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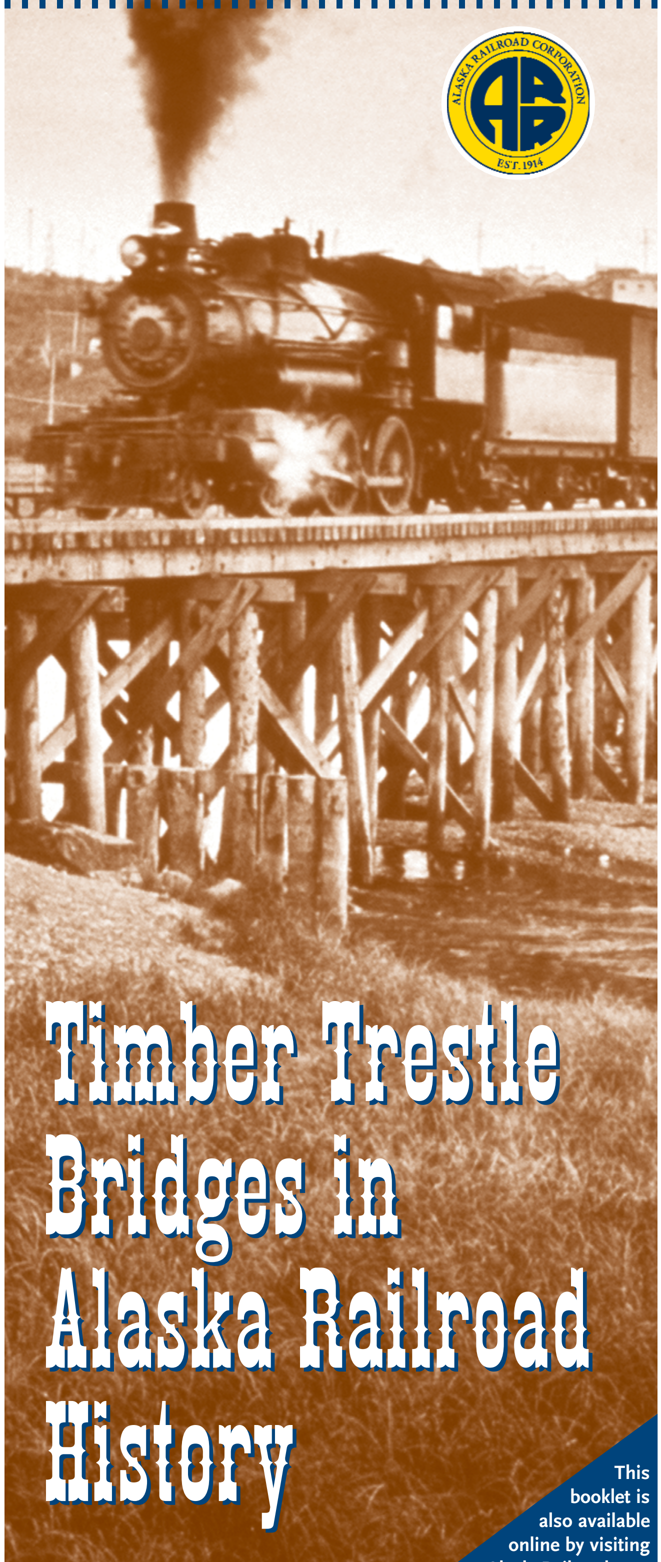

Timber Trestle Bridges in Alaska Railroad History

This booklet is also available online by visiting AlaskaRailroad.com

"The key to unlocking Alaska is a system of railroads."
— President Woodrow Wilson (1914)

Bridge under constructon at MP 54. (ARRC photo archive)

... progress was immediately hindered
by numerous water crossings
and abundant muskeg.
Because a trestle was the easiest
and cheapest way to negotiate these barriers,
a great many of them were erected,
only to be later replaced or
filled and then forgotten.
— Alaska Engineering Commission (1915)

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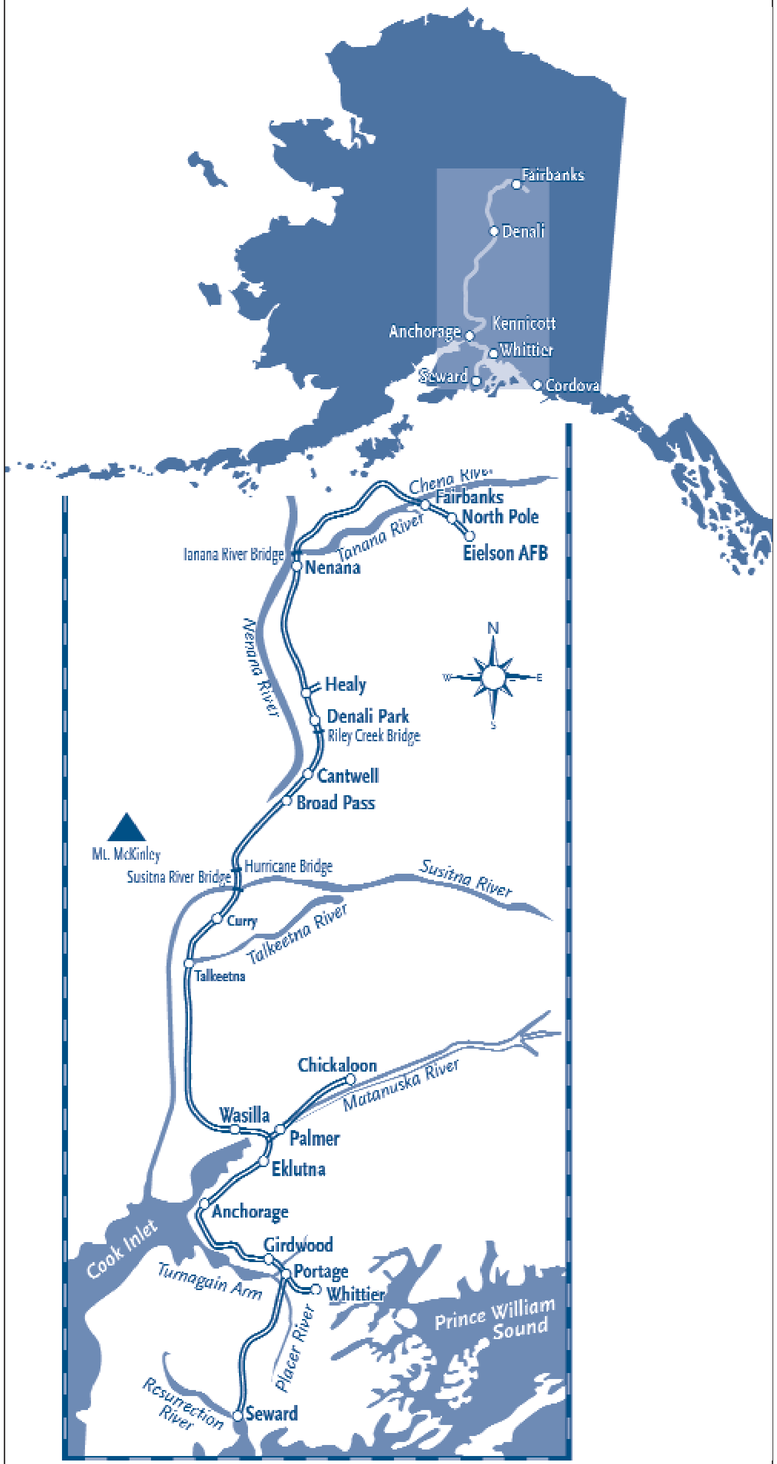
Cover photo: A train leaves Anchorage, crossing Ship Creek Bridge in 1922. (ARRC photo archive)

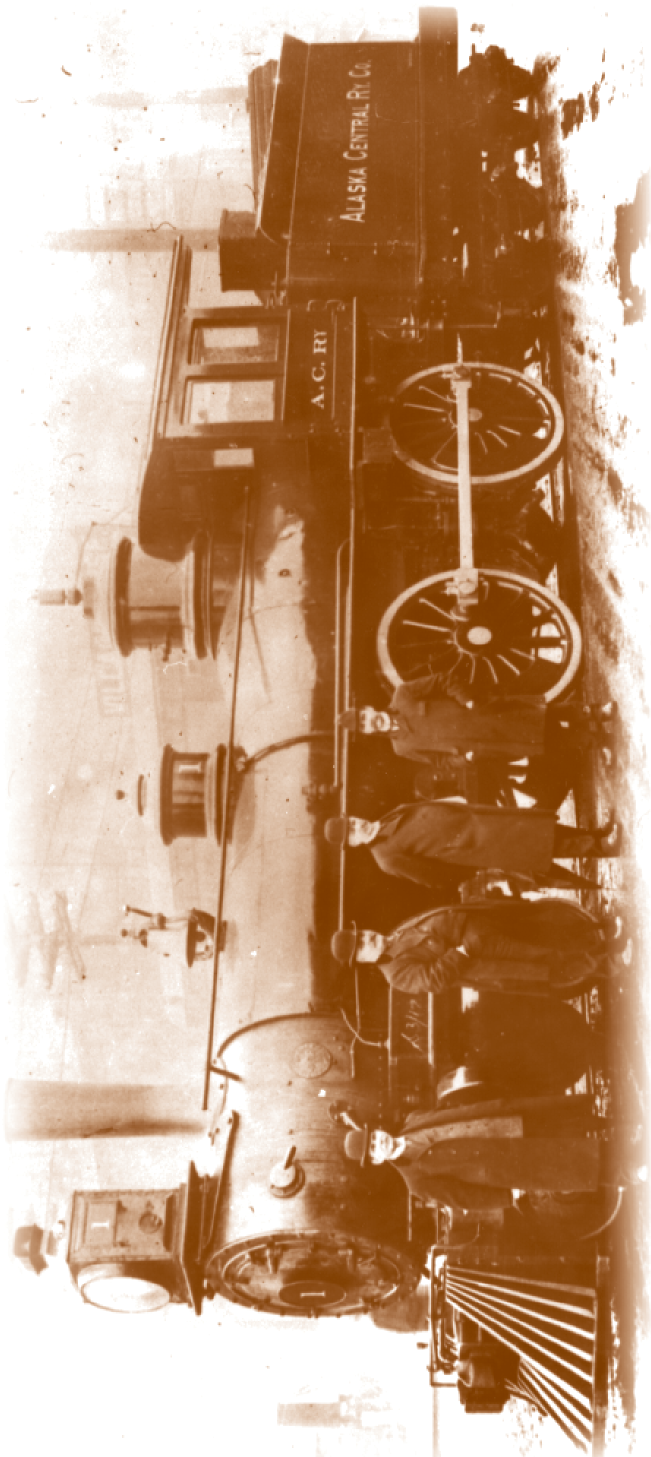


The Alaska Railroad at a Glance

Nearly a century ago, President Woodrow Wilson charged the Alaskan Engineering Commission with building a railroad connecting a southern ice-free harbor to the territory's interior in order to open this vast area to commerce. From 1915 to 1923, approximately 5,000 workers wielding shovels, saws and spike mauls built nearly 500 miles of track between the harbor town of Seward and the interior hub of Fairbanks. The railroad was operated by the federal government until 1985, when the State of Alaska purchased it for $22.3 million.

Today, the Alaska Railroad Corporation (ARRC) is one of North America's only railroads that carry both passengers and freight and one of very few offering whistle stop service. Travelers have rail access year-round, with daily service May through September, and weekly service from October through April. ARRC provides a seamless freight operation between shipping points in the Lower 48 to many destinations in Alaska. Crucial to the operation is Alaska Rail Marine, a barge service running between Seattle and Whittier. Between in-state rail terminals, trains haul petroleum products, gravel, coal, timber, oil-related pipeline materials and other freight.

The Alaska Railroad owns more than 36,000 acres of land. Roughly half is used for the railroad's right-of-way and yard operations. The other half is available for lease. Some lease land is adjacent to rail lines, ports and communities, making it prime property for manufacturing, construction and retail. In some cases, public entity leases provide communities with resources to improve quality of life for residents.



Alaska Central Railway owners pose beside a locomotive in Seward.
(ARRC photo archive)

Alaska Railroad Historical Overview

During construction of the Alaska Railroad, bridges were erected to cross rivers, streams, gorges, and other geographical barriers. Following a brief historical overview of the Alaska Railroad, this publication focuses on the timber trestle bridges used to span those barriers.

Early Development and Operations

Entrepreneurial pioneers formed the Alaska Central Railway (ACR) in 1902 to build a railroad from tidewater into the interior. Investors chose the head of Resurrection Bay as the southern terminus and established the town of Seward. ACR laid track reaching 50 miles north, but went bankrupt in 1907. The newly organized Alaska Northern Railway (ANR) purchased the railroad and by 1910, ANR extended the tracks to Kern Creek — 71 miles from Seward.

Alaska Central Railroad constructon gets underway in 1904 near Seward. (ARRC photo archive)

In 1914, the United States Congress agreed to fund, construct and operate a railroad in Alaska. By 1915, the federal government acquired ANR's assets, platted the Anchorage townsite and established the Alaska Engineering Commission (AEC) to complete a railroad between Seward and Fairbanks. In 1917, the Tanana Valley Railroad, a 45-mile narrow-gauge line into Fairbanks, was puchased. President Warren G. Harding officially opened the "Government Railroad" on July 15, 1923, in a ceremony at the Tanana River Bridge in Nenana.

Early operations were difficult and the newly named Alaska Railroad (ARR) required constant repairs. The combined population of 5,400 people in Seward, Anchorage and Fairbanks — the three towns of any size along the railbelt — did not generate enough business to make the railroad profitable.

Alaska Engineering Commission crews employ a steam-driven pile driver to construct the bridge over Ship Creek. (ARRC photo archive)

Railroad Revitalization and World War II

The ARR's first profitable year was 1938, when the military began building Fort Richardson near Anchorage and Ladd Field near Fairbanks in anticipation of World War II. The military built a railroad branch from Fairbanks to Ladd Field (now Fort Wainwright) and also helped ARR extend and maintain a rail connection to Whittier, a deep water port in Prince William Sound deemed vital to Alaska's defense. The war years were profitable, but also terribly wearing on the railroad (Fitch 1967).

The Alaska Railroad supported World War II efforts between 1938 and 1945 by hauling troops and military freight. (ARRC photo archive)

Railroad Rehabilitation & Early Cold War

Post war rehabilitation began in 1948, when Congress authorized funding in recognition of the threat posed by the Soviet Union. The military extended the branch track from Ladd Field to Eileson Air Force Base in the late 1940s and early 1950s. By late 1952, the ARR had rehabilitated over 400 miles of mainline track and replaced or reconstructed many bridges to accommodate heavier loads and increased tonnage required for national defense.

Recent Alaska Railroad History

In 1983, President Ronald Reagan signed a bill authorizing the sale of the Alaska Railroad to the State of Alaska for $22.3 million. The state established the Alaska Railroad Corporation (ARRC) as a quasi-public corporation. On January 5, 1985, the transfer occurred, and the Alaska Railroad became the property of the state.

Since the mid-1990s, millions of dollars have been invested to upgrade the Alaska Railroad's infrastructure — straightening track, improving and replacing bridges, and building new facilities. These improvements are part of a progressive modernization program to prepare for the future.

Timber Trestle Bridges:
Typically simple structures, with a few exceptions.

While some timber trestle bridges — such as the bridge at mile 75 that was reconstructed in 1919 — are tall and elaborate...

... Most timber trestle bridges are simpe, utilitarian structures — such as this bridge at mile 335.8 (ARRC photo archive)

About Timber Trestle Bridges

In addition to vast distances and incredible weather extremes, the builders of in the Alaska Railroad were confronted with countless gullies, canyons, and water features. Economic and technical necessity made the railroad follow the path of least resistance across the landscape. Where a gully or water feature intervened, crossing often required a timber trestle or other bridge type.

Bridge types on the Alaska Railroad are:

- Steel – Girder (Through or Deck)
- Steel – I-Beam
- Steel – Truss (Through, Deck, or Pony)
- Mixed Bridges (Timber and Steel Spans)
- Timber Trestles

This publication highlights the timber trestle bridges. The Alaska Railroad had as many as 800 bridges and trestles at one time. While a handful of ARRC timber trestles have been tall and elaborate, most are simple structures comprised of short and easy-to-erect spans. Timber trestle design typically boiled down to a series of utilitarian spans required to cross a natural barrier. Whether for a minimal or multi-tiered structure, the appeal of timber bridge construction was the abundant and available supply of local material.

History of Timber Trestle Bridges in the United States

Timber trestle bridges have been used to cross depressions, ravines and waterways since ancient times. As a readily available natural resource, timber has served as a bridge material since the American colonial era. While timber has a relatively short life in an exposed environment, its plentiful supply and straightforward assembly promoted widespread use in early bridge construction.

The earliest recorded colonial pile trestle span was at York, Maine, built in 1761 by Major Samuel Sewell. Timothy Palmer (1751-1821) of Newburyport, Massachusetts, the first of the pioneer wooden bridge builders, was a self-taught engineer / constructor. He built his first wooden bridge around 1780 and filed his first patent for a wooden bridge in 1797. By 1800, he was regarded as the leading builder of timber bridges in the United States and preceded the later truss designers beginning with Theodore Burr who patented the Burr truss in 1817. These early timber bridges supported relatively light loads of people, animals and horse-drawn wagons.

With the arrival of railroads — beginning in 1830 when the first component of the Baltimore and Ohio Railroad opened — came the demand for major advancements in bridge design and construction to support the heavy steam-driven trains. Railroad construction proliferated throughout the east during the 1830s and 1840s. Railroads required very small vertical grade changes with a maximum incline of 2 to 4 % depending on circumstances. Early railroads employed massive stone viaducts to traverse deep ravines, but used simple timber pile trestles to pass over small depressions, waterways and marshlands.

As railroads expanded westward after the Civil War, an era of tremendous and rapid construction occurred between new competing railroad companies racing to be the first to cross the continent. While the Rocky Mountains presented significant obstacles to railroad construction, the prairies were vast, and relatively flat with numerous rivers and ravines. Despite limitations, the economic advantages of wood-based construction proved irresistible. Railroads frequently built timber trestles to "bridge the gaps" and overcome the challenge of quick and inexpensive construction without highly skilled labor. In this frantic environment, railroads would bridge small ravines with simple pile trestles, while erecting large multitiered trestles to cross sizeable ravines and steep terrain.

> *"The only excuse for a timber bridge is that it is cheaper than some other form of construction. It is less durable than either steel or masonry. It cannot be built in as long a span as steel. It is the least resistant to fire of any type of construction. It has, however, the advantage of cheapness for ordinary loads and spans, and as timber is usually found in abundance in new localities, it is made use of for the earliest of the bridges to be built. As these new localities in the early days did not need to provide for the heavy loads of the present day, the problem of building a timber bridge was a comparatively simple one."*
> — (Hool & Kline 1942)

For these reasons, railroad construction of simple pile trestles continued at a prolific pace during the late 19th century and first half of the 20th century. By the mid-1950s, approximately 1,800 miles of timber trestles were in service on the nation's railroads. The cost of using relatively non-durable timber was high. Given serviceable life spans of 20 to 30 years for local untreated timber, bridge elements commonly failed and required replacement. Replacing the entire structure was often more economical and many timber trestles were replaced with other bridge types or filled to create embankments to support the track structure.

Rendition of an Alaska Engineering Commission document that specified standards for building wooden trestle bridges.

DEPARTMENT OF THE INTERIOR
ALASKA ENGINEERING COMMISSION.
Ship Creek, Alaska, May 25th, 1915
GENERAL SPECIFICATIONS FOR PILING FOR TRESTLE BRIDGES.

All piling shall be cut from sound live trees of slow growth, firm grain, free from shakes, decay, large unsound knots, or other defects that will impair their strength and durability. They shall be butt cut, above the ground swell, and be uniformly tapering from the butt to the tip. They shall be so straight that a line stretched from the center of the pile at the butt to the center of the pile at the tip will not leave the center of the pile at any point more than

two(2) inches for piles twenty feet long,
four (4) inches for piles thirty feet long,
six (6) inches for piles fourthy feet long,
eight (8) inches for piles fift feet long.

No short bends will be allowed. All knots shall be trimmed close to the body of the pile and the bark peeled.

Piles under forty feet in length shall be not less than fourteen (14) inches, nor more than eighteen (18) inches in diameter at the butt, and not less than ten (10) inches in diameter at the tip. Piles forty (40) feet long and over, shall be not less than sixteen (16) inches, nor more than twenty-two (22) inches in diameter at the butt, and not less than eight (8) inches in diameter at the tip. They shall show not less than seventy-five (75) per center heart at the tip.

The above specifications apply to Alaska Spruce for all piling, except for docks and approaches in sea water, when the bark should be retained, and shall be followed in all cases except when otherwise ordered.

W. J. H. Fogdstrom
Bridge Engineer. per F.H.C.

History of Timber Trestle Bridges on the Alaska Railroad

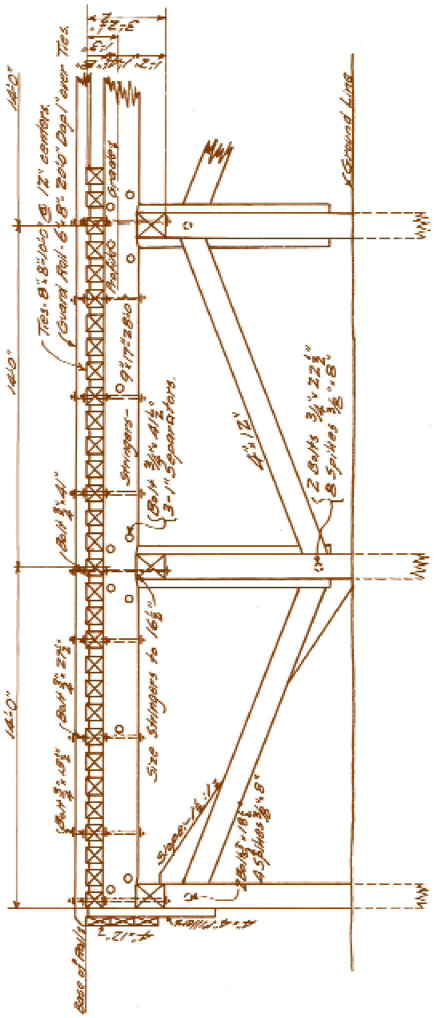
Similar to locations throughout the United States, timber trestles on the Alaska Railroad were employed as temporary, expedient structures. During initial construction, numerous water crossings and abundant muskeg impeded progress and the cost of bridge building was onerous. Timber trestles were the easiest and cheapest way to negotiate the barriers and a great many were constructed, and then later replaced with other bridge types or filled (Alaska Engineering Commission [AEC], 1915).

Early ARR timber trestles were constructed with 14- to 15-foot spans in accordance with *General Specifications for Piling for Trestle Bridges* as approved by the AEC on May 25, 1915. Span length was limited by the load bearing strength of timber stringers. To minimize costs, many spans were built using green native timber and were held together with spikes rather than bolts (Wilson 1977). Specifications called for the use of spruce trees with the bark removed to make piling for all timber trestle bridges: “All piling shall be cut from sound live trees of slow growth, firm grain, free from shakes, decay, large unsound knots, or other defects that will impair their strength and durability” (AEC, 1915). Timber trestle bridges built to these standards no longer exist.

Most timber trestle bridges were very simple structures, however, the former trestle constructed in an area known as the “Loop District” was a remarkable exception. In order for the railroad to climb the Kenai Mountains at a reasonable gradient, “high timber trestles were built in the Placer River canyon at miles 48 and 50 as alternatives to costly hillside and tunnel work. One was an incredible four-story loop that crossed over itself and looked like a donut from the air” (Wilson 1977).

During the early years of operation, the ARR’s timber trestle bridges required constant repair or replacement to keep the railroad in a safe condition for transportation (AEC 1926). The ARR dealt with these problems as money became available throughout the 1920s. By 1927, the

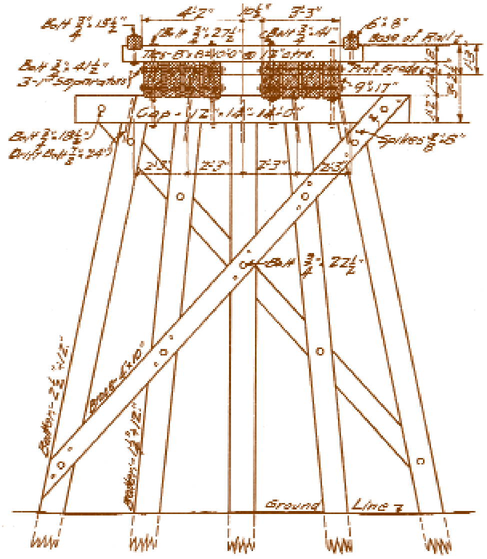
Alaska Engineering Commission 1915 engineering drawings for a standard pile trestle bridge.



TYPICAL SIDE ELEVATION OF TRESTLE
HEIGHTS TOP OF CAP TO GROUND 10FT OR LESS.

Notes:- All piles to be sized to 12" at intersections of braces.
All longitudinal braces to be on track piles.

DEPARTMENT OF THE INTERIOR
ALASKAN ENGINEERING COMMISSION.
STANDARD PILE TRESTLE.
SIDE ELEVATION- HEIGHTS 10FT & LESS.
Scale:- 1/2"=1'0"
Ship Creek, Alaska. April, 1916.
Chairman.



BILL OF MATERIAL - ONE BENT SWAY BRACED.					
1	Cap	12"x14"	14'0"	196'	
2	Braces	4"x10"	—	—	
3	Drift Bolts	7/8"	24"	21#	
10	Bolts	3/4"	18 1/2"	29	
1	"	3/4"	22 1/2"	4	
24	Boat Spikes	3/8"	8"	6	
22	Washers for 3/4" bolts			22	84
ADDITIONAL FOR TWO BULKHEADS.					
3	Fillers	4"x4"	20'0"	80'	
2	Planks	4"x12"	16'0"	128	
2	"	4"x12"	20'0"	160	
2	"	4"x12"	24'0"	192	
2	"	4"x12"	26'0"	208	768'
165	Boat Spikes	3/8"	8"	55	55#
BILL OF MATERIAL - ONE SPAN DECK (No Long Brac)					
4	Stringers	9"x17"	28'0"	1428	
14	Ties	8"x8"	10'0"	747	
1	Guard Rail	6"x8"	30'0"	120	2295
10	Bolts	3/4"	41 1/2"	57	
4	"	3/4"	41"	23	
6	"	3/4"	27 1/2"	24	
8	"	3/4"	15 1/2"	20	
30	Separators	3/4"	1"	39	
56	Cast Washers for 3/4" bolts			56	219#
ADDITIONAL DECK MATERIAL FOR EACH TRESTLE					
2	Bolts	3/4"	15 1/2"	5#	
4	"	3/4"	41"	23	
12	Cast Washers for 3/4" bolts			12	40

TYPICAL ELEVATION INTERMEDIATE BENT.

Notes:- All piles in each bent to be driven by swinging pile driver leads and center lines of piles to meet at a point 20'-8 1/4" above top of cap.
Trestle bents below 7'0" in height from ground to top of cap need neither transverse nor longitudinal bracing. Between 7'0" and 12'0" only transverse bracing, and above 12'0" both transverse and longitudinal bracing.
Loading:- Cooper's E-50.

DEPARTMENT OF THE INTERIOR
ALASKAN ENGINEERING COMMISSION.
STANDARD PILE TRESTLE.
INTERMEDIATE BENT.
Scale:- 1/2"=1'0"
Ship Creek, Alaska. April, 1916.
Chairman.

The Loop District…
high trestles were built in the Placer River canyon at miles 48 and 50 as alternatives to costly hillside and tunnel work. One was an incredible four-story loop that crossed over itself and looked like a donut from the air.

During the winter of 1948, railroad crews conduct brace work to stiffen the Loop District trestle at mile 48.3. in order to ensure continued safe operation. (ARRC photo archive)

A train goes under the loop track where it crosses over itself during the summer of 1950. (ARRC photo archive)

amount of track on timber trestles had been reduced from 17.2 to 13.7 miles (Wilson 1977).

Further improvement came in anticipation of World War II. In the late 1930s, the military began building Fort Richardson, adjacent to Anchorage. Troops also helped ARR to expand and maintain a rail connection to Whittier, an ice-free port deemed vital to Alaska's defense. Two tunnels were drilled and five timber trestles erected along the 12.4-mile Whittier Branch. Among them was a notable bridge at branch mile F5.7. Constructed in 1942, Bridge F5.7 was a 238-foot timber trestle comprised of seventeen 14-foot spans to cross Placer Creek.

After World War II ended, ARR remained a federal focus due to Cold War tensions. Railroad rehabilitation began in 1948, when Congress authorized funding in recognition of the threat posed by the Soviet Union. ARR adopted a new Standard Open Deck Pile Trestle plan in June 1949. Over the next 10 years, timber pile trestle renovations proliferated, with 37 replacements built to these new standards. During this time, creosote was used as a wood preservative that could extend the useful life of trestle timber from 25 to 50 years if properly maintained.

By the time railroad rehabilitation peaked in late 1952, diesels replaced most steam locomotives, 70-pound rail was exchanged for 115-pound rail along the roadbed, and creosoted timber replaced untreated piles at many bridge locations. ARR had also swapped several timber trestles and some other older bridges with military surplus steel bridges. In 1951, the timber trestles of the "Loop District" were replaced through realignment, fill and construction of a steel bridge (Prince 1964).

Since 1959, ARR's timber trestles have been periodically reconstructed, upgraded or altered, and many have had all original materials replaced. Nearly all of the ARR's remaining timber bridges are classified as "open deck" construction, as opposed to "ballasted." With open decks, the track is directly fixed to the trestle and functions as a rigid structure. Ballasted decks are continuous with a layer of rock ballast upon which the track structure is laid.

Status of Timber Trestle Bridges on the Alaska Railroad

Today, timber trestle bridges are functionally obsolete and are no longer economically feasible to maintain for modern Alaska Railroad operations. Some timber bridges also have structural deficiencies or create river flow problems and are prone to damage during floods. Regulatory constraints discourage continued use of creosote-treated timber in fresh water streams. Moreover, a significant portion of the Alaska Railroad's freight business comes by interchange with other railroads via a rail-barge operation between Seattle and Whittier. ARRC must be able to accept heavier tonnage and higher speed trains, or risk losing business that is critical to its mission and long-term economic viability.

Timber trestle bridge at mile F5.7 on the Whittier Branch. (ARRC photos)

ARRC has initiated a progressive bridge modernization program to prepare for the future. Design and material emphasis is on durable, low maintenance, long service life structures that can be installed with minimal interruption to train operations. These replacement bridges are often steel or concrete ballast deck with steel piles. They are less expensive and have a longer life cycle, better safety performance, and less environmental impact than timber trestle bridges. For example, Bridge F5.7 was replaced in 2006-2007 with a new steel bridge.

When full replacement of a timber bridge is not an option, ARRC makes repairs, such as replacing deteriorated timber piles and caps with steel pile bents and caps. At the time of this booklet publication in 2008, approximately 50 timber trestle bridges remain on the railroad, with most expected to be replaced within 10 years.

A steel bridge replaced the timber bridge at mile F5.7 in late 2006.

Historical Significance of Timber Trestle Bridges on the Alaska Railroad

In consultation with the Alaska Office of History and Archaeology/State Historic Preservation Officer (SHPO), a number of ARRC timber trestle bridges were found eligible for the National Register of Historic Places. Most are eligible under National Register Criterion C, as they embody the distinctive characteristics of a type, period, or method of construction and are representative examples of this bridge type on the Alaska Railroad. The period of significance is from 1914 at initial construction to 1959, when most trestles of post war reconstruction were completed.

ARRC and SHPO have agreed on several measures to mitigate historical impacts associated with replacing the timber trestle bridges, including publishing this educational booklet. In addition, architectural recordation forms for five individual timber trestle bridges have been permanently archived with the National Archives and Records Administration in Anchorage.

Representative Alaska Railroad timber trestle bridges found eligible for the National Register of Historic Places

Bridge 6.60 is a 135-foot timber trestle with nine 15-foot spans. It crosses Bear Creek near Seward. Originally built in 1917, Bridge 6.6 was rebuilt in 1953, and most components were replaced in 1985.

Bridge 61.3 is a 54-foot timber trestle comprised of two 15-foot, one 14-foot and one 10-foot spans. It crosses a Placer River tributary near Portage. Originally constructed in 1919, it was rebuilt in 1950, and many components have been replaced since then.

The Ship Creek Pedestrian Bridge at mile 114.6 is in the Anchorage Rail Yard. Originally built in 1916 as a 196-foot bridge comprised of fourteen 14-foot spans, it was rebuilt in 1938 and 1956. Bridge 114.6 was removed from train service in 1987, when it was converted to pedestrian use only.

Bridge 337.0 is a 42-foot timber trestle with three14-foot spans. It crosses a Nenana River drainage eight miles south of Denali Park. Originally built in 1922, it was rebuilt in 1948 and many components have been replaced since then. (2004 ARRC Bridge Survey photos)

Publication Credits

Acknowledgements

The Alaska Railroad acknowledges the work of McGinley, Kalsow & Associates LLP (MKA), Somerville, Massachusetts; Cultural Resource Consultants (CRC) and HDR Alaska Inc., located in Anchorage, Alaska. These firms contributed to the draft *Alaska Railroad Historic Bridge Survey* that provided the basis for preparing this publication.

Bibliography of References

Alaska Engineering Commission. 1914.
Map of the Alaska Northern Railway and Alternative Survey, Seward to Turnagain Arm Mile 0-65. S/158. On file, Bureau of Land Management, Anchorage.

Alaska Railroad. 1917.
Annual Report. Annual, Monthly, and Miscellaneous Reports of the Alaska Railroad. Record Group 322 P2258, 1915-1954. National Archives and Records Administration, Anchorage.

Alaska Railroad. 1919.
General Specifications for Pilings for Trestle Bridges. May 25, 1919.

Alaska Railroad. 1926.
Annual Report. Annual, Monthly, and Miscellaneous Reports of the Alaska Railroad. Record Group 322 P2258, 1915-1954. National Archives and Records Administration, Anchorage.

Anchorage Daily Times. February 8, 1921

Clifford, Howard. 1981.
Rails North: Railroads of Alaska and the Yukon. Superior Publishing Company Seattle.

Clifford, Howard. 1999.
Alaska/Yukon Railroads — An Illustrated History. OSO Publishing, Arlington, Virginia.

Cohen, Stan. 1984.
Rails Across the Tundra: A Historical Album of the Alaska Railroad Pictorial Histories Publishing Company, Missoula.

Crittenden, Katherine Carson. 2002.
Get Mears! Frederick Mears: Builder of the Alaska Railroad. Binford & Mort, Portland.

Fitch, Edwin M. 1967.
The Alaska Railroad. Praeger, New York.

Hool, George A., and W. S. Kinne. 1942.
Steel and Timber Structures, Second Edition. McGraw-Hill, New York.

Prince, Bernardine Lemay. 1964.
The Alaska Railroad in Pictures. Ken Wray's Printshop, Anchorage.

Wilson, William H. 1977.
Railroad in the Clouds: The Alaska Railroad in the Age of Steam, 1914-1945. Pruett Publishing, Boulder.

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