following the same technique. The Hurricane Gulch Bridge had no piers set into the river below it, so was constructed primarily during the summer season. Folllowing the example of construction of the Susitna River Bridge, the Riley Creek Bridge was completed in February 1922, the Tanana River Bridge in February 1923, and the Nenana River (temporary) Bridge completed in April 1922, with the rebuilt (steel) bridge completed in May 1925.

The engineers who recognized and solved this problem deserve recognition for their major contribution to the technology of Artic construction. In addition, the problems of logistics were enormous, seemingly insuperable. Advance engineering surveys had to be made in this remote place. The only access in winter was by dog team and, during the summer, by the long river route and on foot or by pack train, while fighting the terrible Arctic mosquitos. There were no roads, only paths and trails, and the airplane was still a novelty for daredevils, in the interior of Alaska.

The bridge superstructure was fabricated in a mill at Gary, Indiana, shipped by rail like a huge Tinker Toy, to Seattle, by ship to Anchorage, and by rail to the end of steel at the construction site, where it was reconstructed by a team of riggers sent, from Gary, by the manufacturer, The American Bridge Company.

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