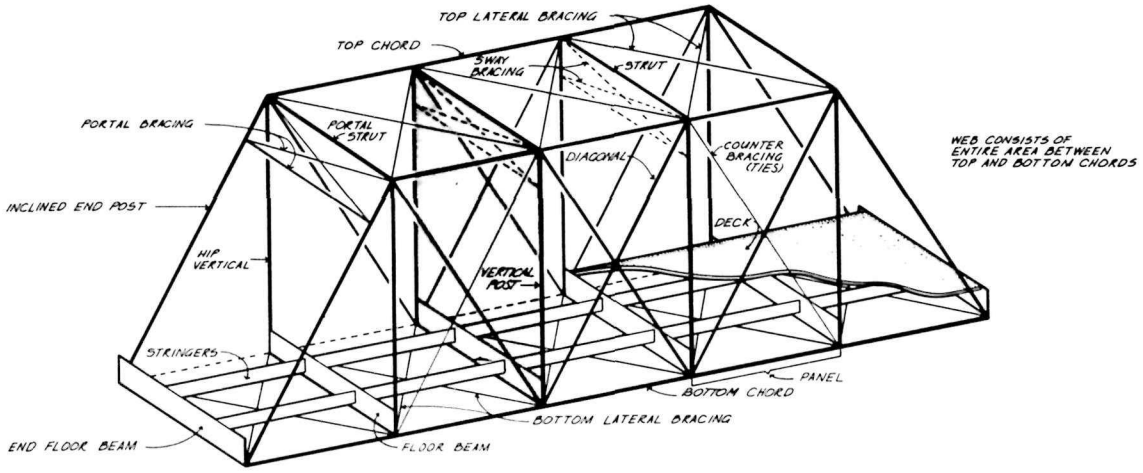
HISTORIC BRIDGES IN MONTANA

U.S. Department of the Interior
National Park Service



TRUSSES

A STUDY BY THE

HISTORIC AMERICAN ENGINEERING RECORD

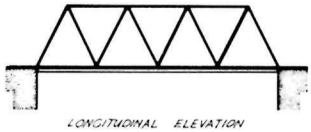
A TRUSS IS COMPOSED OF STRUCTURAL TRIANGLES JOINED TOGETHER WITH PINNED OR RIVETED CONNECTIONS. THE MAIN PIECES OR MEMBERS MAY BE EITHER STIFF HEAVY STRUTS, POSTS OR THIN FLEXIBLE BARS. IT IS THE ARRANGEMENT OF THESE MEMBERS THAT DETERMINES THE SPECIFIC TRUSS TYPE.

STRUCTURAL MEMBERS RESIST FORCES IN TWO PRIMARY WAYS — COMPRESSION AND TENSION. HEAVY RIGID MEMBERS MAY RESIST BOTH COMPRESSIVE AND TENSILE FORCES, BUT THIN RODS CAN ONLY RESIST TENSION AND THESE CHARACTERISTICS ARE MAJOR CLUES IN TRUSS IDENTIFICATION. NOTE THAT THE MAIN STRUCTURAL MEMBERS OF A TRUSS PANEL MAY BE SUPPLEMENTED BY THIN DIAGONAL TIES. BECAUSE TRUSS TYPES ARE DETERMINED BY THEIR MAIN STRUCTURAL MEMBERS, THESE COUNTER BRACES (INDICATED BY BROKEN LINES, ON THE IDENTIFICATION SHEET) MAY BE IGNORED. AFTER MATCHING THE STRUCTURAL OUTLINE OF THE TRUSS IN QUESTION WITH THE DIAGRAM IT MOST RESEMBLES, CHECK TO MAKE SURE THE ARRANGEMENT OF HEAVY COMPRESSION AND LIGHT TENSION MEMBERS IS COMPATIBLE WITH THE DIAGRAM. IF THERE IS AGREEMENT, THEN THE BASIC TRUSS TYPE IS IDENTIFIED.

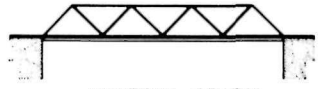
THE SHEET OF TRUSS DIAGRAMS PRESENTS ONLY THE STANDARD FORMS OF THE MOST COMMON TRUSSES. THERE ARE ALSO MANY "HYBRID" TRUSSES THAT DO NOT FALL INTO EASILY-DEFINED CATEGORIES. IN SUCH CASES IDENTIFICATION SHOULD BE MADE AS CLOSELY AS POSSIBLE IN TERMS OF THE STANDARD DESIGNS. ADDITIONALLY, TRUSSES OFTEN ARE INVERTED, CREATING OUTLINES QUITE DIFFERENT FROM THE ORIGINAL — TENSION MEMBERS BECOMING COMPRESSION MEMBERS AND VICE VERSA. BEFORE ASSUMING A TRUSS IS NOT REPRESENTED ON THE DIAGRAM, CHECK TO SEE IF IT IS AN INVERTED FORM.

MOST BRIDGE TRUSSES ARE OF THREE BASIC TYPES. IF THE DECK AND/OR RAILS ARE LEVEL WITH THE BOTTOM CHORDS, IT IS A THROUGH TRUSS. A PONY TRUSS IS A THROUGH TRUSS WITH NO LATERAL BRACING BETWEEN TOP CHORDS. A DECK TRUSS CARRIES ITS TRAFFIC LOAD LEVEL WITH THE TOP CHORDS.

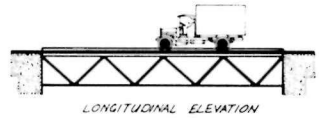
TRUSS BRIDGES



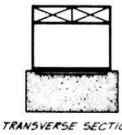
LONGITUDINAL ELEVATION



LONGITUDINAL ELEVATION



LONGITUDINAL ELEVATION



TRANSVERSE SECTION

THROUGH TRUSS

TRANSVERSE SECTION

PONY TRUSS

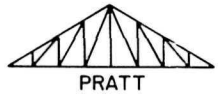
TRANSVERSE SECTION

DECK TRUSS

ROOF TRUSSES

FINK

THIS IS A VARIATION OF THE FINK TRUSS SHOWN IN THE BRIDGE DIAGRAM.



PRATT

DIAGONALS IN TENSION

SAWTOOTH

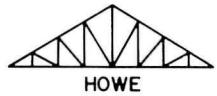
USUALLY USED TO ALLOW NATURAL LIGHTING OF LARGE FLOOR AREAS.

SCISSORS

USUALLY USED FOR LARGE VAULTED CEILINGS

BELGIAN

DIAGONALS PERPENDICULAR TO TOP CHORDS



HOWE

DIAGONALS IN COMPRESSION

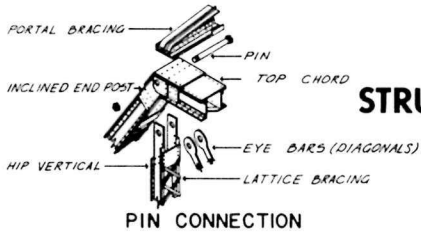
HOWE

DIAGONALS IN COMPRESSION

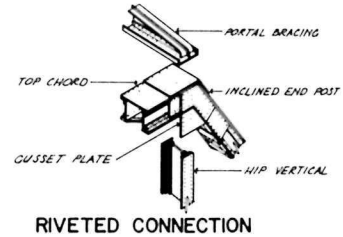
THREE-HINGED ARCH

USED FOR EXCEPTIONALLY LONG SPANS

STRUCTURAL CONNECTIONS



PIN CONNECTION



RIVETED CONNECTION

1ST PRINTING 1976. REVISED MAY 1976.

OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION
TECHNICAL INFORMATION PROJECT
UNDER DIRECTION OF THE NATIONAL PARK SERVICE, UNITED STATES DEPARTMENT OF THE INTERIOR

TRUSS IDENTIFICATION: NOMENCLATURE

RECORD NO. HAER TI-1

HISTORIC AMERICAN ENGINEERING RECORD
SHEET 1 OF 2 SHEETS

LIBRARY OF CONGRESS
HAER NUMBER

HISTORIC BRIDGES IN MONTANA

FREDRIC L. QUIVIK

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HISTORIC AMERICAN ENGINEERING RECORD
SPRING, 1982

U. S. DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE
Russell E. Dickenson, Director

HISTORIC AMERICAN ENGINEERING RECORD AND
HISTORIC AMERICAN BUILDINGS SURVEY DIVISION
Washington, D. C.
Robert Kapsch, Chief

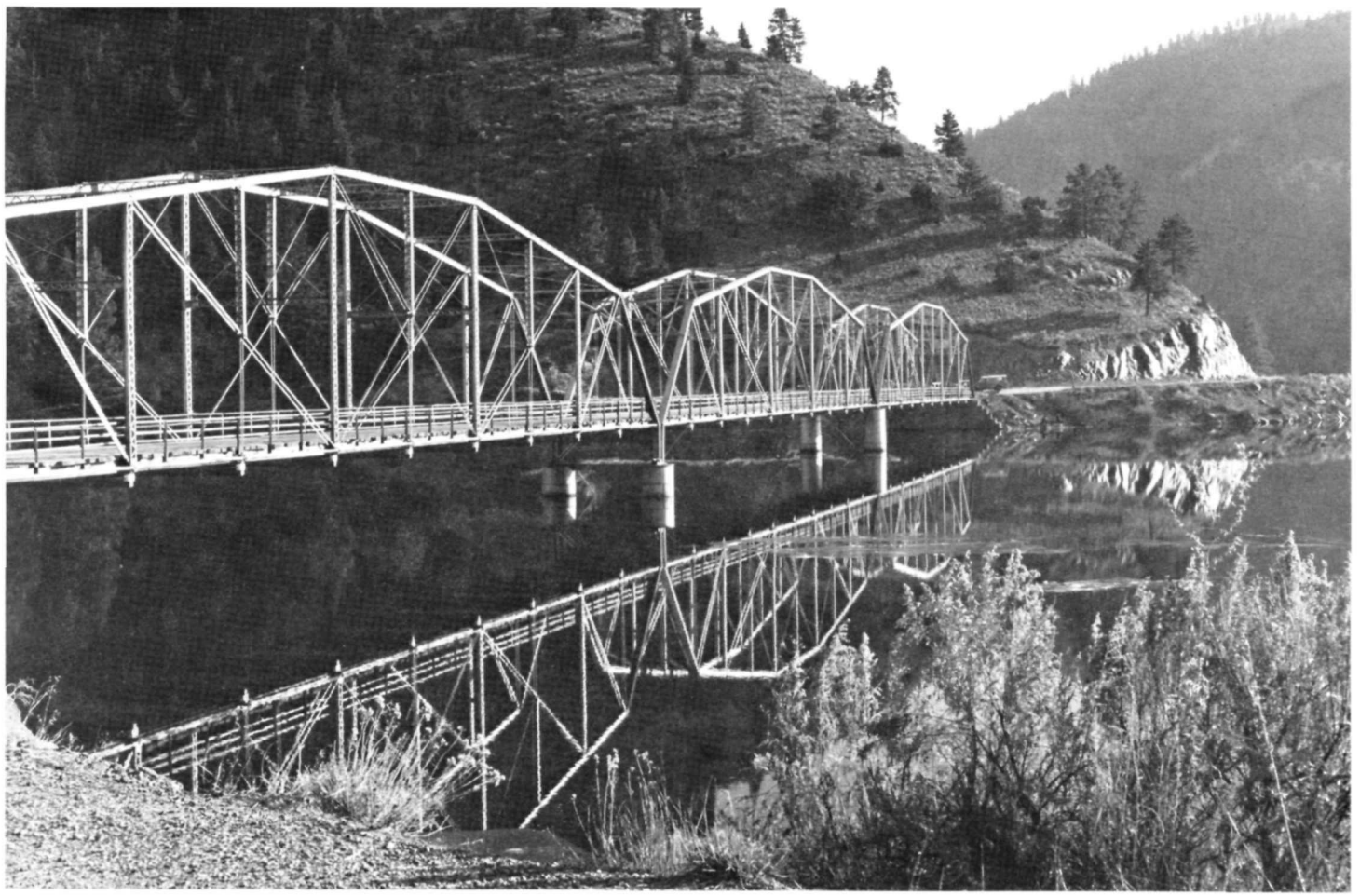
HISTORIC AMERICAN ENGINEERING RECORD
T. Allan Comp, Ph.D., Senior Historian
Donald C. Jackson, Staff Engineer
Fredric L. Quivik, Historian

ROCKY MOUNTAIN REGIONAL OFFICE
Denver, Colorado
Lorraine Mintzmeyer, Regional Director
Katherine H. Cole, Chief, Division of Cultural Resources
de Teel Patterson Tiller, Chief, Branch of Technical Assistance and Project Review
Gregory D. Kendrick, Elise Boyd, Theresa Lamb, Editors
Mary Patricia Kisling, Division Secretary

The inventory of historic bridges in Montana was co-sponsored by the Historic American Engineering Record, a division within the Office of Archeology and Historic Preservation of the National Park Service, the Montana Highway Department, and the Montana State Historic Preservation Office, Montana Historical Society. This report has been written in partial fulfillment of the terms of a Memorandum of Agreement between the National Park Service and the Montana State Highway Department.

HISTORIC AMERICAN ENGINEERING RECORD (HAER)

Staffed by engineers, architects, and historians, HAER conducts a nationwide program of documentation and publication projects which focus on historic engineering and industrial sites and structures. Highest priority is given to sites threatened by demolition. In many cases, this documentation, deposited in the Division of Prints and Photographs in the Library of Congress, may be the only lasting record of a site's existance.



In 1906, Lewis and Clark County Commissioners and officials of the Helena Power Transmission Company sponsored the construction of the York Bridge, a three-span, pin-connected Pennsylvania through truss over the Missouri River. (Photograph Travis Smith, Montana Highway Department).

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

There are many people who have helped to make the Montana Historic Bridge Inventory easier. Montanans at the local level have been very helpful. Several people at HAER have been helpful, particularly T. Allan Comp who got the project going. Grey Fitzsimmons did an excellent job inventorying bridges during the first three months of the project. Donald Jackson's consultation on bridges contributed greatly to this project. I wish to thank the Montana State Highway Department for its help, particularly Jack Walsh of the Maintenance Division and Paul Pourier of the Office of Planning and Research for their ready willingness to find and offer information. Finally, I owe the greatest thanks to my wife, Melinda Quivik, for her patience, for a magnificent job of preparing the inventory cards and for typing the drafts of this report.

Fred Quivik
Butte, Montana
1981

INTRODUCTION

This report is the result of the Montana Historic Bridge Inventory, a project of the Historic American Engineering Record, undertaken for the Montana State Highway Department in cooperation with the Montana State Historical Society.

The Montana Historic Bridge Inventory is to be used by the Highway Department as a planning tool when evaluating whether bridges in the state should be maintained or replaced. Rather than investigating the cultural significance of a particular bridge after plans had been made for that bridge, the Highway Department saw the benefit of assessing the significance of bridges within the state as a single thematic unit. Such an approach accomplishes three things: 1) it allows the significance of any one bridge to be more accurately evaluated in the context of the history of bridge building in Montana; 2) it is more cost-effective in the long run to inventory all bridges at once than to inventory them piecemeal; and, 3) it provides the Department with information at the outset of the planning process to help decide whether a given bridge should be preserved and maintained, or, if it must be replaced or altered, the inventory guides the planning for mitigation measures.

There are four basic parts to the Montana Historic Bridge Inventory. The first part was the actual field work. All bridges in the state over 20 feet in span and over 45 years of age were visited. Bridges included all vehicular bridges, both on and off the Federal Aid System, as well as significant privately owned bridges. (Included in the list of privately owned bridges are numerous railroad bridges). While the inventory is sponsored and will be used by the Highway Department for the planning of vehicular bridge projects it is important to include railroad bridges in the inventory so that a complete historical context can be created. The inventory includes only major railroad bridges (those bridges over 45 years of age and longer than 20 feet in span). Bridges were photographed on the site and field notes were made. These notes included a description of the structure as well an assessment of condition and contextural setting. Fieldwork also included historical research to determine dates of construction, builders, and other pertinent information. All of the field work culminated in the preparation of an Historic American Engineering Record (HAER) inventory card for each bridge. Approximately 500 cards were prepared.

The second portion of the project was the preparation of a final report (this publication) which is intended to provide a brief and general description of the history of bridge building in Montana from its beginning to the 1930's. Information in this final report comes from both primary sources uncovered during the field work and secondary sources pertaining to Montana's economic history which can be related to the history of bridges in Montana. This report is not meant to be the definitive work on bridges in Montana, but it is hoped that it has made some important connections between bridge building and its relationship to the economic, transportation, and technological history of Montana while indicating further questions which deserve more historical investigation.

The results of the field work and this final report were used to evaluate the significance of the various bridges, and they were divided into three categories of significance: Category I--the 24 most significant bridges in Montana; Category II--those bridges believed to be eligible for the National Register of Historic Places; and, Category III--those bridges which either are not eligible for the National Register or for which enough information was not gathered within the limited time of this inventory to make a determination of eligibility. This evaluation of bridges was presented to a Bridge Advisory Committee, made up of engineers, historians, and historic preservationists from around the state. The committee ratified the categorization of the various bridges. The Montana State Historic Preservation Office in

Helena will use the information gathered in the inventory to prepare a thematic nomination of 79 bridges (all Category I and II bridges) to the National Register.

The last portion of the project was the more detailed photo-documentation of the Category I bridges. HAER's photographer accompanied the project coordinator to each of the twenty bridges and, using a 4" x 5" view camera, carefully photographed each to show in detail how the structure and each of its components functions. Many of those photographs are reproduced in this publication. All of the photographs, as well as all the inventory cards, will be deposited at the Library of Congress. Copies of the photographs and inventory cards can be found at the Montana State Highway Department's Office of Planning and Research, the Montana State Historical Society, and the Denver Regional Office of the National Park Service.

HISTORY OF BRIDGES IN MONTANA

To study the building of bridges in Montana is to study the building of Montana. Within the patterns of bridge building across the state, one can discern the broad economic patterns which have formed across the state's history. The major theme of Montana history is economic: that of a resource-rich frontier far from the nation's main centers of economic activity. The variations on that theme are shaped by influences from those distant centers, by the physical nature of the territory, and by political responses to the economic and environmental forces. Among the remains of the interaction between economic and environmental forces are bridges.

Montana is a geographically large state covering 560 miles from east to west and 290 miles from north to south. The western third of the state is mountainous and rugged while the eastern two-thirds is open and arid. Because of its topography and climate, Montana was one of the last areas of the United States to be settled by Europeans. Prior to the European settlement, Montana was populated by Native American tribes, nomadic Plains Indians in the east who followed the buffalo and more sedentary tribes in the western mountain valleys. The first known European activity in Montana was that of French-Canadians who traded with the Indians along the upper Missouri during the 1790's; the major resource attracting traders at that time was furs. England, France and Spain had been vying for control of the interior of the North American continent and by the 1780's, the newly-formed United States joined in the struggle. The U. S. made a major step towards gaining control when, in 1803, Robert Livingston and James Monroe negotiated the purchase of the entire Lousiana Territory from Napoleon. The territory extended from New Orleans to the headwaters of the Missouri River.

Before the United States purchased the Louisiana Territory, westward expansion had brought settlers west of the Mississippi River and President Jefferson had planned and obtained Congressional approval for the famous Lewis and Clark Expedition. The objectives of the expedition were to look for a water route to the Pacific Coast, to contact the Indians for purposes of fur trade with Americans, and to explore the territory west of the Continental Divide for possible future acquisition. Lewis and Clark travelled up the Missouri River, the first major transportation thoroughfare into the Montana Territory during that period. Along the way they noted abundant wildlife and the upper Missouri was soon opened to extensive fur trade.

Fur trading posts, subsistence ranch operations, and a few missions were the only white settlements in Montana during the first two-thirds of the 19th Century as the westward expansion of the U. S. by-passed the Great Plains and the Rocky Mountains and moved to the West Coast. With the gold rush of the 1860's came Montana's first major surge in white settlement. From then until the end of the 1910's waves of people flooded the state to exploit newly-discovered resources. In the 1870's, eastern Montana was opened to the livestock industry. The 1880's saw the beginning of copper mining in Butte, an

area that was to become the greatest copper producer in the world by 1900. And around 1900, the homestead era began. This greatest of all the booms brought thousands of hopefuls to the arid plains of eastern Montana. Each of these exploitive endeavors required a transportation network to carry supplies into the territory and to carry the raw resources to eastern markets. These transportation networks in turn required bridges to provide reliable year-round crossing of Montana's rivers and streams.

EARLY TRANSPORTATION

During the first half of the 19th Century, fur trade was the major European economic activity in what was to become Montana. American, as well as Canadian, fur trading companies established trading posts (called forts) throughout the territory. The major transportation link to the east was the Missouri River and its tributaries. The first post built in Montana was completed in 1807 on the Yellowstone River at the mouth of the Big Horn River.[1] White trappers and traders used keelboats to carry supplies upstream to the forts and to carry the furs down to market. The fur trade flourished until the 1840's when a combination of decimated animal populations in Montana and a growing textile industry in the East led to decline in the fur business. Of the two dozen fur trading posts established in Montana, only Fort Benton was to last as a permanent settlement.[2]

The impact of the fur trade was significant, but not because it left permanent settlements in Montana. The traders explored and mapped the territory so that by the time of the gold rush, the territorial geography was known. The traders also established the Missouri River as a major transportation route and brought with them missionaries who established the first permanent settlements with farming. However, major settlement was not yet to occur in Montana, in part because of its reputation as the "Great American Desert."[3]

The Oregon Trail began carrying pioneers to the Northwest in the 1840's, but it went south of Montana. By the 1850's, even with the fur trade in decline, Montana found itself in the midst of an emerging transcontinental transportation network. In the early 1850's, the United States was considering a transcontinental railroad to the Pacific Coast. A southern, a central, and a northern route were the three possibilities considered. General Isaac Stevens, accompanied by a young Lieutenant John Mullan, was in command of the 1853 railroad survey of the northern route. After the central route was chosen (along the route of the present Union Pacific Railroad), Congress, in 1855, authorized the construction of a military road to connect the Missouri River from its head of navigation at Fort Benton to the Columbia River at Walla Walla, Washington. The road would thus allow the transport of people and goods from St. Louis to the Pacific Northwest. It would also allow the military to move more rapidly in response to Indian troubles. Lieutenant Mullan was put in charge of construction of the new road and was ready to begin in 1856, but conflicts with the Indians delayed the actual work until 1859. Construction progressed from west to east and the road was complete to Fort Benton, Montana by 1860.

Construction of the Mullan Road was no small task. Crossing the Bitterroot Range by climbing out of what is now Idaho along the Coeur d'Alene River and descending the east slope of the Bitterroots into present day Montana along the St. Regis River, the Mullan Road bridged the Coeur d'Alene River forty-two times and the St. Regis River forty-seven times. After the first season, all but four of those bridges were washed out.[4] The length of the road was 624 miles. Using only hand tools and horse-drawn equipment, Mullan and his crew were able to fashion a road thirty feet wide. The road included 120 miles through dense mountain forests and thirty miles of earth and rock excavation.[5] It is estimated that the Mullan Road carried 20,000 immigrants to the Washington Territory during its first four years of service.[6]

Lieutenant John Mullan standing beside one of his bridges under construction along the Mullan Road. This is a speculative painting by Montana artist Shorty Sharpe. (Montana State Highway Department).

Although the federal government built the Mullan Road, it did not appropriate much money for maintenance. After the bridges washed out, the Mullan Road would have been relegated to use as a pack trail were it not for entrepreneurs who repaired the bridges, maintained the road, and charged tolls for their efforts.[7] Thus, an early pattern was set for transportation in Montana, and tolls were collected for roads, bridges and ferries throughout the territory for years to come.

The Mullan Road brought another transportation form into prominence in Montana. The Missouri River had already been established as the major link to the east, but not until 1859 and the Mullan Road did the first steamboat, the Chippewa, travel past Fort Union, at the confluence of the Missouri and the Yellowstone Rivers in the Dakota Territory, to Fort Benton. From that point until the beginning of the railroad era in Montana, Fort Benton was the major commercial center and transportation hub in the Territory.

Fort Benton became the headquarters of the first major shipping and

mercantile businesses in the Montana Territory with peaks of 39 dockings in 1867, and 47 in 1879.[8] Between 1860 and 1865 there were between two and eight steamboat landings at Fort Benton per year. Then with the gold rush in southwestern Montana in the mid-sixties, Fort Benton boomed. The boom continued through the 1870's as Fort Benton channeled supplies to newly established Canadian Mounted Police outposts and to recently created Indian Reservations to the north. But by 1880, the Northern Pacific Railroad had reached central North Dakota and a branch line from the Union Pacific in Utah had entered southwestern Montana. Except for an innovative burst of activity with the construction of the Fort Benton Bridge (Description 14) in 1888 and minor local river boat traffic after 1880, Fort Benton was to become a minor city in Montana.[9]

The last important pre-gold rush transportation link between Montana and "civilization" was the freight road connecting Fort Hall, Utah with southwestern Montana. The route was established in the early 1850's by a Mexican trapper named Emanuel Martin.[10] The route became important with the gold discoveries in southwestern Montana in the 1860's, and with the completion of the transcontinental railroad in 1869, it experienced heavy freight and passenger traffic. Therefore, it follows that the first railroad to enter Montana came from the south, not the east, generally along the route of this Utah-Montana connection.

TRAVEL DURING THE GOLD RUSH DAYS

When prospectors drifted into Montana Territory and discovered gold in Beaverhead Valley on Grasshopper Creek in July of 1862, the rush was on.[11] The town of Bannack was formed and miners flooded into Grasshopper Creek. Exploring the nearby valleys, prospectors found gold in Alder Gulch of the Ruby Valley in May of 1863 and Virginia City was formed. Although the rush to Montana did not equal the magnitude of the rush to California in 1849 or to Colorado in 1859, it was still larger than the existing transportation networks could supply. In 1862 there were less than 1,000 non-Indian persons in Montana.[12] By the end of that year there were perhaps 500 persons in Bannack alone.[13] By 1866 there was a peak gold rush population of 28,000 in Montana, and Montana was only second to California in gold production in the U. S.[14]

The major link to Bannack and Virginia City was the freight road from Utah, now terminating at Corinne rather than Fort Hall. Corinne was a non-Mormon town and identified more closely with the Montana frontier than with Utah.[15] The freight wagons were pulled by oxen and were slow. Consequently, prices were very high in Montana. Because the condition of the road depended on the weather, prices sometimes sky-rocketed, as they did during the winter of 1863-64. Heavy snows caused a shortage of flour in the mining camps and led to the "Bread Riots" in Virginia City. Adding to the costs of freight were the numerous tolls collected along the way.[16]

In July of 1865 gold was discovered in Last Chance Gulch and the town of Helena sprang up. Helena was near the route of the Mullan Road, and the link between the gold fields and Fort Benton was made. From that point until the railroads arrived, the Missouri River was the greatest route of supply to the gold fields and the main shipping point for production from the gold fields.[17] The resulting transportation network gave rise to Helena as a major commercial center so that after gold played out in Last Chance Gulch, Helena was able to continue as a major town in Montana and eventually grew to become the capitol of the Territory.

After 1866, gold production began to taper off in Montana, but the gold rush left a scattering of permanent communities, the beginnings of an agricultural base, and a network of roads throughout southwestern Montana. The road from Corinne forked in Montana with one fork serving Bannack and continuing on to the Big Hole, Deer Lodge, and Bitterroot Valleys. The other fork served Virginia City and went on to Helena and the Mullan Road with another fork heading into the Gallatin Valley. Each of these major roads had smaller branches serving

the smaller mining camps.[18]

The early network of roads left in Montana by the gold rush yielded some of the first permanent bridge sites. These early Montana bridges were built and maintained by local entrepreneurs who charged tolls. Many of the road routes and bridges have since been abandoned, but other bridge crossings, such as Browne's Bridge (Decription 1), remain in use to this date. However, the original structures have long since been replaced.

BEGINNINGS OF PERMANENT SETTLEMENTS

In 1864, Congress divided the Idaho Territory into two parts, thus creating the Montana Territory. Governor Sidney Edgerton, in his first address to the new Territorial Legislature, stressed the need for improved roads. The only action relating to roads taken by the Legislature during that session, however, was to license thirty-five bridge, ferry, and wagon road toll companies.[19] In the 1866 Legislature, the only road-related action taken was to request that Congress appropriate money to improve the Mullan Road.[20]

In 1869, the Montana Legislature finally began the serious consideration of transportation in the Territory. The Legislature empowered the counties to set up road districts with road supervisors to care for them. The same Legislature authorized county commissioners to levy special taxes for bridge building. Finally, in response to the public outcry against the exorbitant costs of tolls, the Legislature rejected several toll road and bridge franchises and prohibited the collecting of tolls on the Mullan Road, from Fort Benton to the Idaho line.[21] However, not until 1877 did the government begin to make serious improvements on the road.[22]

The advent of quartz mining for silver and gold in Montana had a great impact on the development of the Territory, bringing modern institutions and technologies. Individual miners had been able to extract gold from the stream beds of southwestern Montana. Quartz mining required organized companies to dig the ore, operate stamp mills, raise capital and coordinate all of those various activities. So the quartz miners brought with them people with new skills such as bookkeepers, lawyers, promoters and technicians. They helped establish banks. They established the timber industry in Montana to provide mine timbers.[23] Finally, quartz mining required improved transportation to ship the required equipment to the mines and mills and to ship ore to the mills.

Some of the first quartz silver operators were local miners who had grown rich and powerful on Montana gold. But in almost all cases they required assistance from the East. The remoteness of Montana was the biggest problem facing quartz miners. There were no skilled hands to operate the mines and mills. The railroads were still far away and so were the ore processing facilities. Nevertheless, even during the years around 1873, equipment was being shipped up river to Fort Benton and ore was being shipped from the mines to Fort Benton and Corinne and from there to smelters in California, Germany and Wales. Rich resources caused the railroads to look to Montana with increasing interest. The Northern Pacific began its push to the West from Minnesota in 1870, and, in 1871, the Utah Northern was formed to build a branch from Utah north to Montana. However, both projects were delayed by the Panic of 1873. Montana businessmen tried to get the Legislature to offer subsidies to the railroads to speed their arrival, but the lure of resources was enough that the railroad soon arrived and no local subsidies were ever granted.[24]

Following the Panic of 1873, silver mining activity began to increase in Montana. The most important new mining center was Butte. Butte had been a placer camp in the mid-60's and then died until William Farlin began mining and milling silver in 1876. When Farlin failed to make payments on his loan, W. A. Clark, a Deer Lodge, Montana banker

took over. That same year, Marcus Daly came to Butte to examine the silver prospects for the Walker Brothers, Salt Lake City bankers. He recommended they buy into the action. He managed their first operation in Butte. Clark and Daly were to become the two most prominent of Butte's Copper Kings in the not-to-distant future.

Besides Butte, there were some other major silver districts in Montana. By the late 1870's, the Philipsburg area was again prospering. At Marysville, north of Helena, Thomas Cruse discovered and built his famous Drumlummon Mine and mill, one of the richest single gold and silver mines in Montana. Between Butte and Helena, Anton Holter developed rich silver deposits at Elkhorn, and the smelter at Wickes, controlled by Sam Hauser, processed ore from mines as distant as Coeur d'Alene, Idaho. All of the major silver activity was focused in southwestern Montana, although there were some smaller fields in the Little Belt and Castle Mountains in central Montana.

In addition to equipment, all of these mining centers needed food. The first mining camps in the 1860's got their food from Mormon farmers in Utah, but transporation made it expensive. Some miners turned to farming instead and soon the valleys of southwestern Montana were producing vegetables, grains, meat and metal. By 1870, enough wheat was produced in Montana that flour was no longer imported.[25] Although farming was spread across southwestern Montana, the Gallatin River Valley was the most productive and Bozeman became its center. Other important farming areas were the Madison, Jefferson, Prickly Pear, and Deer Lodge Valleys. By 1870, there were 851 farms in Montana and 84,674 acres of improved farmland.

After the initial growth in farming, Montana did not experience another farming boom until the great land rush beginning in 1900. There were two reasons for the delay: population growth slowed after the gold rush ended, so local demand was not great, and even with the railroad, Montana was too far from markets to profitably ship much of its production. There was some growth in farming, however. Irrigation opened new areas and the railroads did export some production. Farming moved beyond southwestern Montana to the Smith, Sun, Yellowstone, and Judith River Valleys. The 5,603 farms in Montana in 1890 can hardly be called a boom from the 1870's if one considers the vast acreage available.[26]

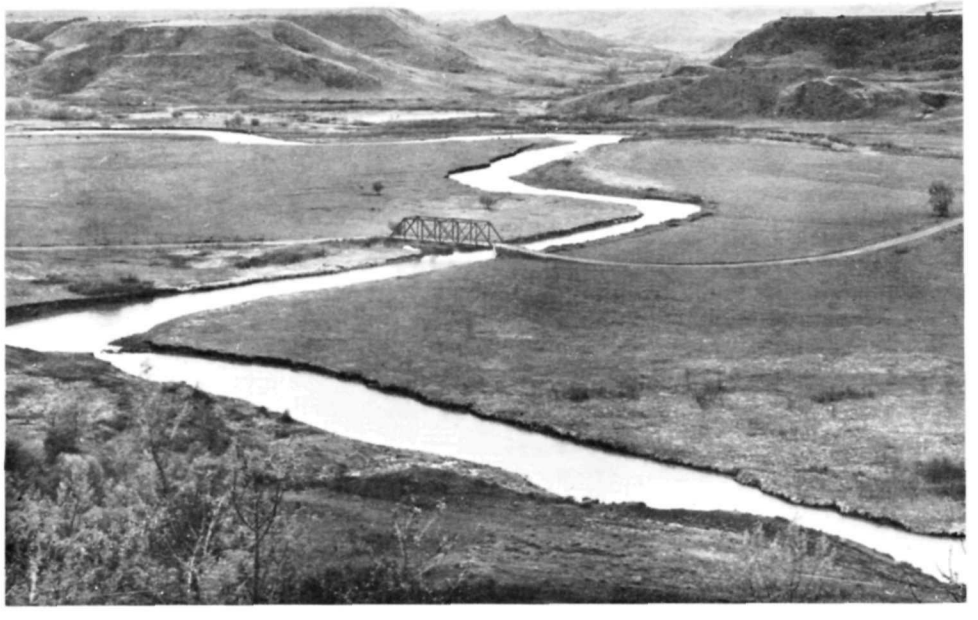
However, not all agriculture was stagnating in Montana during the '70's and 80's. During those years the livestock industry in Montana boomed. Some cattle were already being raised around the trading posts and missions in 1862 when the gold rush began, so these early cattlemen were able to expand their herds to respond to the demand for beef. By 1866 grazing had expanded out of the southwestern Montana valleys and by 1868 the first cattle drive left the Territory for sale to the Union Pacific construction crews in Wyoming. In the early 1870's, there were drives into Canada to supply beef to the Canadian Pacific crews. In the late 1870's, drives to the Dakotas fed mining camps in the Black Hills or met the Northern Pacific rail head at Bismarck for shipment east.[27] By this time there were also drives into Wyoming for shipment along the Union Pacific.

The combination of expanded production and competition from farmers in the southwestern Montana valleys soon forced the cattlemen into central Montana. By the early 1870's, cattle were grazing on the open range along the Sun River. By 1880 they had moved into the Smith, Judith and Musselshell River Valleys. These herds had been moved out of western Montana and were owned by Montana operators, some of whom, like Con Kohrs and John Bielenburg of the Deer Lodge Valley, had become rich selling beef to mining camps. Others, such as Granville Stuart, Samuel Hauser, and Thomas Cruse, had made it rich in mining and diversified into cattle. These herds were comprised of cows, calves, and steers, and the operators grazed their stock on Montana range from the time they were born until they were ready for market.[28]

In about 1870 the "Great Buffalo

Hunt" began. By 1884 an estimated thirteen million bison had been wiped from the Great Plains, eliminating the source of life of the Plains Indians. The void created in southeastern Montana was filled by a different kind of cattle herd than those grazing in central Montana. Herds of steers were driven into Montana from Nebraska and Texas to be fattened on the nutritious plains grasses and then shipped to market. Unlike the central Montana herds, these cattle were owned by capitalists from as far away as New Hampshire and Europe.[29] The boom continued until the winter of 1886-87 when a combination of over-grazing, drought, and brutal spring storms killed as many as 60% of the cattle in the Territory. After that, the practice of turning cattle loose on the open range in winter was replaced by providing winter shelter and hay. The boom was over, and the cattle industry stabilized.

Sheep raising, started after the cattle industry, boomed to greater numbers and was not hurt by the winter of 1886-87. By 1900, sheep outnumbered cattle 6 to 1 with Billings as the state's main shipping point.[30] Like many large Montana business endeavors, the sheep industry remained colonial in essence with raw materials such as wool shipped east for processing into finished products. The state tried offering incentives to Montananas to start a woolen mill, but high freight and labor costs killed the one attempt in Big Timber.[31]



The boom in bridge building that accompanied the county splitting of the Homestead Era left many steel truss bridges in remote places such as the Deerfield Bridge over the Judith River. (Photograph Jet Lowe).

When the railroads arrived in Montana (the Union Pacific was completed to Butte in 1881 and the transcontinental Northern Pacific linked at Gold Creek in 1883), southwestern Montana was established as a network of permanent settlements with inter-connecting transportation and communication links. The rest of the state, with the exception of Fort Benton, was still largely unsettled and unconnected. By 1900 and the dawn of the great homestead boom in Montana, settlement had pushed into northwestern Montana where lumbering, dairying and fruit growing were important. In central Montana livestock and grains were the economic

base, and on the Northern Pacific corridor along the Yellowstone River livestock became the main industry.

Southwestern Montana was first served by a network of toll roads, bridges and ferries which connected it to Corinne and the Mullan Road. The links were travelled by individuals as well as freight companies and stage lines. A. J. Oliver established the first stage company in the fall of 1863, linking Virginia City and Salt Lake City.[32] The dominant freighting company in southwestern Montana, the Diamond R Freighting Company managed by C. A. Broadwater, was formed in Virginia City in 1864. Soon Broadwater's company owned 300 wagons, 350 mules, and 1,000 oxen and moved its headquarters to Helena.[33]

When the gold fields first opened, there was no U. S. Postal Service to Montana. The freight and stage companies carried letters and newspapers, charging one dollar per document. By late 1864, the U. S. had established mail service to Montana.[34] The subsidies gained from contracts to carry the mail played a significant role in competition among the freight and stage companies. By 1866, Wells Fargo entered the Montana market and gained some mail contracts. Even with the subsidies, travel was expensive. In 1866, Wells Fargo charged $145.00 for a trip from Helena to Corinne, a 550-mile, 4 1/2-day trip.[35] Communications were improved when the Union Pacific reached Utah. In November of 1866, a telegraph line was completed from Corinne to Virginia City. By October of 1867 it had reached Helena.[36] Nevertheless, it still took a long time for news to travel. For example, the Custer battle on the Little Big Horn took place on June 25, 1876, but news of it did not reach Missoula until July. Missoula residents found it interesting that Indians in the area already knew about the battle when word arrived by telegraph.[37]

Missoula was not an area of major mining activity, but it did get an early start as a permanent settlement, largely due to its position along the Mullan Road. Situated near the confluence of the Blackfoot, Bitterroot and Clark Fork Rivers, Missoula had a saw mill by the winter of 1864-65. In 1865 a grist mill was built.[38] From that point onward, Missoula was the site of significant lumber and mercantile activity. Even though there were only some 2,500 people in Missoula County (with a much larger area than today's Missoula County) in 1870, accounts from local newspapers and county commissioners minutes indicate lots of ferry and bridge building activity around early Misoula. Problems faced included frequent bridge wash-outs due to high water and primitive structures, and also unscrupulous toll collectors.[39]

The Gallatin Valley was perhaps the most important agricultural center in early Montana. By 1886 it had fourteen saw mills and five flour mills.[40] Bozeman was the major town in the Gallatin Valley and like Helena, had grown to prominence long before the Northern Pacific arrived in 1883. Since most of the mining camps were west of the Gallatin Valley, and since a great deal of the Valley was in proximity to the headwaters of the Missouri River (the Gallatin, Madison and Jefferson Rivers come together at Three Forks to form the Missouri), many roads and bridges had to be built in the Gallatin Valley to get agricultural produce from farm to town and from town to mining camp.

The Three Forks area was well known for its bridges. James Shedd built a series of bridges over the rivers and streams in the Three Forks area in 1871. He later built the Shedd's Bridge over the West Gallatin River west of Bozeman and a bridge on that site still bears his name today. By the mid-1880's, there were said to be twenty-three bridges in the Three Forks area, some over rivers and streams, some over swamps, and all intended to make travel more direct and reliable.[41] Many were probably still in private hands, as evidenced by the March, 1880, refusal by the Gallatin County Commissioners to buy the Nixon (Description 26) and Bartoe Bridges.[42]

Numerous other bridges today still claim the names they held during the years of early settlement. An example is the Parson's Bridge

Parson's Bridge over the Jefferson River was, in 1866, a prominent southwest Montana landmark during early settlement. It is typical of the bridges built by local bridge builders. Note that the middle floor beam is supported by a tensile member suspended from the upper chord which acts as a beam. (Montana State Historical Society).

over the Jefferson River between Madison and Jefferson Counties. The bridge that exists today probably bears little resemblance to the Parson's Bridge used by the Territorial Legislature in 1869 as part of the boundary description of the newly-formed Madison County.[43]

Virginia City was--and is--the county seat of Madison County but because it, like most other mining camps, is in higher country, it did not see much bridge activity. Greater Madison County bridge activity occurred in the Madison and Jefferson Valleys. A good example of the many bridges built in the valleys is in the town of Twin Bridges, formed in about 1873 and named for the two bridges which cross the Big Hole and Beaverhead Rivers where they come together to form the Jefferson. The early bridges at Twin Bridges were probably wooden structures built and owned locally. By 1886, Madison County was contracting with the King Bridge Company of Cleveland, Ohio, to replace the one over the Beaverhead.[44] Yet, in June of 1887, the county commissioners refused to buy one of the Pennington Lane Bridges.[45] The county commissioners' minutes from the late 19th Century show a recurring pattern of counties agreeing to buy some bridges, refusing to buy others. Eventually, of course, all highway bridges in Montana came into public hands.

Besides the problem of buying private bridges, counties also experienced problems agreeing to build bridges over rivers that formed their boundaries. An example of this is the dispute between Jefferson and Meagher Counties. When the Northern Pacific was completed through the Territory in 1883, it travelled down the Missouri River from Three Forks through Townsend to Helena, crossing the river near Townsend. The residents of Townsend and the farmers and ranchers of Meagher County thought it would be convenient to have a vehicular bridge across the river near Townsend as well, and asked Jefferson County to share in the cost. Since Jefferson County was on the Helena side of the river and had no reason to want to get to Meagher County, residents saw no reason to build the bridge across the Missouri.[46]

Counties often agreed, however, and many examples were recorded in county commissioners' minutes of the cost of bridges being shared. Another approach to the problem was worked out between Fergus and Yellowstone Counties at the Musselshell River boundary. With the coming of the Northern Pacific, Billings became a major shipping point for agricultural production. At about the same time, the Judith River Basin in Fergus County was opening up as one of the most productive agricultural areas in the Territory. Fergus County wanted to get its products to market, and Billings, in Yellowstone County, wanted the trade. The major barrier between the two was the Musselshell River. Two roads ran between the Judith River Basin and Billings, so Fergus County maintained the bridge (Description 34) at the crossing at Lavina[47] while Yellowstone maintained the bridge (Description 54) at Roundup.[48]

These early bridges were relatively primitive structures built by local individuals. Often they were log stringer spans or, in some cases, multi-span king-post truss bridges like Browne's Bridge (Description 1) over the Big Hole River.[49] With the railroads came more sophisticated truss designs and, as in the case of the bridge at Twin Bridges, the out-of-state bridge building companies. Yet, in the 1880's, wooden Howe truss spans, such as that built over the Musselshell at Roundup, were still being built by what appear to be local individuals and contractors.[50] It must be remembered that, for many years after the railroads arrived, all work at the bridge site, including both assembly and excavation, had to be done by either human or animal power.

The two largest rivers in Montana, the Yellowstone and the Missouri, were not bridged until quite late, except, of course, by railroad bridges. The first bridge over the Yellowstone was built in 1871 near the present town of Gardiner, at the Yellowstone's headwaters. Numerous bridges were built over the upper Yellowstone (above Livingston) in the 19th Century, but not until 1893 was a bridge built over the

The Higgins Avenue Bridge in Missoula, built by O. E. Peppard in 1890's was washed out in the Flood of 1908. Two of the spans were salvaged and moved upstream to Van Buren Street (Description 53) where they stand today. (Stereoscopic photographs in possession of Ray Calkins, President, Butte Historical Society).

The 1895 Yellowstone River Bridge at Glendive (Description 20) was built by the King Bridge Company of Cleveland Ohio and included a swing span. (Montana State Historical Society).

lower Yellowstone (at Columbus). In 1894 a bridge was built at Billings, and in 1895 a bridge was built at Glendive (Description 20).[51] Ferries did exist at various points along the Yellowstone, however.

The first vehicular bridge (Description 14) over the Missouri River was built at Fort Benton in 1888.[52] As we shall see later, its early date of construction was due to some special circumstances in Fort Benton. Bridges were built on the upper Missouri (near Great Falls and Helena) at later dates, but another vehicular bridge was not built in Montana below Fort Benton until the 1930 Wolf Point Bridge (Description 66). Until that time, the more than 350 miles of the Missouri River between Fort Benton and Williston, North Dakota could only be crossed by ferry.[53]

The first ferry known to operate at Fort Benton was built and operated by Ed Smith in 1875.[54] While Fort Benton was such a busy port prior to then, there was no earlier demand for ferries because all points served by overland freight were west of Fort Benton. The Fisk Road, which came from the east, travelled along the north side of the river, and the Judith River Basin of central Montana did not open up to livestock until the mid-1870's. Ferries on the Missouri have continued to serve a valuable transportation function into the 20th Century. Today, five free public ferries still ply the waters of the "Mighty Mo;" one at Carter and four along the 150 mile stretch between Fort Benton and McClelland.

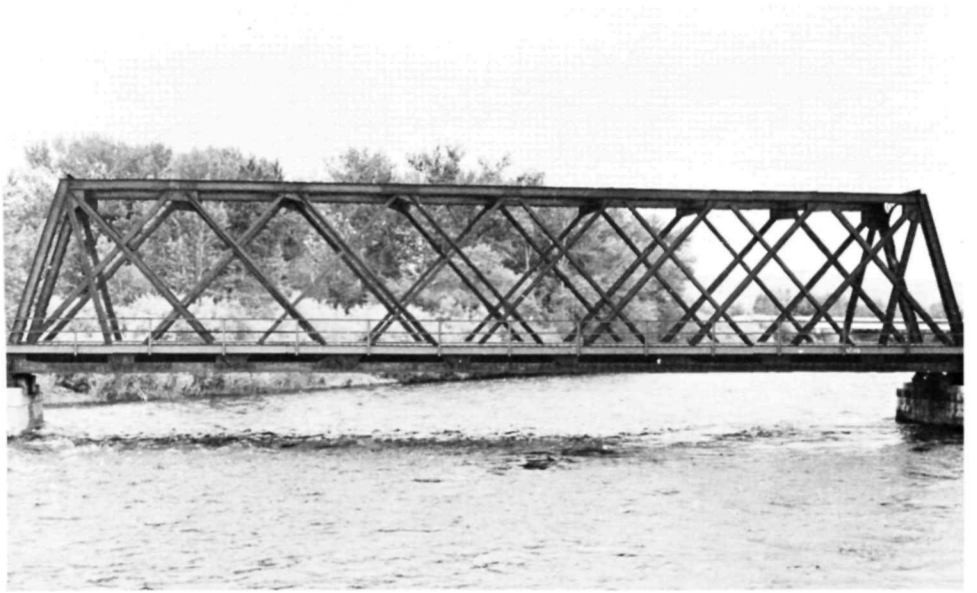
THE COMING OF THE RAILROADS

Notions of a transcontinental railroad across Montana go back at least as far as the 1853 Railroad Survey by General Stevens. The central route, south of Montana, was chosen in 1861 and completed as the Union Pacific/Central Pacific line in 1869, linking Omaha and Sacramento. In 1864, pressure from northern tier states and territories led Congress to charter another railroad, the

Northern Pacific, to link Lake Superior to the Pacific Northwest. Unlike the U.P./C.P., which received federal loans, the N.P. was subsidized by the largest railroad land grant in U.S. history. Granted in a checkerboard pattern along the right-of-way, seventeen million acres of Montana land ended up in Northern Pacific hands.

Construction on the Northern Pacific did not begin in Minnesota until 1870 and stalled in central North Dakota as a result of the Panic of 1873. By that time the placer boom was over in Montana but quartz miners and agricultural producers in Montana were anxious to get their products to market more efficiently. In 1871, the Utah Northern had been formed to link the Union Pacific at Corinne to the southwestern Montana mining fields. The competition was on between the Northern Pacific and the Union Pacific to get to Montana first. Many Montanans responded by advocating subsidies to spur them. No local subsidies were ever granted, but the lure of resources brought the railroads as rapidly as financing would allow. The Union Pacific won the race, crossing the Montana border in 1880 and reaching Butte in December of 1881.

By the time it reached Montana, the Utah Northern had been completely taken over by the Union Pacific and renamed the Utah and Northern. The town of Dillon, Montana, a major depot between the Idaho line and Butte, was named for Sidney Dillon of the Union Pacific and new president of the Utah and Northern. The first line into Montana was narrow gauge. It was replaced by standard gauge track in 1887.[55] Between the border and Butte, the line made numerous creek crossings and several small river crossings. These were undoubtedly bridged by wooden structures in the early years. The present major structures include a plate girder structure over the Red Rock River, a plate girder structure over the Beaverhead River near Dillon, a triple-intersection Warren through truss span over the Beaverhead south of Dillon, and a triple-intersection



The Union Pacific bridge (Description 2) over the Big Hole River near Glen was built in 1901 by the American Bridge Company. It and two other Union Pacific bridges built elsewhere in Beaverhead County in 1902 are the only triple intersection Warren trusses in Montana. (Photgraph Fred Quivik).

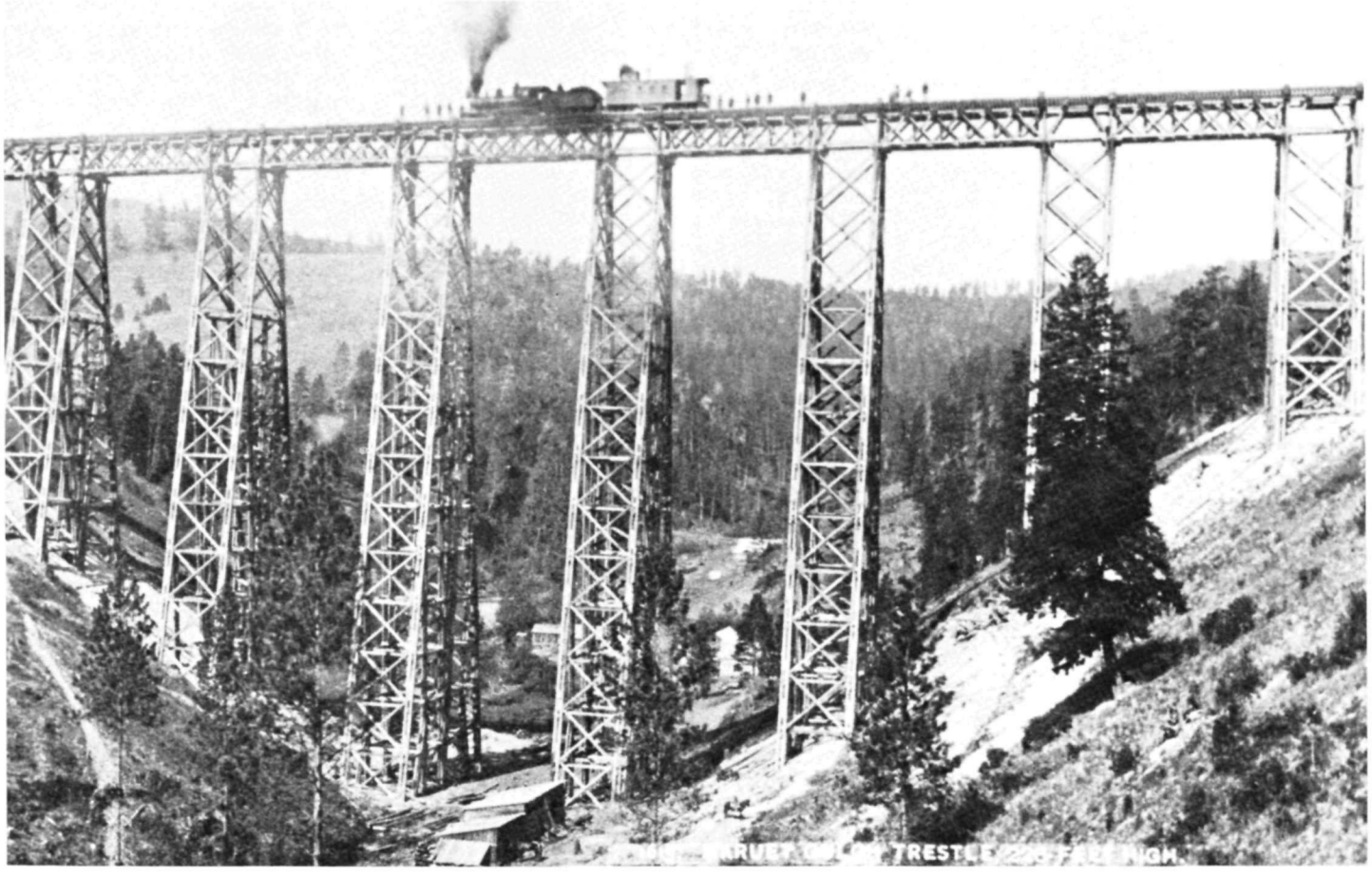
Warren through truss and plate girder structure over the Big Hole River (Description 2). A third triple intersection Warren through truss span was removed from the Red Rock River during construction of the Clark Canyon Dam. It was sold to Anaconda Company in 1963 and is being used in Butte. The Warren trusses were built for the Union Pacific by the American Bridge Company in 1901 and 1902.[56]

By 1881, the Northern Pacific recovered from its financial difficulties and was building along the Yellowstone River in eastern Montana and the Clark Fork River in western Montana. In September of 1883, the last spike of the transcontinental Northern Pacific was driven at Gold Creek near the site of the first discovery of gold in Montana. Crossing the entire length of the state, the Northern Pacific encountered more construction challenges than did the Utah and Northern. Along the original Northern Pacific line there were only wooden bridges in Montana. The Bismarck Bridge over the Missouri River to the east and the Ainsworth Bridge over the Snake River to the west were built on stone piers and had iron super-structures. In Montana, the Northern Pacific crossed the Yellowstone three times, the Missouri once, and the Clark Fork three times, all with wooden Howe truss bridges.[57] Also worthy of note were the Bozeman Tunnel (3,650 feet long) at the top of Bozeman Pass and the Mullan Tunnel (3,850 feet long) at the top of the Continental Divide.[58] One of the most important branch lines of the Northern Pacific left the main line at Livingston to serve America's first national park, Yellowstone National Park.

The railroads and the Butte mines provided the foundation for the timber industry in Montana. E. L. Bonner, R. A. Eddy, and A. B. Hammond built numerous sawmills near Missoula to supply the Northern Pacific with ties and bridge timbers. In 1882 they established the Montana Improvement Company which obtained a twenty year contract to supply the Northern Pacific with all the lumber it needed between Miles City, Montana and Walla Walla, Washington. The Northern Pacific owned half the stock in the Montana Improvement Company. Marcus Daly, Butte Copper King, was one of the original incorporators.[59] Daly's Anaconda Company and the Northern Pacific were, by 1917, to control 80% of the timber industry in Montana.[60]

One of the sawmills built by Bonner, Eddy and Hammond was constructed in O'Keefe Canyon, northwest of Missoula, solely for the purpose of supplying lumber for the Marent Trestle (Description 51).[61] Built in 1883, it was perhaps the most spectacular structure along the Northern Pacific line in Montana. Standing 226 feet tall at its highest point and 866 feet long, it was also a great construction feat. Construction was temporarily slowed when the carpenters went on strike just before the trestle towers were completed. Because the striking carpenters were accustomed to the great heights and the strike-breakers were not, and refused to work on the towers, the railroad yielded to the strikers demands.[62] When completed, the structure featured eight wooden towers with wooden Howe trusses spanning between them. It was replaced by an iron trestle in 1885. The present steel structure, built for the Northern Pacific by the American Bridge Company in 1927 is one of the most spectacular structures in Montana.[63]

The Utah and Northern (Union Pacific) terminus was at Butte. The Northern Pacific did not pass through Butte, but rather through Helena and north of Butte. To link the two railroads, they jointly owned and constructed the Montana Union which ran from Butte to Garrison north of Deer Lodge. The collusion that led to the Montana Union also led to high freight shipping charges to Montanans. Not until J. J. Hill brought his Great Northern Railroad into Montana did competition bring shipping rates down.[64] Except for an early land grant in Minnesota, Hill enjoyed none of the government subsidies of the Northern Pacific and the Union Pacific. Yet he was able to build a transcontinental across northern Montana with a major branch past Fort Benton to Helena and Butte. He had been lured into the area by a friend; Fort Benton sheepman, Paris Gibson. With Hill's help, Gibson



The 1883 wooden trestle at Marent Gulch near Missoula was the most spectacular structure of the new Northern Pacific transcontinental line across Montana. (Minnesota State Historical Society Archives).

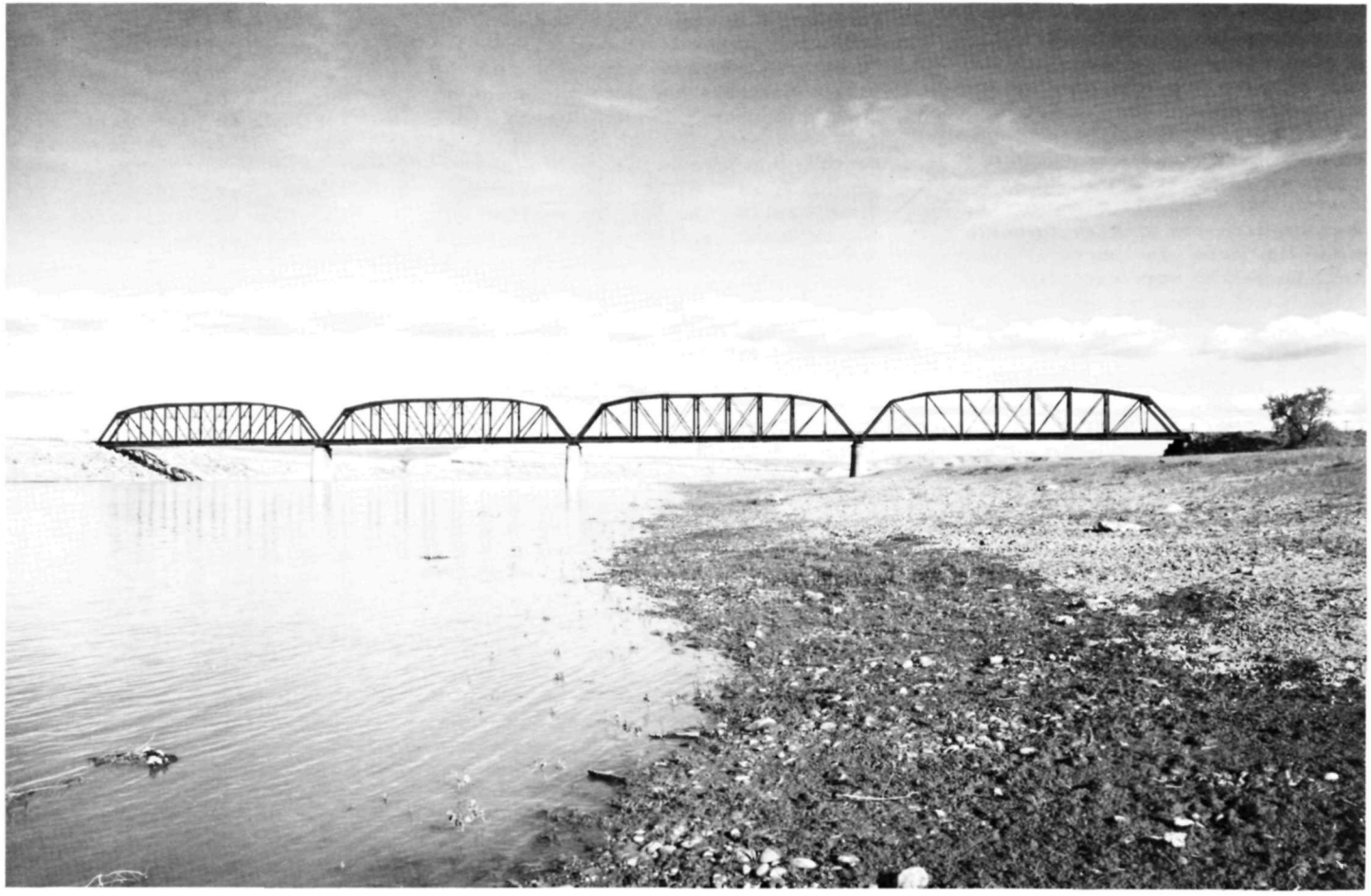
developed a new town in 1884 at the Great Falls of the Missouri to exploit the hydropower potential of the falls and the nearby coal fields. Hill also financed Helena freighting entrepreneur, C. A. Broadwater, to build the Montana Central Railroad between Butte, Helena and Great Falls, in 1886. After great difficulty, Hill finally gained congressional approval in 1887 to build his line across the vast Indian Reservation which then ran all along northern Montana from the Rockies to North Dakota. As soon as approval was granted, he set to work extending his line westward, and between May and October constructed 550 miles of track between Minot, North Dakota and Great Falls--an average of 3 1/4 miles per day.[65] In 1889, the Montana Central was complete to Butte. Butte ore could be shipped directly to Lake Superior. The Northern Pacific cut its Helena-to-St. Paul freight rates by one-third.[66]

Almost immediately, Hill set to work completing his line to the West Coast. In 1889 his location engineer, John F. Stevens, re-discovered Marias Pass over the Continental Divide. The discovery allowed Hill to proceed due west from Havre (from where his Great Falls, Helena, Butte branch left the mainline) and over the Continental Divide through what turned out to be the easiest route over the Northern Rockies. Marias Pass has an altitude of only 5,200 feet and offers a westbound grade of only one percent with an eastbound grade of 1.8 percent.[67] The Great Northern reached the Pacific Coast in 1893. The building of the Great Northern had a great impact on the further development of Montana. In 1892 the Sand Coulee coal mines near Great Falls were producing for the Great Northern and were the greatest coal producers in Montana. In 1892-94 the Boston and Montana Company of Butte developed the hydroelectric potential at Black Eagle Falls near Great Falls, built its smelter and electrolytic refinery at Black Eagle and began shipping ore there from Butte for processing.[68]

In 1883 Marcus Daly chose a site twenty-six miles west of Butte for his new smelter. He chose the site because of its abundance of water and firewood. Next to the smelter he built his new town of Anaconda. Daly shipped his ore from Butte to Anaconda on the Montana Union Railroad, but in 1891 he entered into a disagreement over rates with the railroad. He closed his smelting operation until he organized and built his own railroad. In 1893 he began operation of the Butte, Anaconda and Pacific Railroad between Butte and Anaconda.[69] He had plans to eventually extend to the coast, but he never got any further west than Georgetown Lake, some fifteen miles west of Anaconda. The B.A. & P. is still operating today as a wholly-owned subsidiary of the Anaconda Company which, in turn, is owned by Atlantic Richfield.

The next railroad into Montana was the Chicago, Burlington and Quincy--or Burlington Route. As an established midwestern line, it felt it needed a connection to the Pacific to compete with the new transcontinentals. Rather than build all the way to the coast, the Burlington reached an agreement with the Northern Pacific whereby it could connect with the Northern Pacific tracks at Huntley, just east of Billings. In 1894 the Burlington was completed to Huntley, and Montana had a direct line to Chicago. A later line from Billings connected Montana to Denver. By 1896 J. J. Hill and J. P. Morgan had taken control of the Northern Pacific. In 1901 the Northern Pacific and the Great Northern gained control of the Burlington Route. Even though the railroads were owned by the same interests, they did not formally merge until the Burlington Northern was formed in 1970. With the abandonment of the Milwaukee Road west of Miles City in 1980, the Burlington Northern today has a virtual monopoly on rail traffic in Montana (the Union Pacific still runs to Butte in the southwest, the Milwaukee still runs to Miles City in the southeast, and the Butte, Anaconda and Pacific still runs between Butte and Anaconda).

The last of the major railroads to enter Montana was the Chicago, Milwaukee, St. Paul and Pacific--or the Milwaukee Road. It, like the Burlington Route, was an established



Calipso Bridge (Description 60) over the Yellowstone River west of Terry. (Photograph Jet Lowe).

midwestern railroad, and it too, felt the need to construct a line to the Pacific to remain competitive. Construction westward began from South Dakota in 1906. The Milwaukee reached the Yellowstone River at Terry where it crossed the river (Description 60) travelled along the north side of the Yellowstone until it arrived in Miles City where it crossed back to the south (Description 18) for a junction with the Northern Pacific. Then it immediately crossed to the north again (Description 17) following the Yellowstone to Forsyth from where it headed northwestward into the Musselshell Valley.[70]

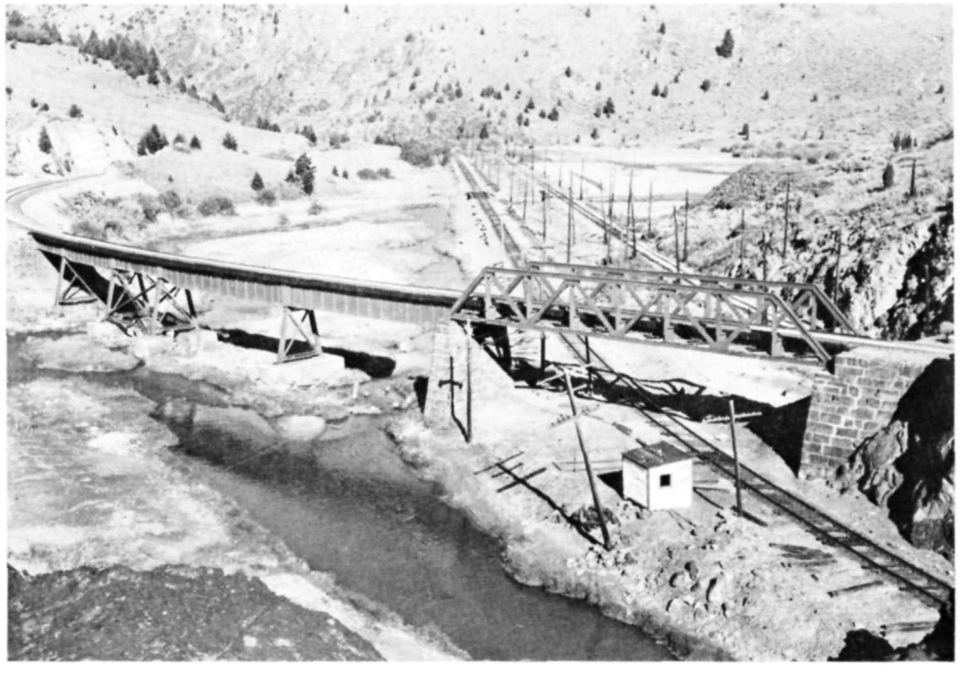
In order to tap the promising agricultural potential of the Musselshell Valley, the Milwaukee then leased the existing route of the troubled Montana Railroad. The Milwaukee Road followed the Montana right-of-way southwesterly from Harlowtown on the Musselshell River to the Missouri River and then followed the Jefferson River west over the Continental Divide to Butte. From Butte, the Milwaukee parallelled the Northern Pacific down the Clark Fork to St. Regis from where it followed the old Mullan Road up the St. Regis River and over the Bitterroots to Coeur d'Alene.[71] When the Northern Pacific built its line down the Clark Fork, it followed every bend in the river rather than bridging it to make a straighter route. This left little room for the Milwaukee, so the Milwaukee paid the Northern Pacific to staighten its line down the Clark Fork River in Montana; thus Milwaukee provided the Northern Pacific with numerous new bridges and several tunnels. The Northern Pacific took advantage of the situation and installed double track from Garrison to Missoula which it used until more recent electronic dispatching allowed the Northern Pacific to return to single track with occasional sidings.[72] That is why Burlington Northern bridges and tunnels along the Clark Fork can accomodate two sets of tracks, but have only one.

The last spike of the transcontinental Milwaukee Road was driven in May of 1909, again at Gold Creek. In the years following, the Milwaukee built extensive branch lines in Montana, the most significant of which were those extending into the Gallatin from Three Forks and into the Judith Basin from the terminus of the Montana Railroad at Lewistown. One of those branches went west to Great Falls and beyond.

When the railroads entered Montana their first bridges were wooden structures. Not until several years of operation had passed did they replace the original structures with the present steel structures. The Union Pacific system reached Butte in 1881, but its steel bridges were not built until 1901-02. The Northern Pacific was completed through Montana in 1883, but its oldest remaining steel bridge was built in 1896. The Great Northern was built in the late 1880's, but its present steel structures were built in the late 1890's. The Butte, Anaconda and Pacific was built in 1891-93, but the only B.A. & P. steel truss bridge (Description 70) was built in 1897. The Burlington Route arrived in Billings in 1894, but its present steel bridges (Description 5) were not built until 1911. The only exception is the Milwaukee Road; the present Milwaukee Road bridges in Montana are original structures, built when the Milwaukee was constructing its line through Montana.

The Milwaukee Road and the B.A. & P. are significant in the history of American railroads for their early electrification. The first electrification of a steam railroad in the U. S. took place in 1895 when the New York, New Haven and Hartford Railroad electrified its Nantasket Beach branch. Later that year, the Baltimore and Ohio electrified its main line through the 1 1/2-mile long Baltimore Tunnel.[73] But the B.A. & P. and the Milwaukee were the first in the United States to electrify lines of any significant length and installed the highest voltage lines in use at that time.[74]

In 1910, because of the extreme weight of ore trains, the B.A. & P. decided to convert to electric power. The conversion took place during 1912-13 along the entire twenty-six mile main line between Butte and Anaconda. The B.A. & P. used 2400 volts DC with substations at both Butte and Anaconda. Electric power for the operation was brought from



The Butte, Anaconda and Pacific Railroad Bridge (Description 70) over Silver Bow Creek and the Burlington Northern Railroad was built in 1897. It is the only truss bridge owned by the B.A. & P. (Photograph Fred Quivik).

Great Falls. The B.A. & P. continued to use electric power until 1967 when it switched to diesel electric locomotives.[75]

The Milwaukee Road was soon to follow. The reason for the switch to electricity was the extremely cold Montana winters which reduced the power of steam locomotives. Electric locomotives would be unaffected by the cold. Also, the Milwaukee could reclaim some of its electricity by switching the electric motors of its locomotives to generators when descending mountain grades, feeding electricity back into the lines. Another key factor in the decision to electrify was the fact that John D. Ryan of the Anaconda Company was also on the board of the Milwaukee Road. Ryan was in the process of organizing what was to become the Montana Power Company.[76] By signing contracts to supply power to the Milwaukee Road--as well as to the Anaconda Company for its mining and smelting operations--Ryan was able to raise the capital to build an extensive network of hydroelectric facilities, which in turn led to the electrification of many Montana communities earlier than would otherwise have been possible.[77]

The Milwaukee began construction of its electrified system in 1914. The first section completed was 112 miles between Deer Lodge and Three Forks in December of 1915. The entire project (440 miles between Avery, Idaho and Harlowton, Montana) was completed by early 1917. The Milwaukee system utilized 3000 volts DC.[78] The electric system was used until the early 1970's when the Milwaukee switched to diesel electric on its Rocky Mountain Division. In 1980 the Milwaukee Road abandoned all track west of Miles City.

The railroads had a tremendous impact on the economic development of Montana in addition to its effect on the timber industry. While the Great Northern was extracting coal from the Sand Coulee mines, the Northern Pacific was developing coal mines near the Yellowstone River and later, along with the Anaconda Company, in Carbon County, the

The Fort Benton Bridge (Description 14) was built in 1888 by the Milwaukee Bridge and Iron Company. The Parker span on the left was built in 1925. The Baltimore spans on the right are original to the structure. (Photograph Jet Lowe).

state's greatest producer of coal in 1910.[79] Railroads had a great influence on agriculture as well. The Bitterroot Valley, for example, one of the prime agricultural spots in Montana, was not exploited until the 1880's when the Northern Pacific sent a branch up the Bitterroot from Missoula.[80] After that time, the Bitterroot became a major fruit and dairy producing area. It became particularly well known for its McIntosh apples which were exported to the East.[81] But the greatest impact of the railroads may be the role they played in the opening of eastern Montana to farming.

When the railroads entered Montana, they competed for resources and for markets. As the railroads competed, so did the communities on the different lines. An examination of the construction of bridges shows vividly the flow of transportation in response to competition between communities. The competition between Fort Benton and Billings for bridges in Fergus County provides an interesting example.

The Judith Basin was opened to agricultural development during the mid-1870's. Fort Benton was originally the major shipping point for supplies to, and resouces from, the Montana Territory, but it declined rapidly upon the arrival of the railroads. When the Northern Pacific arrived, Billings became the major shipping point for the Judith Basin. Yellowstone and Fergus Counties each owned and maintained a bridge (Descriptions 34 and 54) over the Musselshell River between Lewistown and Billings. Fergus County maintained a public road to each of those bridges.[82] As agriculture developed in Judith Basin, the county built or took over bridges and roads out into the county from Lewistown. Nevertheless the old Lewistown-to-Fort Benton stage road remained unimproved.[83]

As the businessmen of Fort Benton saw Hill's railroad coming, they began to make bold plans to try to capture the agriculture of the Judith Basin in an effort to maintain their declining economic base. They built a bridge across the Missouri River (Description 14). Anxious to take business from the Northern Pacific, the Great Northern agreed to ship the iron for the bridge to Fort Benton free of charge.[84] The Great Northern was completed to Fort Benton in 1887, and the Fort Benton bridge was built in 1888. The bridge was built with private capital and was no small feat. Total length of the bridge was 825 feet, including a 225-foot swing span because the Missouri River was still considered navigable. Built by the the Milwaukee Bridge and Iron Works, the bridge was the first vehicular bridge across the Missouri in Montana and probably the first all-iron truss bridge in the Territory. (An extensive search of the records of the other older counties revealed no mention of an earlier all-iron bridge of any size in Montana.)

The response in Fergus County to the construction of the Fort Benton bridge was almost immediate. On June 3, 1889, the Fergus County Commissioners decided to straighten the old Lewistown-Fort Benton stage road between Sample's Crossing of the Judith River to Arrow Creek, the Chouteau County line.[85] By September 1, 1890, Sample's Crossing had a 100-foot wood and iron combination truss bridge built by the King Bridge Company of Cleveland, Ohio.[86] Increased growth and new trade spurred the same bridge company to replace the wooden bridge with a new 150-foot iron Pratt through truss bridge in 1899.[87] Billings continued to draw a good deal of the Judith Basin trade across a new wood combination Camelback truss bridge over the Musselshell at Roundup (Description 54), built in 1893,[88] and a new iron Pratt through truss bridge over the Musselshell at Lavina (Description 34) built in 1900.[89]

The impact of the railroads on Montana was to be far greater than the bridge-building drama just described in Fergus County. The railroads crossed vast expanses of unsettled land in Eastern Montana. Because they depended for their profits on shipping freight, the railroads embarked on a massive campaign to settle eastern Montana with farming. By so doing, the railroads in

Originally, Sample's Crossing was merely a ford of the Judith River. The first bridge at the site was built in 1890 in direct response to the construction of the Fort Benton Bridge (Description 14). This pin-connected Parker through truss bridge (Description 22) was built in 1899 by the King Bridge Company. It was abandoned in 1948. (Photograph Jet Lowe).

The Brockway Ford Bridge (Description 54) over the Musselshell River was originally built over the Musselshell River at Roundup in 1893 by S. M. Hewett of Minneapolis. (Photograph Jet Lowe).

combination with other technological advances precipitated the biggest population boom (and bridge building boom) Montana has ever experienced.

The railroads had another more direct impact on bridge building in Montana. Besides building many bridges themselves, they changed the nature of vehicular bridge building. First, the railroads allowed out-of-state bridge builders to compete for bridge contracts with the counties of Montana by offering those companies the opportunity to ship bridge steel and other materials into the territory. Second, the railroads brought bridge builders and engineers into Montana to build railroad bridges and many of them stayed. The most prominent of these individuals was O. E. Peppard of Missoula who came to Montana to build bridges for the Northern Pacific and stayed to become one of the most productive of Montana's vehicular bridge builders.

THE HOMESTEAD ERA

After the railroads came, agricultural activity in Montana increased during the late 19th Century. In 1870 there were 851 farms in Montana. In 1890 that number increased to 5,603 farms and by 1900, to 13,097.[90] Prior to 1900, farming had moved out of southwestern Montana into areas west of Great Falls and to Billings. By 1905 there were sizable increases in the numbers of farms in the Golden Triangle north of Great Falls and the Judith Basin. Fergus County, which had doubled its population between 1890 and 1900, tripled its population between 1900 and 1910.

The rest of Montana was growing too, primarily due to the ascendance of the Butte Hill to the position at the top of the world's copper producers. In 1918, State sources claimed that 36,000 men worked in the

The use of reinforced concrete in bridge piers, approach spans, and smaller bridges was a major contribution of the Milwaukee Road to Montana bridge building. These massive piers support the Calipso Bridge (Description 60). (Photograph Jet Lowe).

mines and smelters of Butte alone.[91] In addition, numerous people worked in mining-related industries around the state. The rest of the economy was not as well industrialized. The 1910 census showed only 13,694 persons working in non-mining industries in Montana, the largest of which was the timber industry which employed 3,106.[92] It is worthy of note that the mining industry had enough political power that it did not have to release its employment figures then. Such non-disclosure was part of the copper industry ploy to avoid paying taxes. In 1916, for instance, miners in Montana produced gross proceeds of $141,500,000 compared to gross proceeds from farming and livestock of $135,300,000. Yet, the mining industries contributed only 8.79% of the taxes paid in Montana that year, while farmers and livestock growers contributed 42.87% of the taxes paid.[93]

Corporate control was prominent in Montana. The huge railroad corporations began huge promotional campaigns to settle eastern Montana with homesteaders. A number of circumstances coincided with the railroad promotions to create the homestead boom. Out of the Industrial Revolution came new farm implements which made it easier to operate larger acreages of grain. The Enlarged Homestead Act of 1909 increased the possible size of homesteads from 160 to 320 acres and created easier residency requirements.[94] World grain prices were high, especially as Europe went to war in the second decade of this century.[95] Finally, new dry land farming techniques were developed, most prominent of which was the Campbell system. Hardy Webster Campbell operated experimental farms for the Northern Pacific during the 1890's. He developed a method of farming which employed special tillage techniques and for which he claimed little or no moisture, whether from rain or irrigation, was needed.[96]

Most newspapers in the state supported the Campbell System and the railroads in the promotions. The notable exception was the Rocky Mountain Husbandman.[97] The Rocky Mountain Husbandman[98] had been around Montana long enough to know that dry land farming required large acreages and that one could not count on the unusually high rainfall that happened to occur during the early years of the homestead era.

Indeed, there was a great deal of irrigation accomplished in Montana during the homestead era. Under the Carey Act of 1894 and the Reclamation Act of 1902, over a million acres of farmland were provided with irrigation.[99] But irrigation could only benefit a small amount of the vast open area in eastern Montana, so ignoring the advice of the Rocky Mountain Husbandman, the promoters went to work and induced tens of thousands of people into Montana to make their fortunes at dry land farming.

Campbell was working the Northern Pacific which had millions of acres of its land grant to sell. J. J. Hill was the most aggressive of all the railroad capitalists, hiring Thomas Shaw as his dry land farming expert while at the same time trying to discourage the notion that Montana was arid land.[100]

Buoyed by higher than average rainfall, production was high and the promoters succeeded in bringing the homesteaders in, mostly from the upper Midwest.[101-105]

The increased population had an immediate and dramatic impact on the political face of Montana. Between 1910 and 1925, twenty-eight new counties were created in Montana, almost all of them in eastern Montana. And as "the counties were created, new courthouses were built, new sheriffs and clerks were hired, filing cabinets were ordered, new roads and bridges and schools came into existence, new surveys were made by new surveyors, new judges ordered new benches--and new taxes, many new taxes were levied to pay for it all."[106-107]

Montana's bridge construction also kept pace with the dramatic influx of settlers. Figure #1 shows the number of presently existing bridges built during each decade from 1880 to the 1930's as represented in the Montana Historic Bridge Inventory. The Inventory examines extant bridges in Montana older than forty-five years of age and longer than twenty feet in

span and includes roughly 500 bridges. Figure #1 does not claim to show the total number of bridges built in Montana during each of those decades. An exhaustive survey of the records of every county would be required to do that. Figure #1 represents the pattern of bridge building in Montana, especially the boom in bridge building activity that took place during the homestead era and the precipitous decline in bridge building during the lean years that followed.

Like most businesses, bridge builders enjoyed prosperity in Montana during the early years of the 20th Century. The boom in bridge building helped establish Montana bridge builders, such as O. E. Peppard of Missoula and the Security Bridge Company of Billings, but out-of-state builders continued to play a significant role. Counties began building bridges almost as soon as they came into existence to facilitate the reliable transport of goods to market.[109]

For example, Musselshell County was created by the Legislature on March 1, 1911. The county was formed out of portions of Meagher County (the upper portion of the Musselshell River), Fergus County (north of the Musselshell), and Yellowstone County (south of the Musselshell). The major issue in the formation was the need for more bridges across the Musselshell. One of the first acts of the new county commissioners was to ask for bids to build four new steel bridges over the Musselshell River (33, 55, 56), thus better linking the two halves of the county. Before the decade was out, Musselshell County would build at least seven other steel bridges over the Musselshell.

The many pony and small Pratt through truss (Appendix 1) bridges are a legacy to the boom and to the homestead era. While a great many bridges built during that time in the more populous areas of western Montana have since been replaced due to traffic pressures of a growing population, eastern and central Montana have an abundance of early bridges which survive mainly because the roads and ranches they serve are so greatly reduced in number.

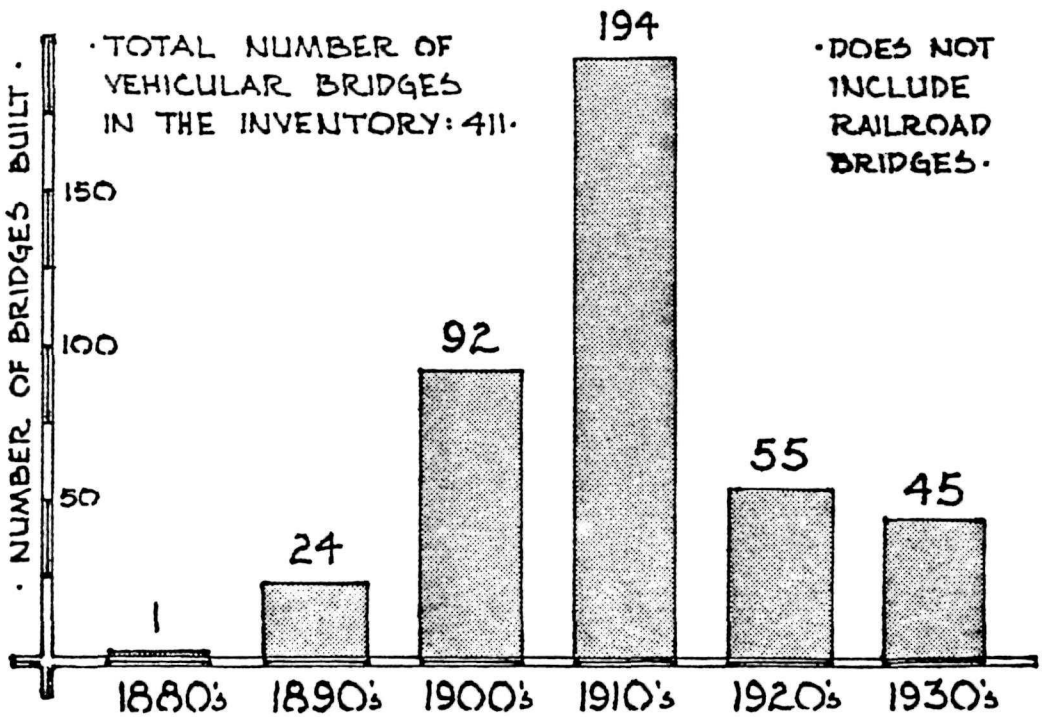
THE LEAN YEARS

The prosperity was to be short-lived. In 1917, drought struck the northern tier of counties. In 1918, all of eastern Montana experienced drought, and in 1919, even some of the western Montana valleys were hit.[110] Perhaps 60,000 of the immigrants left the state by 1922,[111] and 11,000 farms were vacated. Half of the mortgages on homesteads in the state were foreclosed, and 211--or half--of Montana's banks failed.[112] The year 1919 was the worst year of the drought, but 1920 was almost as bad. By 1922 the drought was over, but by then, the war in Europe had been over for several years. Europe could supply its own food, and the world price of wheat dropped drastically.[113] Montana was in a slump well before the rest of the United States experienced the Great Depression.[114] With the exception of a brief revival in Montana in the late 1920's Montana's economy remained depressed until the end of the Great Depression.

The end of the war meant a decline in the copper and timber inducstries, as well as a decline in farm prices. Between 1919 and 1925, two million acres of Montana farm land were no longer producing.

The first decades of the 20th Century also witnessed other changes affecting transportation in Montana. Perhaps most importantly, automobiles arrived.[115] The first known automobile advertisement in Montana appeared in the January 3, 1904 issue of Great Falls Tribune.[116] In 1921 the first paved highway in the state was built between Butte and Anaconda.[117] By 1921, Montana had 4,700 miles of trunk highways and 4,300 miles of primary county roads.[118]

Figure #1 **VEHICULAR BRIDGES BUILT --BY DECADE**



Anaconda Company began buying other copper and brass concerns, as well as developing copper mines in Latin America. The result has been that its Montana operations have meant less and less to the Anaconda Company, and as a consequence, copper mining has become a smaller part of the state's economy.

Other mineral resources have taken copper's place. Around 1915, oil and gas were discovered near Glendive and also in the area east of Glacier National Park. While never producing on the scale of Oklahoma or Texas, Montana has continued to produce oil and gas to the present time, with Billings as the center of the industry.

After 1920, Montana's underground coal mines around Great Falls, Roundup, and Red Lodge began to decline. But in 1924 coal began to be strip-mined at Colstrip. Coal production generally stagnated until the boom in western coal in the 1970's. The recent coal, oil and gas development has had a significant impact on bridges in eastern Montana. Those counties containing active fossil fuel extraction operations have had the demand and resources to replace their older bridges. These counties, such as Rosebud (coal) and Fallon (oil and gas), today have fewer older bridges than their neighbors which are still almost solely agricultural.

By the 1930's, Montana farmers were practicing more sustainable methods of dry land farming and grazing. But drought struck again in the 1930's along with the Depression. During the New Deal, Montana farmers received price supports to help them stay in business. Not until rains returned and prices increased during World War II, did Montana farmers get on their feet again. Since then, Montana agriculture has become less diversified. Wheat and cattle are the mainstays, while sheep, dairying, and fruits play an almost insignificant role in Montana's agricultural economy.

Montana has grown slowly but steadily since 1930, yet there has never been a return to the prosperity that existed during the early years of

this century when copper and agriculture were booming. Tourism has become a major industry in Montana and big trucks have taken much of the freight the railroads once carried. These factors have led to changes in the highway system which have required alteration or replacement of many bridges built during the early 20th Century.

THE BRIDGE BUILDERS

The first major bridge building effort in Montana came as part of the Mullan Road Project. The bridges did not last and were rebuilt or repaired by entrepreneurs who charged travelers a toll for the privilege of crossing a bridge. These bridge builders and toll keepers were early pioneers who often had other businesses as well. For example, James Shedd, in Gallatin County, combined bridge building and toll collecting with the operation of a sawmill.

Another prominent bridge keeper was Joseph A. Browne who owned, and perhaps built, the Big Hole Toll Bridge and the Big Hole Toll Road between Bannack and Helena. Moving to the Big Hole in the late 1860's, he either bought or built the Big Hole Bridge which from then on has been known as Browne's Bridge (Description 1). He established a ranch nearby and went on to a fairly active political life.

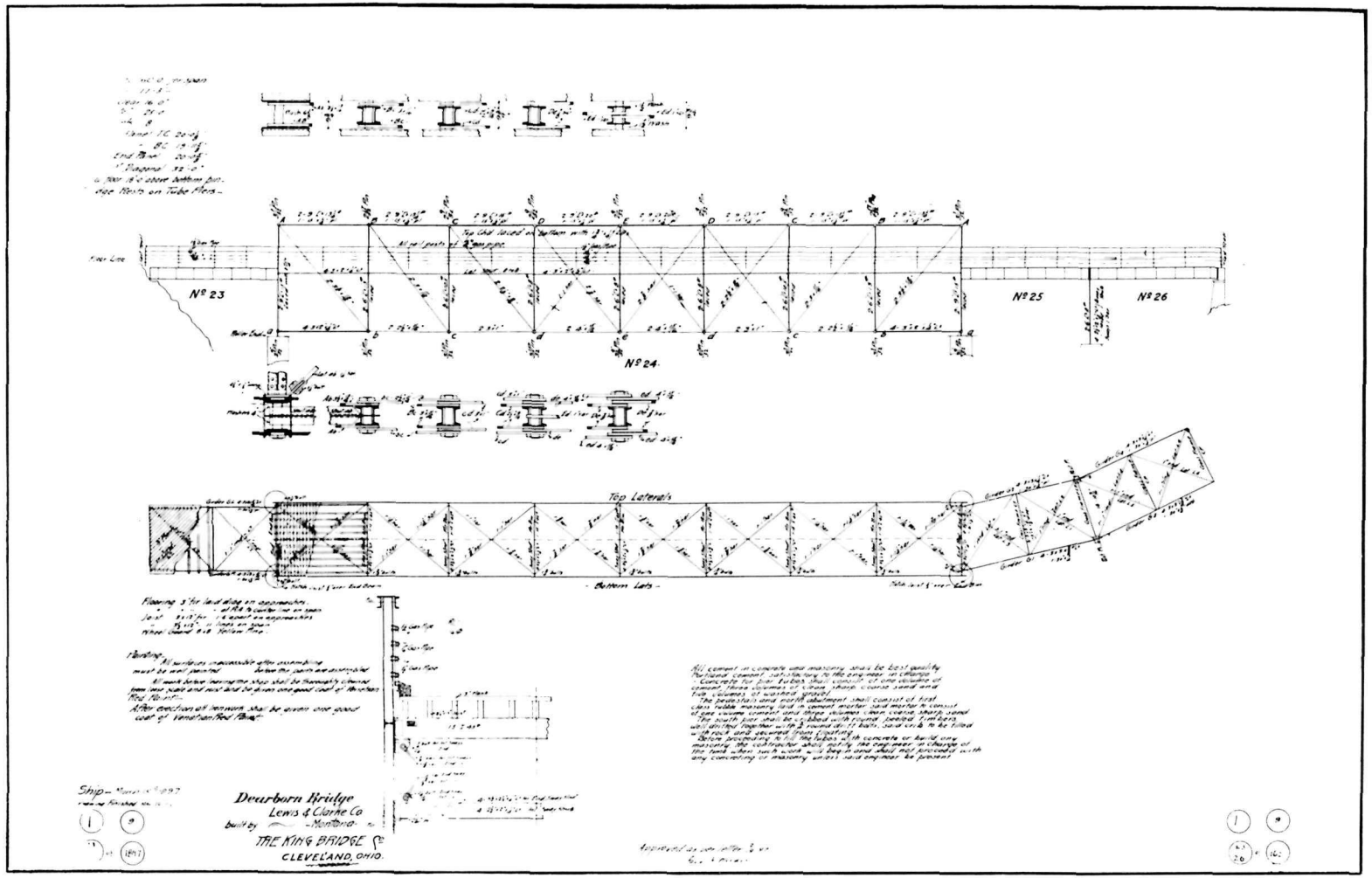
After the Territorial Legislature authorized the counties to begin building bridges, they followed the usual practice of advertising the bids and then selecting the lowest or most acceptable bid for a contract. Early contractors were local individuals who were perhaps farmers or lumbermen, as well as builders--like Con Kohrs in Deer Lodge County. Kohrs was a Deer Lodge Valley rancher who in 1870 was paid $100.00 by the county for hauling bridge logs.[119] Not until the railroads came did companies from out of state begin bidding on bridge projects in Montana. In the 1880's, bridge companies came from California as well as from the Midwest. In 1887, for instance, the California Bridge Company and the San Francisco Bridge Company were bidding against the Milwaukee Bridge and Iron Works and the Kansas City Bridge Company to build a bridge across the Big Hole River in Madison County. The California Bridge Company won the contract to build a 130-foot wood combination truss bridge with iron and concrete piers.[120] However, by the 1890's, Midwestern companies dominated bridge construction in Montana while small bridges were still built by local individuals.

Although the bridge building companies came from all across the Midwest, those from the upper Midwest, especially Minneapolis, were dominant. Minneapolis bridge builders enjoyed the advantage of having a direct link to Montana by means of the Great Northern and Northern Pacific Railroads. The main exception to this rule was the King Bridge Company of Cleveland, Ohio. But the company operated in Montana out of its Minneapolis office. The earliest known King Bridge Company bridge in the Territory was built in 1886 over the Beaverhead River at Twin Bridges.[121] In the 1890's the Minneapolis agent for the King Bridge Company was M. A. Adams. By 1903 he formed his own Minneapolis-based bridge company which built several bridges in Montana.[122]

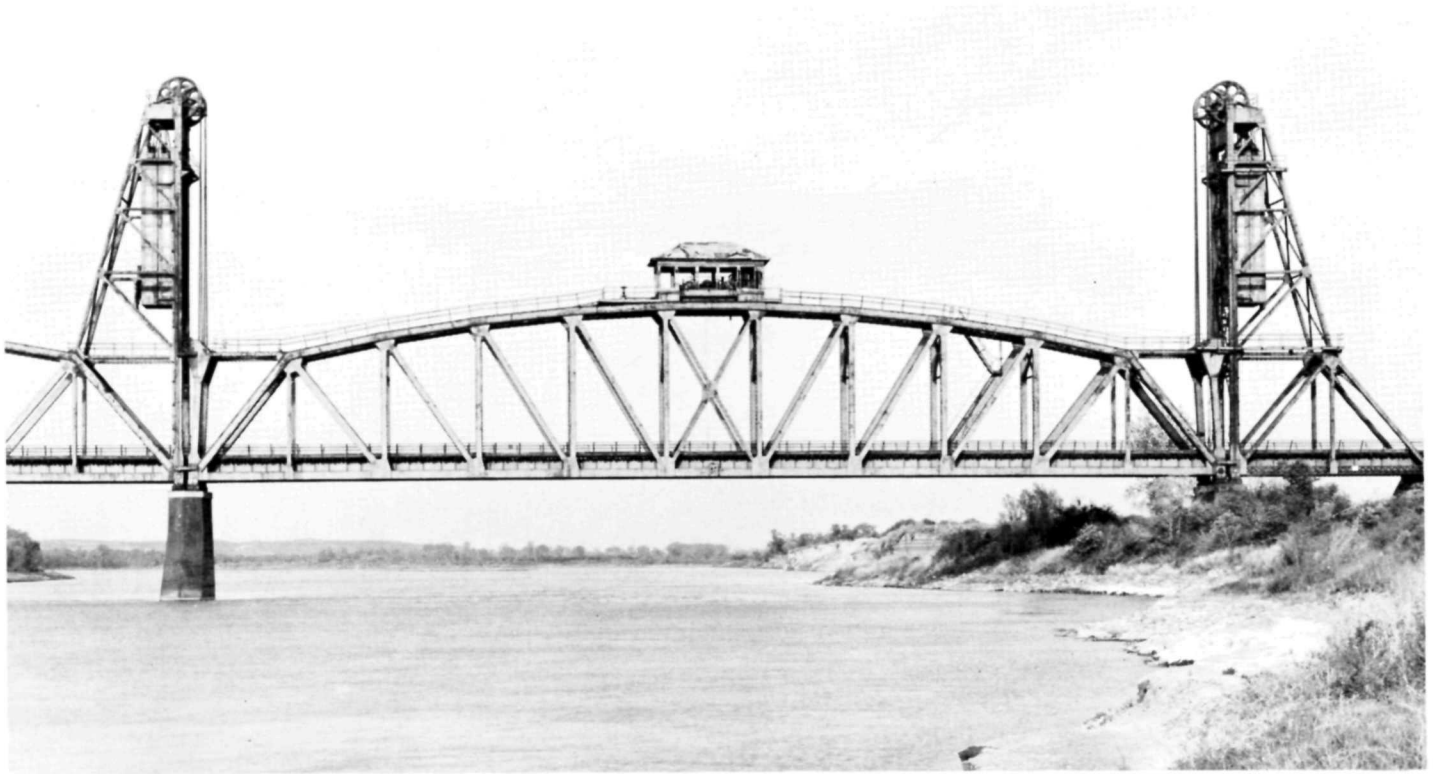
Several Minneapolis-based bridge companies played significant roles in Montana. Chief among them was William S. Hewett who will be discussed later. Others include Gillette-Herzog Manufacturing Company, A. Y. Bayne, and the Minneapolis Steel and Machinery Company. Eight of the surviving 25 pre-1900 bridges in Montana were built by Gillette-Herzog (Descriptions 23, 26, 27, 28, and 29), which kept a field office in Butte. A. Y. Bayne, an associate of William S. Hewett, built numerous bridges in Montana around 1910 (Descriptions 25, 63, and 64).[123] The Minneapolis Steel and Machinery Company built numerous bridges in Montana during the homestead era (Descriptions 29 and 37).

Until 1915, when the Montana State Highway Commission Bridge Department was created, there was not a standardized method for designing bridges. Some of the larger counties employed engineers who could design a bridge and prepare plans and specifications. More often than not, the counties simply specified the site and the length of a bridge and relied on contractors to provide plans and specifications with their bids. Some-

The Old Steel Bridge (Description 23) over the Flathead River at Kalispel is a three-span, pin-connected Pratt through truss bridge built by Gillette-Herzog of Minneapolis in 1894. It is the oldest surviving bridge in northwestern Montana. (Photograph Jet Lowe).



The Dearborn River High Bridge (Description 38) plans are among the few bridge plans surviving which were prepared before the creation of the Montana State Highway Commission. (Montana Highway Commission).



The 296-foot lift span of the Snowden Bridge (Description 65) was necessitated because the Missouri River was still considered a navigable river at this point in 1913. Designed by Waddell and Harrington of Kansas City, the bridge was the longest lift span in the world at the time of its construction. (Photograph Jet Lowe).

The Fairview Bridge in North Dakota crosses the Yellowstone River just over the Montana/North Dakota border. It is similar to, but smaller than, the Snowden Bridge (Description 65). The Fairview Bridge was also designed by Waddell. (Photograph Jet Lowe).

times contractors would submit several alternative plans, each with a different cost, from which counties could choose. Counties made exceptions in the cases of larger bridges. In 1900, after the 1895 Glendive Bridge (Description 20) had been washed out, the Dawson County Commissioners retained the services of C. F. Loweth of St. Paul, Minnesota, to design the replacement ridge. Subsequently, the Pueblo Bridge Company of Pueblo, Colorado received the contract to build the bridge.[124] And in 1909, the Sanders County Commissioners contracted with William Pierce Cowles of Minneapolis to design and supervise the construction of three bridges over the Clark Fork River (Descriptions 67 and 68). O. E. Peppard of Missoula submitted the low bid to construct these bridges.[125]

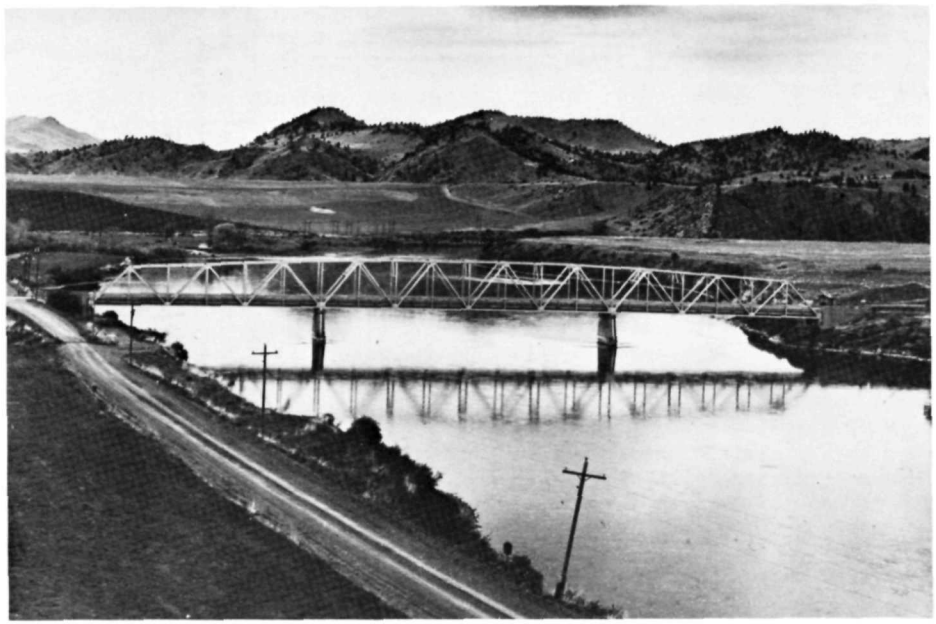
The most prominent bridge designer to work on a Montana Bridge project was J. A. L. Waddell of the Kansas City engineering firm, Waddell and Harrington. The firm was hired by the Great Northern Railroad to design two vertical lift bridges for new branch lines over the Missouri and Yellowstone Rivers near the Montana-North Dakota border. The moveable spans were required by the War Department because both rivers were classified navigable in 1913. The Great Northern complied with the War Department requirement though the railroad predicted it would rarely lift the Missouri Bridge (Description 65) and never lift the Yellowstone Bridge.[126] This prediction proved correct. Waddell based his designs for the two Great Northern bridges on his 1894 Halstead Street Bridge in Chicago.[127] Construction began on the two bridges in 1913. Substructures for bridges were built by the Union Bridge and Construction Company of Kansas City; steel for the superstructures was fabricated by the Gary, Indiana works of the American Bridge Company; and the superstructures were assembled on site by Gerrick and Gerrick of Seattle.[128] When the Snowden Bridge (Description 65) over the Missouri in Montana was completed, its 296-foot vertical lift span was the largest in the world.[129]

O. E. Peppard of Missoula and the Security Bridge Company of Billings, were the most notable Montana bridge builders. They will be discussed later with William S. Hewett. Other contractors from Montana who built bridges included J. F. Harrington of Missoula, the Perham Brothers of Butte, and the Montana Bridge and Iron Company of Livingston. Livingston began as a Northern Pacific railroad town where the Northern Pacific located its largest engine shops west of Brainerd, Minnesota.[130] The Montana Bridge and Iron Company was formed sometime after 1906,[131] and its extant bridges (Description 59) were built in 1909-1911. The company built numerous bridges in Park County as well as some as far away as Madison County.[132]

Montana's early wooden railroad bridges were built by the railroads themselves. O. E. Peppard was employed by the Northern Pacific in the 1880's to direct its crews in building all the bridges on its branch lines up the Bitterroot Valley and up Flint Creek to Philipsburg.[133] However, all of the later steel railroad bridges were built by bridge building companies under contract to the railroads. The companies which built railroad bridges in Montana did not build vehicular bridges, and the companies which built vehicular bridges in Montana did not build railroad bridges. Railroad bridge building companies came from such places as Milwaukee (the Wisconsin Bridge and Iron Company), Chicago (Lassig Bridge and Iron Works) and Pennsylvania (Penncoyd Iron Works). The most prominent railroad bridge builder in Montana was the American Bridge Company of New York.

Steel for the bridges--railroad and vehicular--was shipped into Montana by rail from such companies as Illinois Steel, Lackawanna Steel, and Carnegie Steel. The bridge builders ordered the needed components (channel sections, angle sections, eyebars, lacing bars, rivets) from the steel fabricators. Unassembled pieces would then be shipped to the site and erected by the bridge building company.[134]

By the 1930's bridges were still



The Wolf Creek Bridge (Description 39) over the Missouri River was built in 1933. It was the first multi-span, continuous truss bridge built in Montana. (Photograph Jet Lowe).

built by out-of-state contractors, like the Portland Bridge Company which constructed the Sidney Bridge over the Yellowstone River in 1932 or the Missouri Valley Bridge and Iron Works that built the Wolf Point Bridge (Description 66) over the Missouri in 1930.

The early 20th Century Montana firms of O. E. Peppard and the Security Bridge Company had, by this time, dissolved. But new Montana contractors had been formed to take their place. These included: Boomer, McGuire and Blakesley of Great Falls which built the Bell Street Bridge (Decription 20) over the Yellowstone at Glendive in 1926; W. P. Roscoe of Billings which built the Wolf Creek Bridge (Description 39) over the Missouri in 1933; and W. J. O'Brien of Butte who built the East Billings Bridge over the Yellowstone in 1935. Figure #2 lists all of the builders known to have built bridges which appear in the Montana Historic Bridge Inventory. Other builders are known to have worked in Montana, but their structures no longer exist.

O.E. PEPPARD

The first Montana bridge builder to come into prominence was O. E. Peppard of Missoula. Obert E. Peppard was born on December 15, 1855 at Lansing, Michigan and grew up in Red Field, Iowa, where his father was a bridge builder.[135] He left Iowa in 1881, heading for Alaska to find his fortune. He worked on construction projects along the way, eventually getting on the Northern Pacific payroll.[136] Obert was made supervisor of bridges and buildings for the Northern Pacific's Missoula[137] division and was responsible for building all of the bridges on the Bitterroot and Philipsburg branch lines.[138]

Sometime in the late 1880's, O. E. Peppard decided to start his own bridge building company[139] The earliest known bridges built by O. E. Peppard were in Deer Lodge County. On April 16, 1889, he received a contract to build a wood combination truss bridge at Gold Creek and an iron truss bridge at Deer Lodge.[140] The latter bridge was built only one

Figure #2

THE BRIDGE BUILDERS IN MONTANA

NAME (HOME OFFICE)	NUMBERS	DATES
Security Bridge Co. (Billings, MT)	32	1907-1921
O. E. Peppard (Missoula, MT)	27	1907-1916
A. Y. Bayne (Minneapolis, MN)	15	1906-1911
American Bridge Co. (New York, NY)	14	1901-1940
Minneapolis Steel & Machinery Co. (Minneapolis, MN)	14	1906-1916
King Bridge Co. (Cleveland, OH)	9	1892-1901
Gillette-Herzog Manufacturing Co. (Minneapolis, MN)	8	1891-1901
William S. Hewett Co. (Minneapolis, MN)	8	1897-1906
W. P. Roscoe (Billings, MT)	7	1925-1945
Illinois Steel Bridge Co. (Jacksonville, IL)	6	1910-1913
Pennsylvania Steel Co. (Steelton, PA)	5	1911
M. A. Adams (Minneapolis, MN)	4	1903-1905
Central States Bridge Co. (Indianapolis, IN)	4	1910
Wisconsin Bridge & Iron Co. (Milwaukee, WI)	4	1907-1913
Keystone Bridge Co. (Pittsburgh, PA)	3	1898-1899
Lassig Bridge & Iron Works (Chicago, IL)	3	1897-1900
Minneapolis Bridge Co. (Minneapolis, MN)	3	1911
Missouri Valley Bridge & Ironworks (Leavenworth, KS)	3	1897-1930
George Sheehy (Denver, CO)	3	1908
Midland Bridge Co. (Kansas City, MI)	2	1908-1912
Milwaukee Bridge & Iron Co. (Milwaukee, WI)	2	1888-1896
Montana Bridge & Iron Co. (Livingston, MT)	2	1911
Penncoyd Iron Works (Penncoyd, PA)	2	1896
Portor Bros. (Spokane, WA)	2	1920
Beley Construction Co. (Livingston, MT)	1	1914
Boomer, McGuire & Blakesley (Great Falls, MI)	1	1926
Canton Bridge Co. (Omaha, NE)	1	1902
Coast Bridge Co. (Portland, OR)	1	1912
Continental Bridge Co. (Peotone, IL)	1	1913
Crenshaw Construction (Livingston, MT)	1	1921
Elkhart Bridge Co. (Elkhart, IN)	1	1903
J. F. Harrington (Missoula, MT)	1	1914
HIPCO	1	1925
International Bridge & Iron Co. (Livingston, MT)	1	1911
Lord Construction Co.	1	1917
Massilon Bridge Co. (Massilon, OH)	1	1909
McClintic-Marshall (Bethlehem, PA)	1	1927
C. A. McClung (Spokane, WA)	1	1926
Phoenixville Bridge Co. (Phoenixville, PA)	1	1897
Jess U. Stout	1	1915
United States Bridge Co.	1	1914
S. M. Hewett (Minneapolis, MN)	1	1893

NOTE: This is not an inclusive list of all bridge builders to have been active in Montana. Nor are the dates inclusive for the builders listed. This list shows the dates during which the bridges included in the Montana Historic Bridge Inventory were built and the builders by whom those bridges were built.

year after the Fort Benton Bridge (Description 14) and is the second known iron truss vehicular bridge built in Montana. By 1890 he was bidding on bridges in Missoula County. In the early 1890's O. E. Peppard built the Higgins Avenue Bridge, a structure washed out by the flood of 1908.[141] (Description 53)

During World War I, the bridge business slowed. Peppard went into the farm implement business with two locations: one in Missoula and the other in Spokane, which was operated by his son.[142] But the timing was not good, and with the onset of the bust in agriculture in Montana, Peppard's farm machinery business closed. Although he was still listed in the City Directory in 1922 as a bridge builder, his main source of income from then until his death was rental of his apartments. O. E. Peppard died on September 24, 1929 at the age of 73.[143]

During the height of his career, O. E. Peppard was one of the busiest bridge builders in Montana. Of the bridges recorded in the Montana Historic Bridge Inventory, only the Security Bridge Company of Billings built more than did Peppard.

WILLIAM S. HEWETT

One of the most prominent of the Minneapolis bridge builders in Montana was William S. Hewett. Like O. E. Peppard, Hewett was not the only one in his family to build bridges. He worked with his uncle before forming his own company, the Security Bridge Company, which later moved its headquarters to Billings. The Security Bridge Company is known to have built more bridges recorded in the Montana Historic Bridge Inventory than any other bridge builder. Hewett is also important for his work in the development of pre-stressed concrete.

William Sherman Hewett was born in Hope, Maine on October 27, 1864. In March of 1887 he moved to Minneapolis to work in the company of his uncle, Seth Maurice Hewett, a bridge builder.[144] S. M. Hewett had come west as a surveyor for the Union Pacific Railroad before establishing his bridge business in Minneapolis.[145] Young William gained his technical education working for his uncle who built several bridges in Montana, such as the 1893 bridge over the Musselshell River at Roundup (Description 54). In 1897 William formed his own company, the William S. Hewett Bridge Company headquartered in Minneapolis. His company built numerous steel highway bridges throughout Minnesota, the Dakotas, and Montana. He also was involved in the construction of an early reinforced concrete bridge in Iowa and an early Melan-type reinforced concrete arch bridge in Minneapolis.[146] In 1906 he formed the Security Bridge Company with his cousin, Arthur L. Hewett. The company's headquarters was in Minneapolis.

While the Security Bridge Company was busy building bridges in Montana and the upper Midwest, William branched out into other projects. For example, he associated with A. Y. Bayne on some special bridge projects in Minneapolis, and the two of them bid on the Higgins Avenue Bridge in Missoula in 1908. William also developed and patented a pre-cast concrete culvert which could be assembled in sections.[147] He called it the Security Culvert. In 1911 the Security Bridge Company headquarters moved to Billings and William separated himself from the company and re-established his own firm. But his work in Montana did not cease. He built many of the structures on the Milk River Irrigation Project during the 1910's. He began constructing pre-stressed concrete in 1922 and moved to Chicago.[148] Numerous concrete tanks were built according to the "Hewett System" in the U. S., including a tank of three million gallons at Billings. Although he never carried his work into the area of pre-stressed concrete beams developed by Eugene Freyssinet, William S. Hewett is credited with having been one of the developers of pre-stressed concrete technology.[149] He died on November 20, 1951.

Arthur Leslie Hewett was born on March 18, 1867 in Hope, Maine. He moved to Minneapolis to work with S. M. Hewett in 1888, shortly after William had arrived. Beginning in 1892 he travelled to Montana to represent the company and to super-

The swing span of the 1888 Fort Benton Bridge (Description 14) did not open to allow a river boat to pass until 1908. (John Lepley, Fort Benton Historical Society).

vise bridge construction. He established an office for the Hewett organization in Billings in 1904. Shortly thereafter, he and William formed the Security Bridge Company. They established a branch office in Lewiston, Idaho, and the company undertook projects in Wyoming, Idaho, Washington and Oregon, as well as Montana. Besides building bridges, the Security Bridge Company constructed waterworks, sewers and irrigation projects.[150] The Security Bridge Company went out of business in 1926 and Arthur worked as a salesman for manufacturing companies for four years before being appointed superintendent of the Billings Water Department in 1930, a position he held until 1946. Arthur Hewett died in Billings in 1949.[151]

The transition from the William S. Hewett Company to the Security Bridge Company appears to have been a smooth one. In 1906 the Hewett Company submitted the low bid for a bridge at Kern Crossing over the Stillwater River near Absarokee (Description 73). By the time the Carbon County Commissioners (Stillwater County had not yet been formed) were ready to sign a contract in 1907, the Security Bridge Company had been formed and received the contract without having to re-submit a bid.[152] The letterhead on the early Security Bridge Company bid sheet stated that Security was the successor to the William S. Hewett Company.[153] During the twenty years of its existence, the Security bridge Company was the busiest bridge builder in Montana, bidding on bridge projects all over the state and rarely losing a bid in central and eastern Montana. The Montana Historic Bridge Inventory identified 32 extant bridges in Montana definitely built by Security. It would not be an exaggeration to state that at least an equal number of existing bridges (builder unknown) may be attributed to the Security Bridge Company. Many of the Pratt pony, Warren pony, and Pratt through truss bridges built around 1910 bear no name plate and yet are virtually identical to structures which have been identified as Security bridges.

In 1925, the year before the Security Bridge Company ceased operations, Security had a new competitor: W. P. Roscoe Company. W. P. Roscoe had been the vice-president of Security, and now he formed his own bridge building company based in Billings. In the competition over the contract to build the 1925 bridge over the Clark's Fork of the Yellowstone River in Carbon County, Roscoe won.[154] With the ending of the Security Bridge Company, W. P. Roscoe Company was to become Montana's most prominent bridge builder. Roscoe built many of Montana's larger bridges, including the first continuous truss bridge in the state over the Missouri at Wolf Creek (Description 39) in 1933. Roscoe died in 1956, but the W. P. Roscoe Co. continued until 1974.[155-156]

MONTANA STATE HIGHWAY COMMISSION, BRIDGE DEPARTMENT

At the time Montana became a state in 1889, all road and bridge construction and maintenance was a county responsibility. With the arrival of automobiles in the first decade of the 20th Century, people began to express more concern about the quality and weatherability of roads and the "Good Road Movement" became active in the state. One of the results of the movement was the establishment of the Montana State Highway Commission on March 13, 1913.[157] The counties were instructed to prepare maps of all public roads. The Commission then identified primary and secondary roads and made matching funds available to the counties.[158]

Two years later a Bridge Department was established with the Commission and instructed to develop standardized plans for all bridges costing over $500.00. The Bridge Department became functional on June 1, 1915, employing one structural steel designer experienced in design and construction. A study was undertaken to determine typical Montana loading requirements, looking at such things as livestock, automobiles, and heavy equipment.[159] (It is interesting that many early accounts of bridge failure indicate that livestock crossing the bridge was the primary

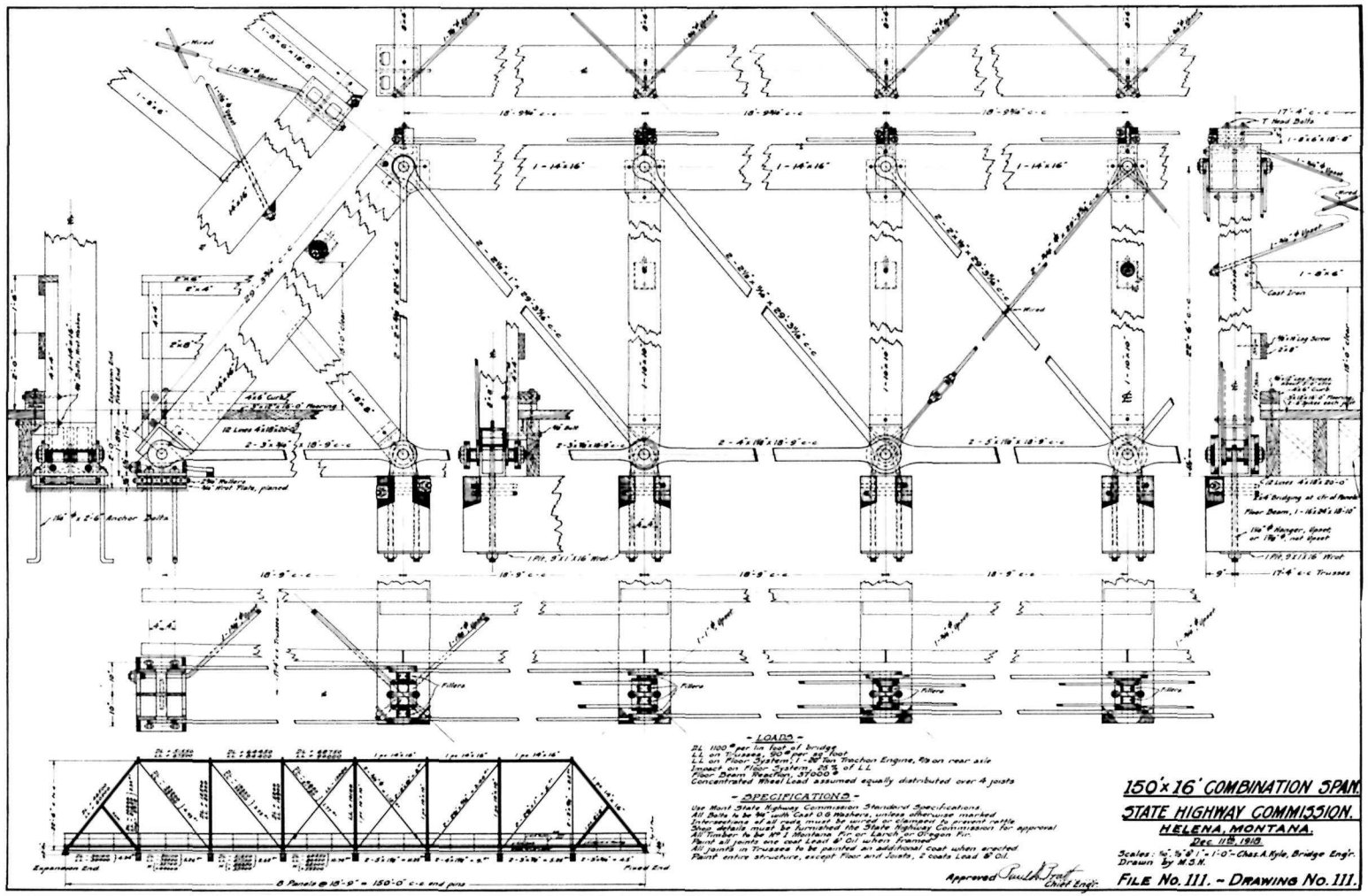
cause.) The State developed sets of standardized plans and specifications which were sent to all the counties along with standardized advertising forms and standardized bidding sheets. All construction of these standardized bridges was supervised and partially paid for by the State.[160]

Charles A. Kyle was the Commission's first bridge designer and throughout the period 1917-1920, he designed numerous structures. Among his most significant designs was the riveted Warren through truss bridge, available in 140-foot and 175-foot spans, built throughout the state.[161] In 1916, the federal government began providing matching highway construction funds to state highway departments.[162] Montana's Bridge Department grew to its peak of activity during the 1930's when massive amounts of federal aid were distributed to the states for highway and bridge construction to help create jobs during the Depression.[163] Many of Montana's modern highway truss bridges were built during this time with federal aid and under the auspices of the Montana State Highway Commission.

The present Browne's Bridge (Description 1) was built according to Montana State Highway Commission standardized plans. (Photograph Fred Quivik).

THE HISTORIC BRIDGES OF MONTANA

Working in a remote state--and, in early days, a remote territory--Montana bridge builders were not, by-and-large, at the cutting edge of bridge building technology. In some cases, however, they came close. As we have already seen, early timber bridges in Montana were either timber stringer or, perhaps, king-post truss bridges. The first large railroad bridges in the territory were wood Howe trusses, as were the first large vehicular bridges. Likewise, the Howe truss was the first prominent truss type in many other parts of the United States. Numerous references are made to Howe trusses in early county bridge records, and one can find some good early photographs of



Even though steel had become the dominant structural material by the time the Bridge Department of the Montana State Highway Department was formed in 1915, standardized plans were developed for wood combination spans as well. A small number of these wooden Montana State Highway Commission truss bridges still exist in the state. (Montana State Highway Department).

This wooden Howe pony truss over the lower Clark's Fork of the Yellowstone Carbon County line is typical of the Howe pony trusses built in 19th Century Montana. (Montana State Historical Society).

Howe trusses in Montana, e.g., the Howe truss at Fromberg which preceded the present concrete arch bridge (Description 9)[164-165]

With the railroads came the Eastern bridge builders and different truss types. Shortly after the railroads arrived, wood and iron combination Pratt trusses became common in Montana and continued to be built in Montana up to 1920.[166] As Eastern bridge builders began to elaborate on the basic Pratt concept, some Montana bridges were soon to follow. For example, the Baltimore and Ohio Railroad developed the first Baltimore truss in 1871 and the Pennsylvania Railroad developed the Pennsylvania truss in 1876.[167] However, these sub-divided Pratts did not become prominent until after 1885[168] and already in 1888, the Milwaukee Bridge and Iron Works was building Baltimore truss spans for Fort Benton. Most of the variations of the Pratt and the Warren truss are found in Montana, built prior to 1900. Like bridge builders elsewhere in the United States,[169] Montana bridge builders after 1900 settled on the basic Warren and the basic Pratt (or its simple variant the Parker) as the most efficient forms. Continuous truss, multi-span structures were becoming popular elsewere in the U. S. around 1900 after designers became adept at calculating the complex secondary stresses involved in the continuous truss.[170] The first continuous truss was not built in Montana until 1933 (over the Missouri River at Wolf Creek Description 39). Even then, to see if calculations had been done accurately, the bridge was tested by putting jacks under the supports, applying different loads, and measuring the stresses in the various members.[171]

Although the truss is by far the dominant historic structural type in Montana, reinforced concrete technology was also developed and employed in Montana. In fact, as we shall see with the Fromberg Bridge (Description 9), some of the reinforced concrete

Figure # 3

BRIDGE TYPES IN MONTANA

TYPE	NUMBERS	DATES OF CONSTRUCTION
PRATT TYPES		
Pratt pony, pin-connected	72	1894-1915
Pratt pony, riveted	13	1907-1935
Pratt through, pin-connected	77	1888-1925
Pratt through, riveted	8	1911-1931
Pratt deck, pin-connected	2	1901-1911
Pratt deck, riveted	8	1900-1936
Pratt half-deck, pin-connected	1	1897
Wood combination trusses, pin-connected	14	1893-1945
Parker through, pin-connected (includes Camelbacks)	24	1899-1915
Parker through, riveted (includes Camelbacks)	11	1918-1940
Double Intersection Pratt through, pin-connected	1	unknown
Baltimore through, pin-connected	1	1888
Baltimore through, riveted	5	1911-1920
Baltimore deck, pin-connected	1	1900
Pennsylvania through, pin-connected	19	1897-1913
Pennsylvania through, riveted	4	1914-1934
WARREN TYPES		
Warren pony, riveted	106	1897-1940
Warren through, pin-connected	2	1895-1900
Warren through, riveted (MSHC design)	15	1915-1921
Warren through, riveted (other)	17	1900-1940
Warren through, sub-divided	4	1898-1900
Warren deck, riveted	10	1900-1935
Warren (double-intersecting) through, riveted	1	1925
Warren (triple-intersecting) through, riveted	3	1901-1902
Warren through, continuous, riveted	3	1933-1945
OTHER TYPES		
Trestles	9	1900-1927
Suspension	1	1951
Plate girder, through	12	1901-1934
Plate girder, deck	3	1900-1910
Steel I-beam stringer	2	1928-1929
Concrete culvert	1	1911
Concrete arch	11	1914-1935
Concrete beam	7	1914-1931
Stone arch	1	1932

NOTE: This list of bridges includes only bridges surveyed in the Montana Historic Bridge Inventory. It does not include all bridges existing in Montana today. The column labeled "Dates of Construction" identifies the periods during which the extant examples of each type were actually built, not the entire period during which bridges of each type were built.

work in Montana appears to be quite early. After building several long arch, multi-span concrete bridges around 1920, the Montana State Highway Commission abandoned the concrete arch, except in a few relatively short span, natural-setting situations. Reinforced concrete beam construction continued to be popular for shorter spans through the 1930's. For longer spans, Montana continued to use the truss up into the 1950's, but reinforced, pre-stressed concrete and deep steel girder beams along with more frequent piers, had taken over the long span function by the 1950's as labor costs prohibited the on-site assembly of trusses.

Figure #3 lists the bridges documented in the Montana Historic Bridge Inventory by structural type. Of the some 500 bridges inventoried, many are historically significant and are eligible for listing in the National Register of Historic Places. The following list contains those bridges which are clearly eligible for the National Register. Figure #4 shows the location of these bridges. Numerous other bridges are not listed here which may be eligible for the National Register, but time has not allowed the research necessary to document their historic significance. Those bridges which are underlined below are considered by the author (and ratified by the Bridge Advisory Committee) to be the 24 most significant bridges in Montana.

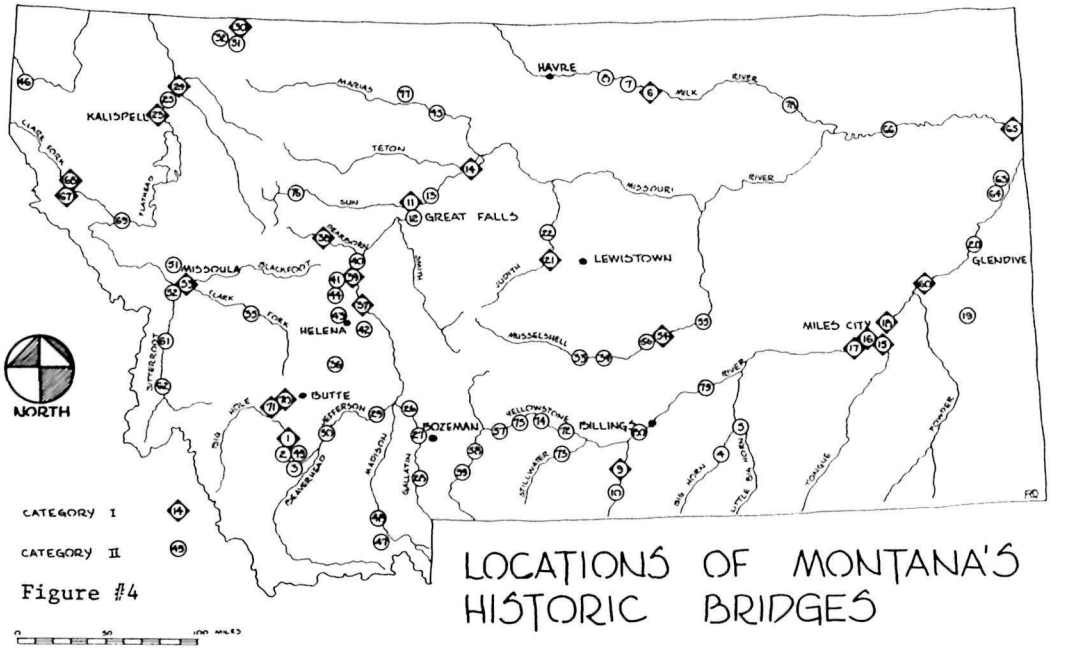


Figure #4

LOCATIONS OF MONTANA'S HISTORIC BRIDGES

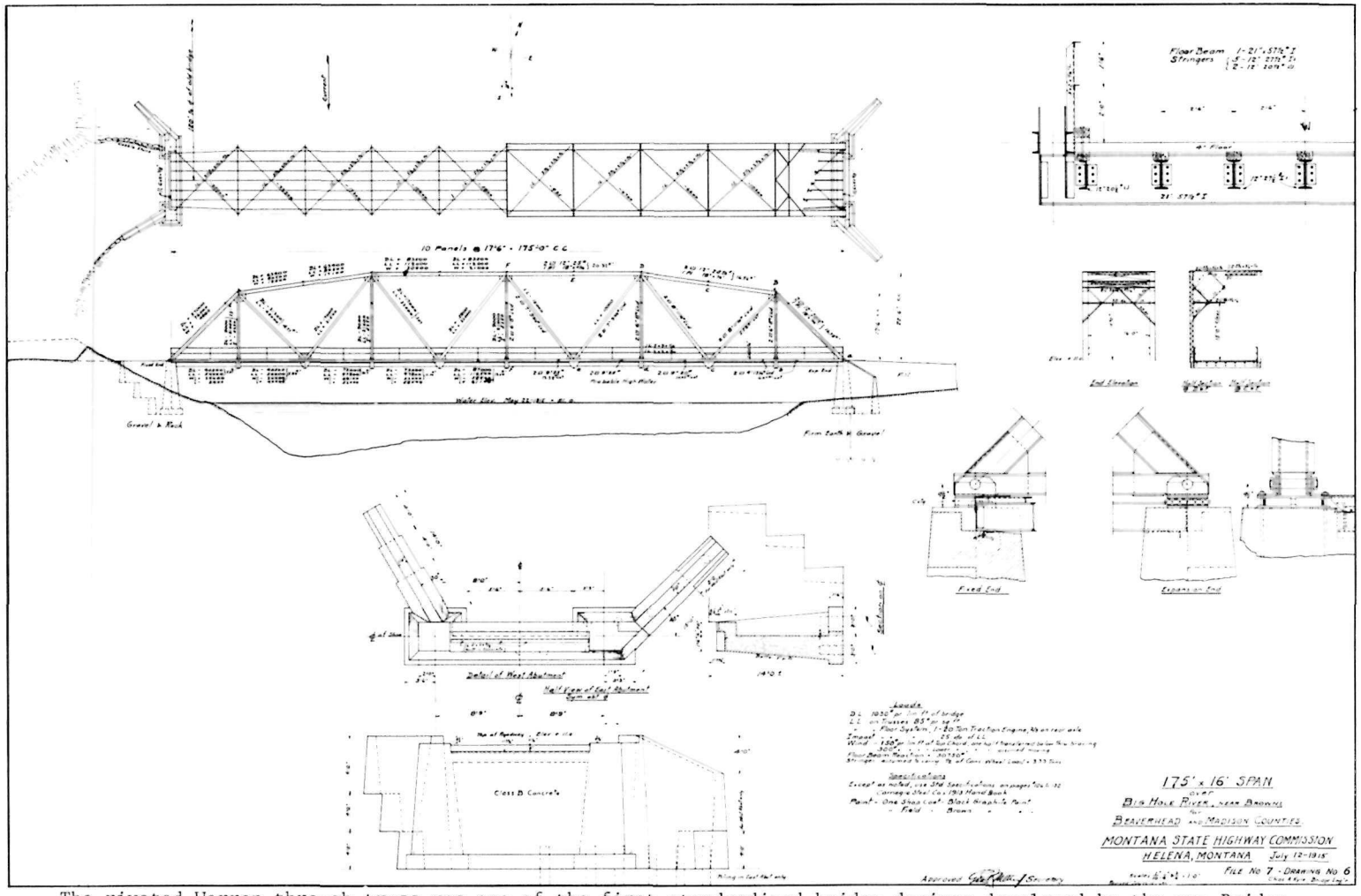
BEAVERHEAD/MADISON COUNTY

1. Browne's Bridge

This bridge is named after Joseph A. Browne, an early Montana pioneer who owned a toll bridge on this site over the Big Hole River. The present 16-foot wide structure is a riveted Warren through truss with 10 panels, each 17 feet 6 inches long, and clear span of 175 feet. Charles A. Kyle of the Montana State Highway Commission, Bridge Department, designed the bridge in 1915 and it was constructed by O. E. Peppard of Missoula in 1915-1916.

2. Big Hole River Bridge

The Union Pacific was the first railroad to enter Montana, reaching Butte in December, 1881. The original narrow guage--and later standard guage line--first crossed the Big Hole and other rivers between Idaho and Butte on wooden bridges. Constructed in



The riveted Warren through truss was one of the first standardized bridge designs developed by the new Bridge Department of the Montana State Highway Commission in 1915. Browne's Bridge (Description 1) was one of the first to be built according to those plans. (Montana State Highway Department).

1901, this riveted, triple-intersection Warren through truss bridge was the first permanent steel truss bridge built by the Union Pacific in Montana. The 144-foot main span is the longest Union Pacific span in the state and is approached on either end by a 50-foot plate girder span, each supported by a stone abutment.

3. Big Hole River Bridge--Glen

This single-span, pin-connected Pratt through truss was erected over the Big Hole River in 1892 by the King Bridge Company of Cleveland, Ohio. It is 128 feet in total span and 15 feet wide. One of the oldest remaining bridges in Montana, it connected the agricultural areas around Twin Bridges with the Union Pacific at Glen.

BIG HORN COUNTY

4. Big Horn River Bridge

Yellowstone County, Rosebud County and the Bureau of Indian Affairs all contributed financially to the construction of this three-span, 660-foot, pin-connected Parker through truss bridge over the Big Horn River. The structure was completed on July 9, 1911 by the Security Bridge Company of Minneapolis and Billings. With the homestead boom and the passing of the Burlington Route through the area, there was pressure to develop the Crow Indian Reservation. Big Horn County was created out of portions of Yellowstone and Rosebud Counties in 1913, two years after the bridge was completed. In 1916, the reservation lands were ceded to agricultural development and large sugar corporations moved into the county to raise sugar beets.[172]

The Coburg Bridge (Description 6) is one of numerous Blaine County bridges O. E. Peppard built during the homestead era. (Photograph Jet Lowe).

5. Big Horn River Bridge--Burlington Route

In 1894, the Chicago, Burlington and Quincy Railroad (Burlington Route) entered Montana from Wyoming, crossed what was to become Big Horn County and joined the Northern Pacific at Billings. This provided Montana with direct access to Chicago. The first bridges of the Burlington Route were wooden. In 1911 the Pennsylvania Steel Company of Steelton, Pennsylvania built permanent steel bridges for the Burlington Route through what is now Big Horn County. This three-span,

riveted Pratt through truss bridge over the Big Horn River is the largest of those bridges.

BLAINE COUNTY

6. Milk River Bridge--Coburg

O. E. Peppard of Missoula built this single-span, pin-connected, wood and iron combination, sub-divided Camelback through truss bridge over the Milk River in 1916. The through truss has a span length of 173 feet, is 17 feet wide and has a vertical clearance of 14 feet. It is a rare structural type, being a sub-divided wooden truss. It is the only one of its kind in Montana, and one of only a few surviving in the United States.

7. Milk River Bridge--Harlem

This 200-foot span, wood combination Pratt through truss bridge over the Milk River is the longest span wooden truss bridge in Montana. The truss has a width of 17 feet 5 inches and a depth of 20 feet. It contains 10 panels, each 20 feet in length. It was built in 1914 by O. E. Peppard of Missoula.

8. Milk River Bridge--Zurich

This structure over the Milk River has a pin-connected Pennsylvania through truss main span of 200 feet and a timber approach span of 21 feet. The bridge is 17 feet wide throughout. The through truss main span was built by O. E. Peppard in 1910 and has ten 20-foot panels. It is the longest surviving O. E. Peppard span.

This wooden Howe through truss at Fromberg was replaced by the present concrete arch bridge (Description 9). The Howe truss is typical of 19th Century Montana wooden Howe through trusses, (Fromberg Service Club).

CARBON COUNTY

9. Fromberg Bridge

The Fromberg Bridge is the oldest multi-arch concrete bridge in Montana and consists of three barrel-arched spans, each 56 feet long and 8 feet from the spring line to the top of the arch. It is an interesting anomaly in Montana bridge construction because it is a concrete structure. One wonders why a concrete arch bridge would be built over the Clark's Fork of the Yellowstone River in 1914 when a steel truss could have been built at less cost. (The final cost was twice what the county paid at that time for steel bridges of comparable length elsewhere along the Clark's Fork). The only clue to that question is that the designer of the bridge was the county

The Fromberg Bridge (Description 9) was built in 1914, very early for reinforced concrete arch construction in Montana. (Photograph Jet Lowe).

surveyor, C. A. Gibson, and the person who supplied the concrete for the job was a Fromberg businessman named John Gibson. Any relation between the two is not known, but can be suspected. John Gibson owned a concrete business in Fromberg and, in 1911, had patented a design for a pre-cast concrete culvert that could be assembled in sections on-site[173] (perhaps similar to the Security Culvert, patented by William S. Hewett). C. A. Gibson is a bigger mystery. His design for the bridge appears to be quite advanced for its time. Ernest Ransome had introduced the use of reinforcing bars for flattened arch construction with the Golden Gate Park bridge in 1889, but the method did not rival the Melan method of I-beam arches surrounded by concrete until some time after 1900.[174] Not until after 1910 did concrete arch designers move away from conservative arches toward flattened parabolic arches. The Fromberg Bridge, with a rise to span ratio of 1 to 7 (8-foot rise to 56-foot span) is relatively daring.[175] The barrel-arch, gravel fill spans are well reinforced with 1/2 inch and 3/4 inch bars. One must wonder where Gibson received design training. Several designs for concrete bridges exist in the Surveyor's Office at the Carbon County Courthouse in Red Lodge. This early use of reinforced concrete is probably related to the Anaconda Company coal mines in Red Lodge. The Three Forks Portland Cement Company of Trident had already existed for a couple of years when the Fromberg bridge was built. A copy of a bridge plan dated 1911 and bearing the Three Forks Company Stamp exists in the Carbon County bridge files. There is another concrete arch bridge in Montana built in in 1914: The Chicago, Milwaukee, St. Paul and Pacific overpass in Great Falls. It is a single-span structure and, though more elegant, is less surprising than the Fromberg Bridge because the Milwaukee Road built many concrete structures along its route.

10. Clark's Fork River Bridge

This two-span, 184-foot structure over the Clark's Fork of the Yellowstone River was built in 1925, making it the oldest known bridge built by the W. P. Roscoe Company of Billings. Each of the 92-foot Pratt through truss spans is pin-connected, an unusual construction method to be employed as late as 1925.

CASCADE COUNTY

11. Tenth Street Bridge

The 1,130-foot Tenth Street Bridge over the Missouri River in Great Falls is the longest multi-span concrete arch bridge in Montana and the oldest open spandrel concrete arch bridge in the state. The bridge was designed by Ralph Adams of Spokane, Washington and George H. Shanley of Great Falls. It was constructed by Porter Brothers of Spokane, Washington in 1920.

12. Rainbow Falls Bridge

This 1,130-foot railroad bridge crosses the Missouri at Rainbow Falls. It has four, 195 foot, pin-connected Pratt deck truss spans and shorter plate girder deck spans at either end. It was built in 1901 by the American Bridge Company for the Great Northern Railroad along its line which connected Great Falls, Helena and Butte to the main line at Havre.

13. C. M. S. P. & P. Overpass

This single-span, filled concrete arch bridge carries 25th Street North in Great Falls over the Chicago, Milwaukee, St. Paul and Pacific Railway (Milwaukee Road) tracks. The 68-foot bridge is 42 feet wide. Built in 1914, it is one of the oldest existing concrete arch structures in Montana. It also is typical of the kinds of concrete construction employed by the Milwaukee Road which used concrete for small bridges and for approach spans to large bridges more freely than did the other railroads in Montana.

CHOUTEAU COUNTY

14. Fort Benton Bridge

Faced with declining importance as a trade center, Fort Benton businessmen formed the Benton Bridge Company to build a bridge across the Missouri River to try to capture the

The Tenth Street Bridge (Description 11) over the Missouri River in Great Falls is the longest surviving multi-span, open spandrel concrete arch bridge in Montana. It and the recently demolished First Avenue North Bridge were built in 1920. (Photograph Jet Lowe).

trade of the developing Judith River Basin. The bridge was built by the Milwaukee Bridge and Iron Works of Milwaukee, Wisconsin within a year after the Great Northern reached Fort Benton in 1887. The original structure had a 75-foot, pin-connected Pratt through span; three-175-foot, pin-connected Baltimore through spans; and a 225-foot swing span. The swing span was required because, even though steamboat traffic no longer travelled the Missouri River into Fort Benton, the river at that point was still classified as navigable. The first ship to use the swing span was the Steamboat "OK" in 1908. In June of that year, the great Flood of 1908, destroyed the swing span. The Missouri River was then declassified as navigable at Fort Benton and a 225 ft. wood combination replacement span was built by O. E. Peppard in November 1908. That span was replaced by the present pin-connected, steel Parker through truss span in 1925 by Boomer, McGuire and Blakesley of Great Falls. The Fort Benton Bridge is the most historically significant bridge in Montana. Besides its historical associations, it was the first vehicular bridge across the Missouri River in Montana; it was the first all-iron vehicular truss bridge built in Montana; and it is the oldest remaining bridge in the state.

CUSTER COUNTY

15. Tongue River Bridge

Built in 1897 by William S. Hewett and Company of Minneapolis, Minnesota, the Tongue River Bridge in Miles City is the oldest surviving bridge in eastern Montana. The bridge has two approach spans from east and two from the west. The main span is a 233-foot, pin-connected Pennsylvania through truss and the bridge is 16 feet wide throughout.

The Fort Keogh Bridge (Description 16) is an excellent example of the pin-connected Pennsylvania truss used frequently for long spans throughout Montana in the early 20th Century. (Photograph Jet Lowe).

16. Fort Keogh Bridge

The first bridges crossing the lower Yellowstone River were constructed in 1895 at Glendive and at Billings. A second bridge at Billings was built in 1901. During the homestead era there was a great deal of agricultural development along the Yellowstone River. As result, ten bridges were built across the Yellowstone beween Billings and Glendive during the years 1902-15. All of these structures were erected by either William S. Hewett or the Security Bridge Company and all but one were multi-span, pin-connected Pennsylvania through truss bridges. The first of these ten bridges was the 1902 Fort Keogh Bridge constructed by W. S. Hewett and Company. It is the only one of the Pennsylvania spans remaining intact. The bridge has two main spans, each 310 feet long, with several approach spans.

17. Paragon Bridge, and

18. Kinsey Bridge

The Chicago, Milwaukee, St. Paul and Pacific Railroad (Milwaukee Road) was the only railroad to build steel bridges immediately upon entering

The Fort Keogh Bridge (Description 16) was recently restored by the U. S. Department of Agricultural Experiment Station at Fort Keogh. (Photograph Jet Lowe).

Montana. Each of these 1,080-foot structures consists of four, 270-foot, pin-connected Parker through truss spans. Both were probably built in 1907 by the American Bridge Company of New York and are, along with a similar bridge (Description 60) in Prairie County, the grandest of the Milwaukee Road bridges in Montana.

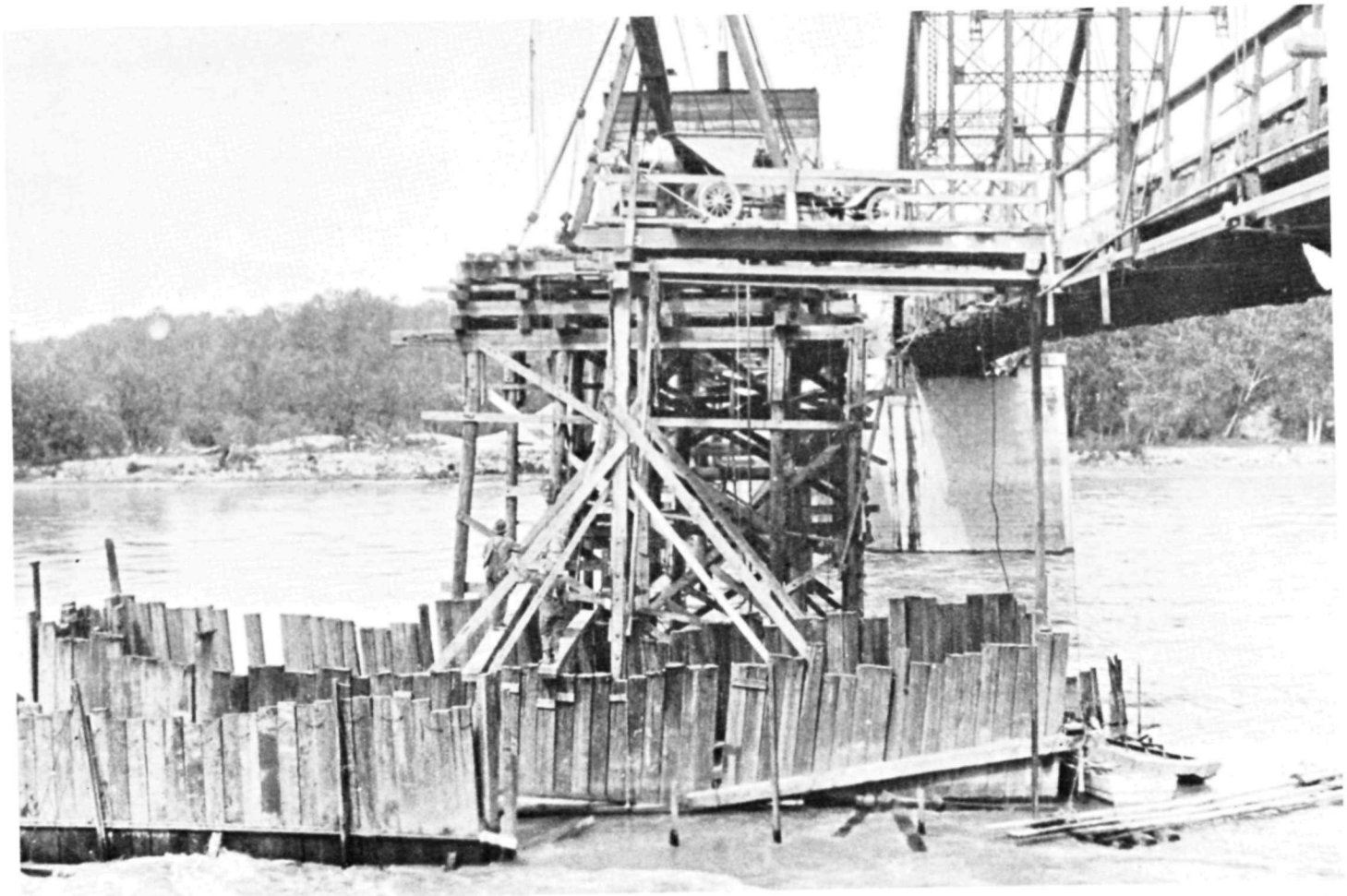
19. O'Fallon Creek Bridge

When the Milwaukee Road arrived in Montana, it spurred the development of small communities along its route, such as Ismay in eastern Custer County. The bridge over O'Fallon Creek near Ismay is significant because it features the two most prominent trusses employed in small bridges in Montana: the pin-connected Pratt pony and the riveted Warren pony. The two Pratt spans, each 63 feet, were built by the Security Bridge Company in 1907 when the Milwaukee Road came through. The 60-foot Warren span was built a few years later when the creek channel changed, necessitating another span.

DAWSON COUNTY

20. Bell Street Bridge

The first bridge over the Yellowstone River at Glendive was built in 1895 by the King Bridge Company of Cleveland, Ohio. It included a swing span since the Yellowstone was considered navigable. Portions of the structure washed out in 1899 and a new bridge, featuring three, 308-foot



The 1900 Yellowstone River Bridge at Glendive was used to transport concrete to mid-channel for construction of the piers of the 1926 bridge, known today as the Bell Street Bridge (Description 20). (Montana State Highway Department).

Pennsylvania truss spans, was built in 1900 by the Pueblo Bridge Company. In 1926, the bridge was replaced by the present six-span structure built by Boomer, McGuire and Blakesley of Great Falls. Each span is a 219-foot, riveted Warren through truss designed by the Montana State Highway Commission.

FERGUS COUNTY

21. Judith River Bridge

There are at present over 100 riveted Warren pony truss bridges in Montana. Of these, 57 were built between 1910 and 1919. The riveted Warren pony is the most prominent truss type in Montana, and the 1910's were it peak decade for construction. This 60-foot riveted Warren pony truss bridge over the Judith River was built by the Security Bridge Company of Billings in 1912. It was chosen to represent those 57 bridges because it is the only one that bears a bridge name plate.

22. Sample's Crossing Bridge

This 105-foot, pin-connected Parker through truss span was built in 1899 by the King Bridge Company. It was abandoned in favor of a concrete beam bridge in 1948 but; the superstructure still stands. It is representative of the agricultural development of the Judith River Basin and the competition between Fort Benton and other trade centers.

The Judith River Bridge (Description 21) is a riveted Warren pony truss, the most commonly used structural type of those covered by the Montana Historic Bridge Inventory. (Photograph Jet Lowe).

FLATHEAD COUNTY

23. Old Steel Bridge

Flathead County was created in 1893 and, in 1894, commissioned this structure built by Gillette and Herzog of Minneapolis, Minnesota. This multi-span bridge has three main, pin-connected Pratt through truss spans. One has a length of 200 feet and the other two are each 144 feet long. Wood stringer approach spans at either end bring the total length of the bridge to 610 feet. It is the oldest surviving bridge in northwestern Montana.

24. Coram Bridge

As the Great Northern Railroad continued westward from Havre in the early 1890's it built wooden bridges over the rivers it encountered in the mountains and foothills. Around 1900 it replaced these structures with steel trestles that supported deck trusses over the actual stream channels. The two, 210-foot, pin-connected Baltimore deck trusses of this bridge over the Flathead River at Coram are the largest of the Great Northern's several trestle bridges. It was built by the Lassig Bridge and Iron Works of Chicago, Illinois in 1898. During the 1920's, the middle line of trusses was added to accommodate heavier loads.

25. Columbia Falls Bridge

In 1911, A. Y. Bayne of Minneapolis, Minnesota was awarded the contract to build this bridge across the Flathead River at Columbia Falls. The two-225-foot, pin-connected Pennsylvania through truss spans of this structure are the longest he built in Montana. These two main spans are approached on either end by timber stringer spans.

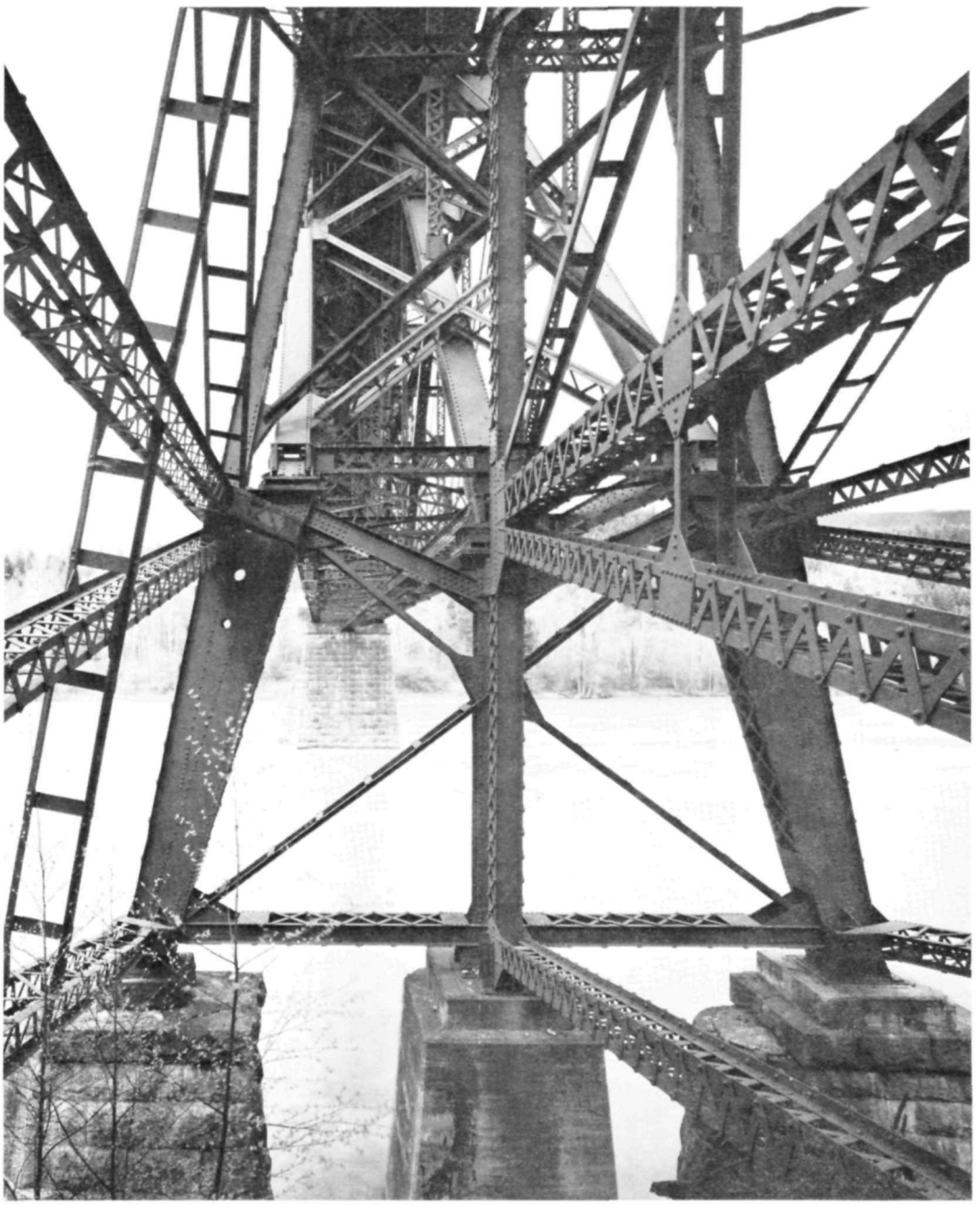
This Baltimore deck truss bridge across the Flathead River at Coram was built by the Great Northern Railroad in 1898. (Photograph Jet Lowe)

GALLATIN COUNTY

26. Nixon Bridge, and

27. Cameron Bridge

These two pin-connected Pratt through truss bridges in Gallatin County are the second and third oldest remaining bridges in Montana. Both were built by the Gillette-Herzog Manufacturing Company of Minneapolis, Minnesota in 1891. The Nixon Bridge is 148 feet long, 16 feet wide and was originally built over the West Gallatin River in Central Park, Montana. In 1924, Mougey and Whitaker of Bozeman removed and reconstructed the bridge at its present site over the Gallatin River. The Cameron Bridge is 130 feet long and 15 feet wide.



The middle line of trusses of the Coram Bridge (Description 24) was added to accommodate heavier freight loads. (Photograph Jet Lowe).

28. West Gallatin River Bridge

This 108-foot, pin-connected Pratt through truss bridge was built over the West Gallatin River in 1892 by Gillette-Herzog Manufacturing Company of Minneapolis. The bridge is 16 feet wide and virtually identical to the Jefferson River Bridge (Description #29).

29. Jefferson River Bridge

This pin-connected Pratt through truss was erected over the Jefferson River in 1894 by the Gillette-Herzog Manufacturing Company of Minneapolis. It is the oldest existing steel highway bridge over the Jefferson River and is 108 feet long and 16 feet wide. It is almost identical to the West Gallatin River Bridge (Description #28).

All of the Gallatin County bridges gain significance from their association with Gallatin Valley agriculture and from the fact that they are among the oldest surviving steel truss bridges in Montana.

GLACIER COUNTY

30. St. Mary River Bridge

There are several truss bridges in Montana which were built to carry irrigation siphons across rivers. This pin-connected Pratt through truss over the St. Mary River is particularly significant because it carries both siphon pipes and a roadway, and more importantly, because it is part of a system carrying water over a continental divide. The St. Mary River flows into Canada and Hudson's Bay. As part of the Milk River Irrigation Project, the United States negotiated an agreement to pipe water from the St. Mary River into the Milk River which flows into the Missouri and eventually into the Gulf of Mexico. A diversion dam was built about eight miles above this bridge. Water flows from the dam along the west side of the St. Mary to a point on the hill just west of this bridge. There the water enters twin pressure pipes. With a head of 160 feet, the water flows through the pipes, across this bridge, and by inverse siphon, up the east hill and over the divide into the Milk River

The St. Mary River Bridge (Description 30) carries water from the St. Mary River to the Milk River as part of an early 20th Century irrigation project. (Photograph Jet Lowe).

drainage. The bridge, built in 1915 by the Minneapolis Steel and Machinery Company, still carries water and vehicular traffic. It consists of two spans, each 96 feet long.

31. Intake Bridge

This abandoned bridge crosses the St. Mary River directly over the diversion dam which channels water from the St. Mary River to the Milk River. The bridge appears to have had three spans originally but the west span is now missing. The two remaining spans are supported by concrete piers which appear to be part of the diversion dam at the intake for the Milk River Irrigation Project Canal. Because of this, it is assumed that this pin-connected Pratt through truss bridge was constructed at the time of the Milk River Project. The superstructures of the two remaining spans are each about 120 feet long.

32. Baring Creek Bridge

This concrete arch bridge was built in the early 1930's as part of the Going-To-The-Sun-Highway Project through Glaicer National Park. It is one of only two sizeable bridges built along the route and crosses the Baring Creek. The arch spans 66 feet and has stone spandrel walls and railings.

GOLDEN VALLEY COUNTY

33. Barber Bridge

In 1911, Musselshell County was formed and one of the first acts of the new Musselshell County Commissioners was to build four new steel bridges over the Musselshell River in order to connect the two halves of the county. One of those bridges is this 157-foot, four span bridge built in 1911 by Security Bridge Company of Minneapolis. The main span is a 98-foot, pin-connected Pratt through truss span. This span is approached from the north by three 19-foot 8-inch steel stringer spans. Golden Valley County was formed out of Musselshell County in 1921.

34. Larson Bridge

This 106-foot, single-span riveted Pratt through truss bridge is privately owned and crosses the Musselshell River on the Larson Ranch. It was built at Lavina by the King Bridge Company of Cleveland, Ohio. It was an early Musselshell River bridge and signifies the utility of truss structures.

35. Drummond Bridge

The Pencoyd Iron Works (A & P Roberts Company) of Pencoyd, Pennsylvania built this pin-connected Pratt through truss bridge over the Clark Fork River for the Northern Pacific Railroad in 1896. It serves the Philipsburg branch line which leaves the main line at Drummond, carrying it over the Clark Fork River. The Pratt main span is approximately 150 feet in length and is approached at each end by wood stringer spans. It is one of the three oldest remaining railroad bridges in Montana (see Descriptions 52 and 69)

JEFFERSON COUNTY

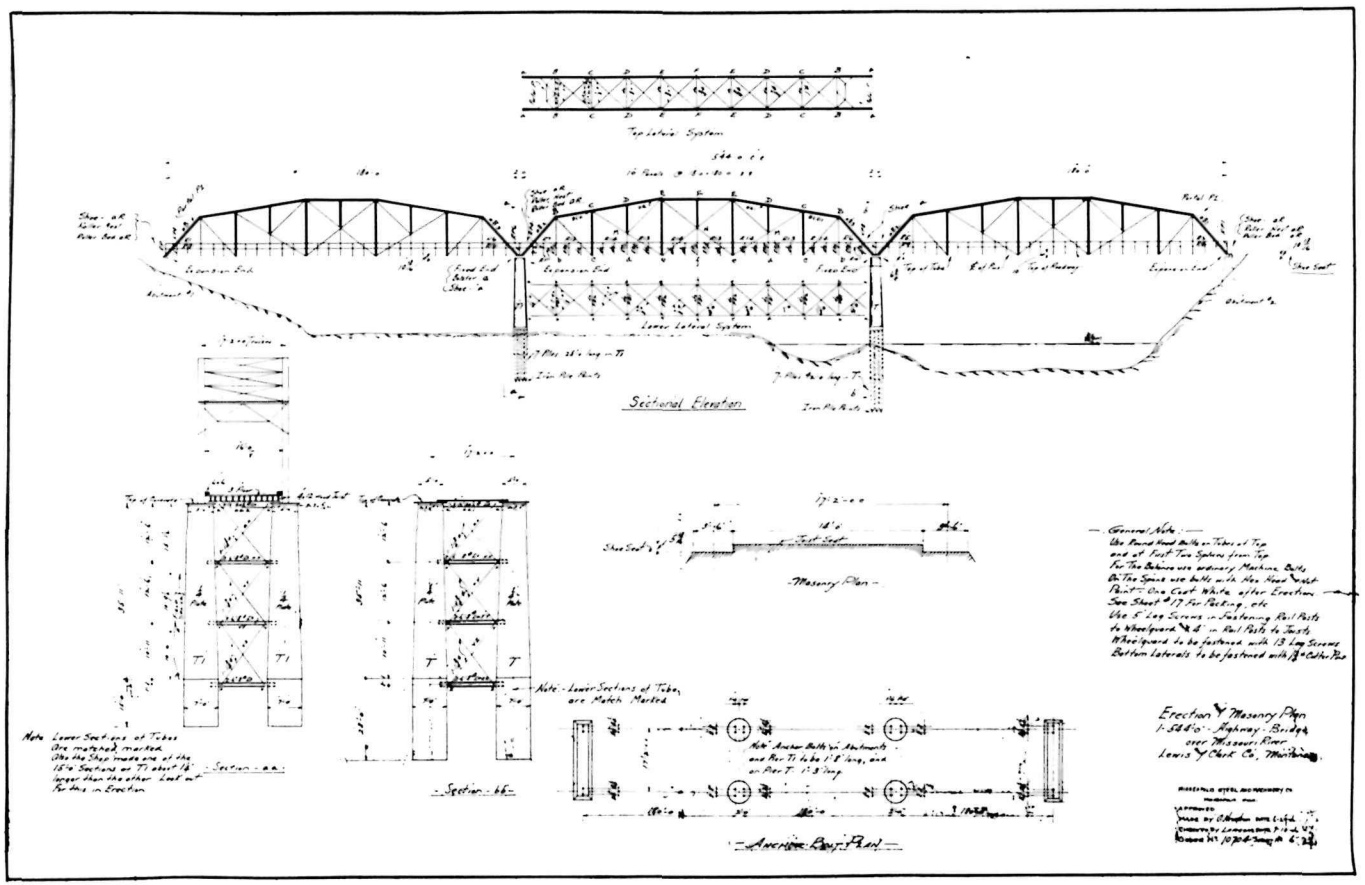
36. Boulder River Bridge

The Gillette-Herzog Manufacturing Company of Minneapolis built this pin-connected Pratt through truss over the Boulder River in 1899. The single-span, 77-foot long and 16-foot wide structure was built to serve ranchers and miners in the region of Boulder and Elkhorn, a quartz mining town. The superstructure is 19 feet in depth and has 4 panels 19 feet each.

LEWIS AND CLARK COUNTY

37. York Bridge

Built by the Minneapolis Steel and Machinery Company in 1906, this three-span,pin-connected Pennsylvania through truss bridge (180 feet per span, 16 feet wide throughout) over the Hauser Reservoir was one of the earliest bridges over the Missouri. Its construction is tied to successful negotiations between the Lewis and Clark County Commissioners and Samuel Hauser and Anton Holter of the Helena Power Transmission Company. By agree-

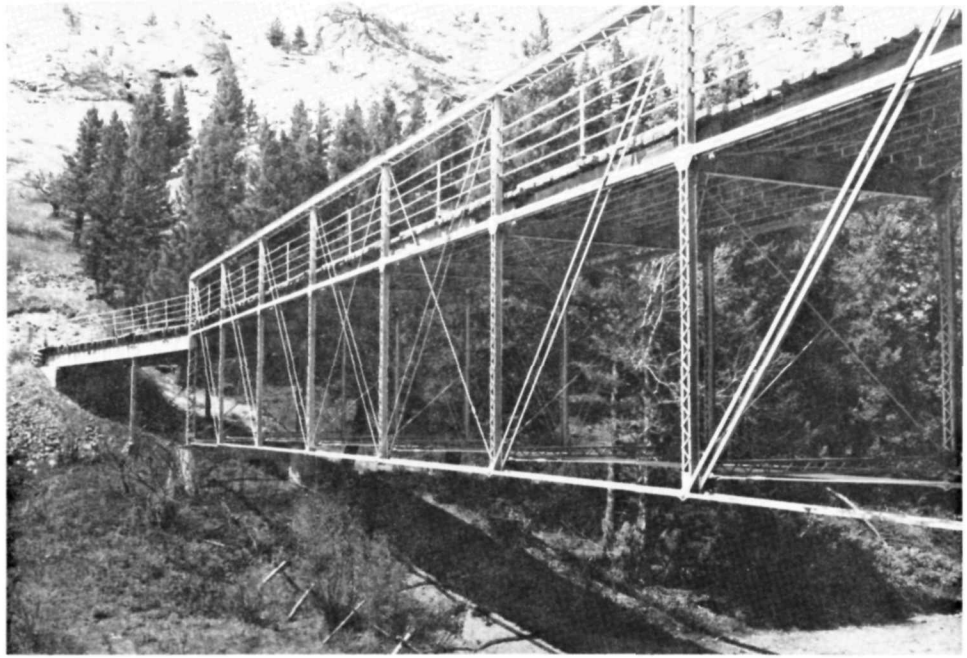


The York Bridge (Description 37) over the Hauser Reservoir (Missouri River) was built in 1906 by the Minneapolis Steel and Machinery Company. (Montana State Highway Department).

ing to pay a portion of the cost of the bridge, Hauser and Holter gained permission to build their hydro-electric dam, one of the first in the state. The dam gave way in 1908 and the rapid downstream flow of water seriously damaged the bridge's substructure. The bridge was soon repaired and remained in use until 1978.

38. Dearborn River High Bridge

Built to serve an early agricultural area west of Great Falls, this 1897 King Bridge Company bridge is an extremely rare structural type. Even in its day it was considered rare.[176] The main span is a pin-connected, half-deck Pratt truss span, 160 feet long and 16 feet wide. The truss itself is a standard Pratt but the deck is attached to the superstructure near the mid-points of the vertical members rather than along the top or bottom chords, as is standard practice for deck and through truss designs, respectively. The Dearborn River Bridge is one of only a few of the half-deck trusses in the United States.



The Dearborn River High Bridge (Description 38) is a Pratt half-deck truss, which means the deck is connected midway between the upper and lower chords. (Photograph Jet Lowe).

39. Wolf Creek Bridge

The Wolf Creek Bridge was built in 1933 by the W. P. Roscoe Company of Billings. It was the first multi-span continuous truss bridge in Montana. The structure has one 21-foot concrete girder approach span and three continuous Warren through truss spans of 135 feet, 180 feet and 135 feet in length. Several steel truss highway bridges similar to this one were built in the state during the 1930's and 40's.

40. Craig Bridge

The Craig Bridge was built in 1903 by the Elkhart Bridge Company of Elkhart, Indiana and is Montana's second oldest vehicular bridge over the Missouri River. As originally constructed, the bridge had three, 136-foot 8-inch, pin-connected Pratt through truss spans with a 30-foot pin-connected Queen-post pony truss span at each end. However, the Queen-post span at the east end has been replaced with a timber stringer span.

The Dearborn River High Bridge (Description 38) was built in 1897 by the King Bridge Company of Cleveland, Ohio. (Photograph Jet Lowe).

41. Little Prickly Pear Creek Bridge -- Wolf Creek, and

42. Pacific Street Bridge

The riveted Warren pony truss bridge was the most commonly used truss configuration in Montana. These two structures in Lewis and Clark County are the oldest remaining such bridges in the state. They were built in 1897 by the Missouri Valley Bridge and Ironworks of Leavenworth, Kansas. Both are single spans 56 feet long and 22 feet wide.

43. Williams Street Bridge

This bridge is the oldest remaining pin-connected Pratt pony truss in Montana. This truss configuration preceded the riveted Warren pony truss as the most commonly used for small spans in the state. The Williams Street Bridge was built in 1894 over Ten Mile Creek and is 67 feet long and 26 feet wide.

44. Little Prickly Pear Creek Bridge --Sieben

The steel plate girder and the deep I-beam have come to replace the truss as the favorite steel bridging structures in Montana. Although the plate girder was frequently used for railroad bridges around 1900, it was rarely used for vehicular bridges. This bridge, built in 1901 by the Gillette-Herzog Manufacturing Company of Minneapolis, is the oldest surviving steel plate girder bridge in the state. The structure consists of two steel plates welded together and is 36 feet long and 16 feet wide.

45. Pugsley Bridge

Built in 1951 by Hurdle Brothers of Billings, this is the only vehicular suspension bridge Montana and perhaps the only one ever constructed in the state. There are--and have been--several pedestrian suspension bridges in the state. This bridge replaced a truss bridge built in 1914 by O. E. Peppard. The present structure is 326 feet in total length with a 290-foot span between towers. The towers rise 54 feet above the concrete piers on which they stand. These piers are piers from the previous 1914 truss bridge.

LINCOLN COUNTY

46. Troy Bridge

The Troy Bridge was built in 1912 and is 488 feet long. It is comprised of two, 222-foot, pin-connected Parker through truss spans. It is the only remaining bridge of three built over the Kootenai River by the Coast Bridge Company of Portland, Oregon. That it was awarded to the Coast Bridge Company is indicative of the fact that extreme northwestern Montana relates more directly to the Pacific Northwest, while the rest of the state relates more directly to the Midwest from where most out-of-state bridge builders came.

MADISON COUNTY

47. Varney Bridge

This is a two-span structure with each span 95-foot long, 15-foot wide, pin-connected Pratt through truss. Built in 1897 by the King Bridge Company of Cleveland, Ohio, it is the oldest remaining bridge over the Madison River.

48. Blaine Spring Creek Bridge

This single-span, pin-connected Pratt through truss bridge is the oldest remaining in Madison County and one of the oldest in Montana. It was built in 1892 by the King Bridge Company of Cleveland, Ohio and moved to its present location over the Blaine Spring Creek in more recent times. The bridge is 125 feet long and 14 feet wide.

49. Glen/Twin Bridges Road Bridge

This single-span, pin-connected Warren through truss, which is a rare structural type, was built in 1890's. Spanning a Big Hole River irrigation ditch, the bridge is 90 feet long and 16 feet 11 inches wide and connects Twin Bridges to the Union Pacific at Glen.

50. Silver Star Bridge

This riveted Warren pony truss span was built in 1913, about 20 years before such trusses of approximately 100-foot spans became popular with the Montana State Highway Commission. This bridge, with two-96 foot spans, was built by the Continental Bridge Company of Peotone, Illinois. It is 17 feet 5 inches wide throughout.

MISSOULA COUNTY

51. Marent Trestle

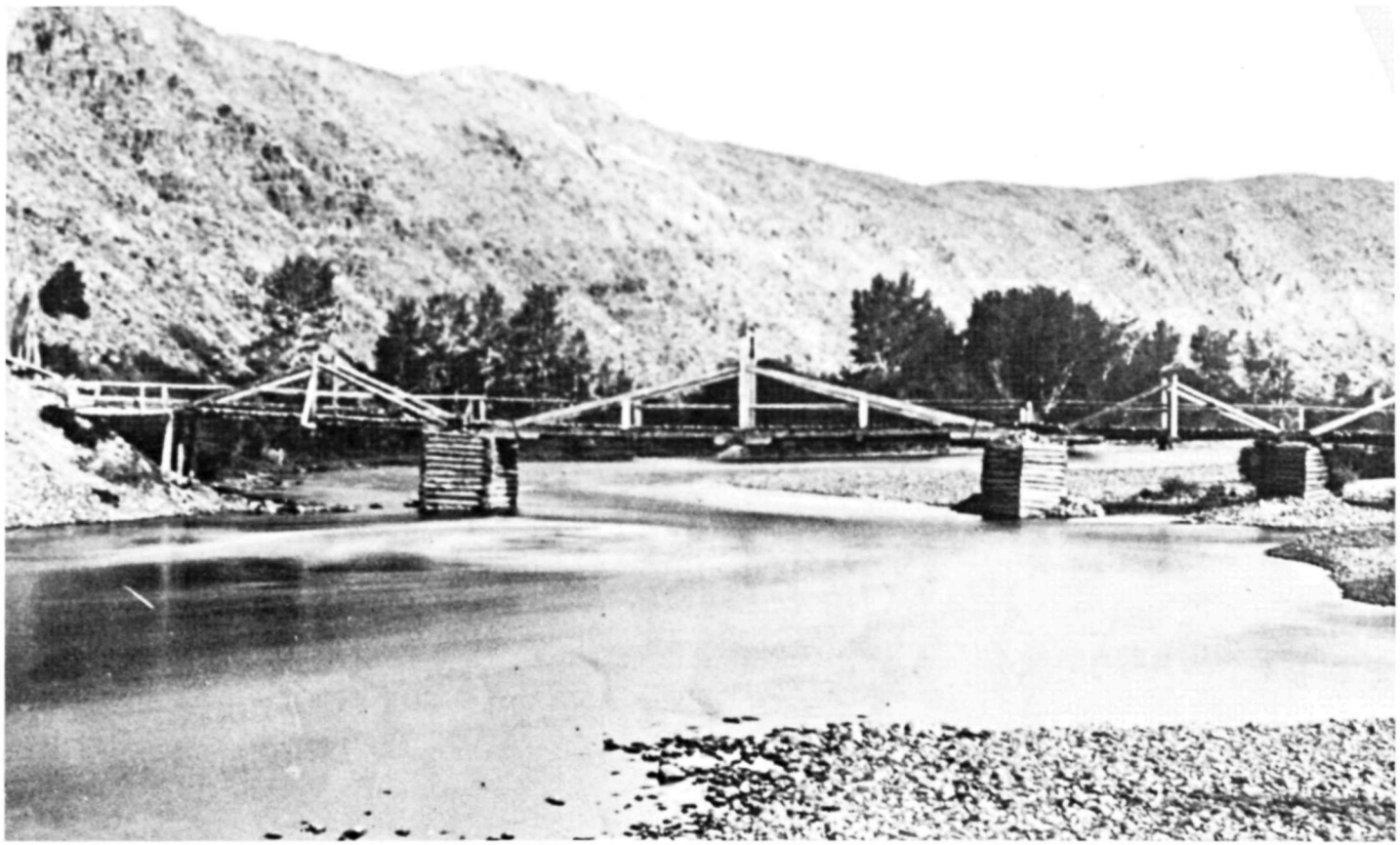
This steel trestle is 226 feet tall and 866 feet long and was built by the American Bridge Company in 1927. The trestle carried the Northern Pacific Railroad over the Marent Gulch and is probably one of the most spectacular structures in the state. It consists of two, 30-foot plate girder deck spans at either end, five 120-foot riveted Pratt deck spans and 4 major trestle towers, each carrying 24 feet of track. It replaced a nearly identical iron trestle built in 1885 which had replaced the original 1883 wooden trestle.

52. Bitterroot River Bridge

This bridge carries the Bitterroot branch line of the Northern Pacific over the Bitterroot River on the outskirts of Missoula. The main span, a 150-foot, pin-connected Pratt through truss, was built in 1896 by A & P Roberts Company, Pencoyd Iron Works, Pencoyd, Pennsylvania and is one of the oldest remaining railroad bridges in Monana (see Descriptions 35 and 69). It is approached on the west by a 75-foot plate girder deck span and on the east by a 120-foot riveted Warren pony span of more recent construction.

53. Van Buren Street Bridge

This bridge consists of two, 132-foot, pin-connected Parker through truss spans with a timber trestle approach on the south and a timber stringer approach on the north. It is the only through truss in the state with polygonal lower chords, a configuration that seems to have been used to raise the deck above high water. O. E. Peppard built this bridge in 1908. Earlier



Browne's Bridge (Description 1) over the Big Hole River was an important part of the network of southwest Montana roads connecting the gold fields with Corrine, Utah and with Fort Benton on the Missouri River. The king post spans survived until 1921. (Montana State Historical Society).

The Brockway Ford Bridge (Description 54) is the oldest remaining wooden truss in Montana. (Photograph Jet Lowe)

that same year, Missoula and the rest of Montana experienced its worst flooding in recorded history. The Higgins Avenue Bridge, built by Peppard in the 1890's, was washed out by the flood and Peppard used part of that bridge in the two-span superstructure of the Van Buren Street Bridge.

MUSSELSHELL COUNTY

54. Brockway Ford Bridge

This 150-foot, pin-connected Camelback through truss bridge is the oldest remaining wooden truss in Montana. It was built over the Musselshell River in 1893 by S. M. Hewett Company of Minneapolis. In 1911, shortly after Musselshell County came into being, this structure was moved from its original site at Roundup to its present site 13 miles downstream.

55. Melstone Bridge, and

56. East Roundup Bridge

One of the first acts of the new Musselshell County Commissioners, after the county was created in 1911, was to build four new steel bridges over the Musselshell River to connect the two halves of the county. The Security Bridge Company of Minneapolis was awarded the contract of which these two pin-connected Pratt through truss bridges were a part. The Melstone Bridge has a truss of 131-foot span and the East Roundup Bridge has a 120-foot main span with a 50-foot pony approach span.

PARK COUNTY

57. Springdale Bridge

The Springdale Bridge was built in 1908 and 1916 by the Minneapolis Steel and Machinery Company. It consists of two pin-connected spans: a 234-foot Pennsylvania through truss (1908) and a 108-foot Pratt through truss (1916). The bridge originally connected the Northern Pacific station at Springsdale with Hunter's Hot Springs, a resort widely publicized by the Northern Pacific Railroad. Because they were built on a bend in the Yellowstone River, bridges at the site have had a history of damaged substructures.

58. Carter Bridge

Built on the site of one of the earliest Yellowstone River Crossings in Park County, the present Carter Bridge is a 270-foot, multi-span, open spandrel, concrete arch bridge. Three pairs of concrete arch rings (the middle spanning 98 feet 8 inches and the others spanning 88 feet 2 inches) spring from concrete abutments and two concrete river piers. Few such structures were built in the state. This one, completed in. 1922, was built by B. N. Crenshaw of Livingston.

59. Pine Creek Bridge

This bridge crossing the Yellowstone River near Pine Creek has a 220-foot, pin-connected Parker through truss span. This main span is approached on either end by a 20-foot wood stringer span. It was built in 1910 by the Montana Bridge and Iron Company of Livingston and is the largest remaining bridge built by them. This was the only early Montana bridge company, besides Peppard and Security, to build more than a handful of bridges. Although the company lasted only a couple of years and never reached the scale of Peppard or Security, it did build numerous bridges in Park County and elsewhere.

PRAIRIE COUNTY

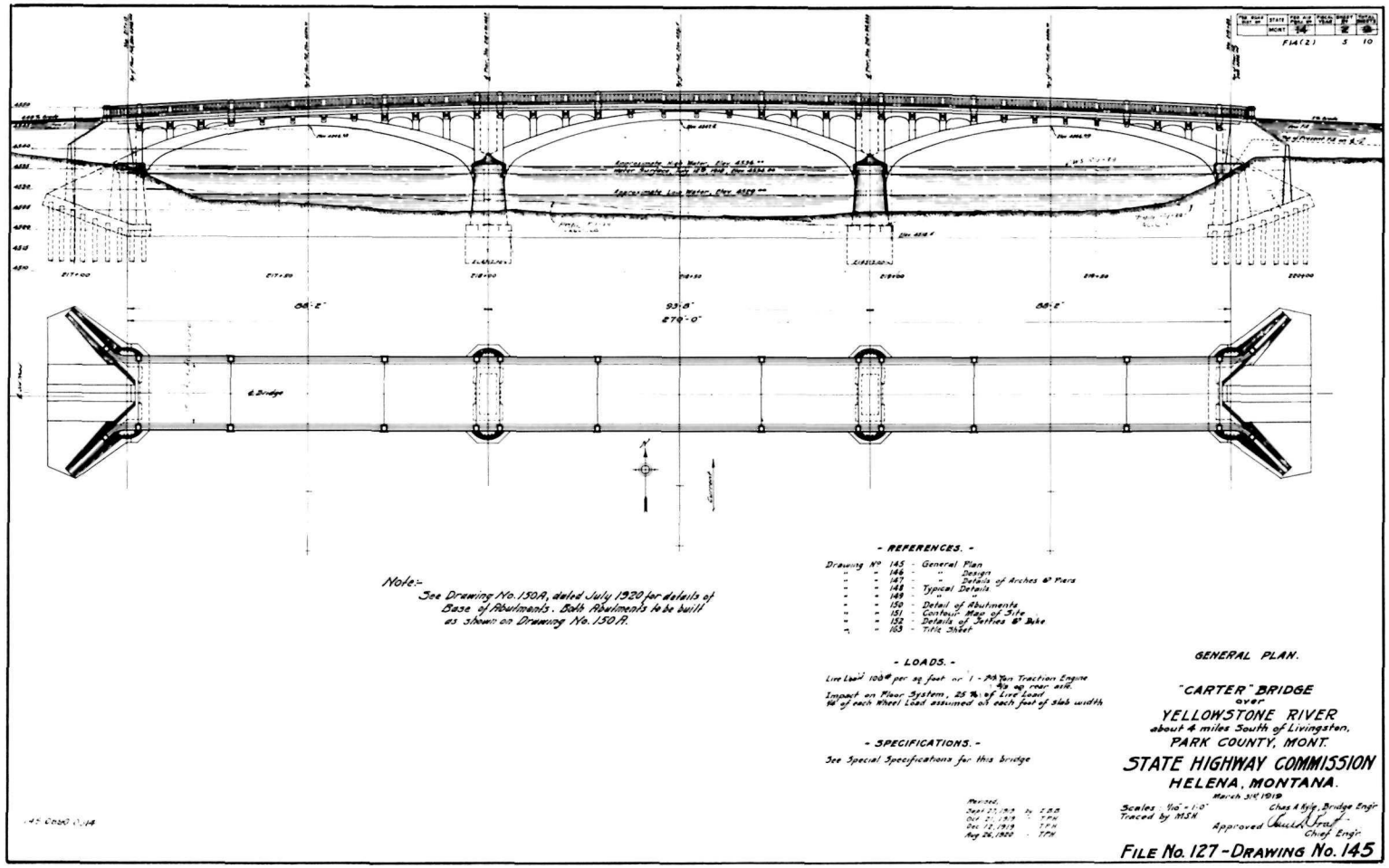
60. Calipso Bridge

This is the third, and eastern most, of the Chicago, Milwaukee, St. Paul and Pacific Railroad Yellowstone River bridges (see Descripions 17 and 18). The structure is comprised of four pin-connected Parker through truss spans, each 270 feet in length.

RAVALLI COUNTY

61. Victor Bridge

This pin-connected Pratt through truss bridge crossing the Bitterroot River was built in 1907.



In 1920, the Montana State Highway Commission designed the Carter Bridge (Description 58). It still stands today with a new wider deck. (Montana State Highway Department).

The main span is 148 feet long and approached by a 20-foot wood stringer span on either end. It is the longest of the three oldest remaining O. E. Peppard bridges in Montana. This structure also gains significance from its association with the orchard industry in the Bitterroot Valley where it connected the trade center of Victor with the Northern Pacific branch line.

62. Bitterroot Valley Irrigation District Siphon

In 1905, this riveted Warren through truss structure was built to carry an irrigation siphon over the Bitterroot River. This was the only irrigation project siphon in Montana that was not built by the U. S. Reclamation Service. The entire project was built by a private developer as part of a land development scheme and was to provide water for potential orchards in Bitterroot Valley.

RICHLAND COUNTY

63. U.S.R.S. Main Canal Bridge--North of Burns, and

64. U.S.R.S. Main Canal Bridge--South of Burns

These two, single-span, pin-connected Pratt through truss bridges were built in 1907 by A. Y. Bayne and Company of Minneapolis to carry public roads over the main canal of the Lower Yellowstone Irrigation Project. Several smaller bridges were also constructed over the main canal. Both of these structures are 84 feet long and 18 feet wide with a vertical clearance of 12 feet. An interesting feature of these bridges is that the trusses of each are offset with respect to each other by one panel.

RICHLAND/ROOSEVELT COUNTIES

65. Snowden Bridge

The Snowden Bridge, over the Missouri River, is the only vertical lift bridge in Montana. It was built by the American Bridge Company in 1913 for the Great Northern Railroad along with the Fairview Bridge which crosses the Yellowstone River in North Dakota. Both were designed by the renowned engineering firm of Waddell and Harrington. The Snowden Bridge, when completed, was the longest vertical lift bridge in existence and had the second largest clear opening of all movable bridges in the world.[177] The bridge consists of three 275-foot fixed spans and the 296-foot life span, all of which are riveted Parker through trusses. In 1926, a timber ramp and a plank deck were added to accommodate vehicular traffic. The lift span was rarely used, and today the machinery is inoperable.

66. Wolf Point Bridge

Erected in 1930 by the Missouri Valley Bridge and Iron Company of Leavenworth, Kansas, this was the first bridge built across the Missouri River between Fort Benton and Williston, North Dakota. The three main spans are riveted Pennsylvania through trusses, one 400 feet long and two 275 feet long. The 400 foot span is by far the longest in Montana.

SANDERS COUNTY

67. Main Channel Bridge, and

68. Dry Channel Bridge

These bridges cross the Clark Fork at Thompson Falls, just above the Thompson Falls Power Plant. They were designed by William Pierce Cowles, a Minneapolis engineer, and were built in 1911 by O. E. Peppard of Missoula. The Dry Channel Bridge, the smaller of the two, is 377 feet long and crosses the reservoir of the Thompson Falls Power Plant. Its three main spans are 90-foot, pin-connected Pratt through trusses. The Main Channel Bridge is 588 feet long and crosses a rock gorge of the Clark Fork below the Main Channel Dam of the Power Plant. An eight-span bridge with three pin-connected Pratt deck trusses, it is the longest remaining Peppard bridge. However, the structure is no longer open to traffic.

The Snowden Bridge (Description 65) was built in 1913 over the Missouri River. (Photograph Jet Lowe).

69. Flathead River Bridge

This four-span, pin-connected Pratt through truss bridge was built for the Northern Pacific in 1896 by the Milwaukee Bridge and Iron Company of Milwaukee, Wisconsin. Each span is approximately 182 feet in length. It is one of the three oldest remaining railroad bridges in Montana (see Descriptions 35 and 52) and the only one of the three on a main line.

SILVER BOW COUNTY

70. Silver Bow Canyon Bridge--1897 and,

71. Silver Bow Canyon Bridge--1913

These two bridges carry the Butte, Anaconda and Pacific Railroad (B. A. & P.). The 1897 structure was built by the Lassig Bridge and Iron Works of Chicago, Illinois and carries the road over the Silver Bow Creek and the Northern Pacific (Burlington Northern) tracks. This bridge has five plate girder deck spans of lengths varying from 32 to 64 feet, and a 96-foot, riveted Warren pony truss span, the only truss span owned by the B. A. & P. The 73-foot, three-span plate girder bridge was built by the Wisconsin Bridge and Iron Company of Milwaukee, Wisconsin in 1913.

Prior to 1913 the Chicago, Milwaukee, St. Paul and Pacific Railroad (Milwaukee Road) travelled over the B. A. & P. tracks between Butte and Gregson. But when both railroads electrified their lines--the B. A. & P. to 2400 volts DC and the Milwaukee Road to 3000 volts DC--it became necessary that the Milwaukee Road have its own track so the electrical current for the trains could be drawn from Milwaukee Road overhead wires. Thus, the 1913 bridge was constructed at Milwaukee Road expense to carry the B. A. and P. track over the new Milwaukee Road tracks. This structure represents the electrification of these two railroads, a significant event in Montana history as well as in the history of electric railroads.

STILLWATER COUNTY

72. Reedpoint Bridge

The Secruity Bridge Company of Minneapolis, Minnesota and Billings, Montana built this structure over the Yellowstone River at Reedpoint in 1911. It is one of the older bridges on the river and consists of three, 152-foot, pin-connected Camelback through trusses approached at the south end by a wood stringer span.

73. Kerns Crossing Bridge

The main span of this 173-foot bridge over the Stillwater River is a 108-foot, pin-connected Pratt through truss span approached at both ends by wood stringer spans. In 1906, the William S. Hewett Company submitted the low bid for a bridge at Kerns Crossing. However, by the time the county commissioners were ready to sign the contract in 1907, a transition to the Security Bridge Company had occurred.

SWEET GRASS COUNTY

74. Greycliff Bridge, and

75. Voques Bridge

Built by the Security Bridge Company in 1911 and 1914, respectively, these are two of the older bridges on the Yellowstone River. Both have two main spans which are pin-connected Camelback through trusses. Those of the Greycliff Bridge are 175 feet in length while those of the Vogues Bridge are 190 feet. The deck of each is 16 feet wide.

TETON/LEWIS AND CLARK COUNTIES

76. Sun River Bridge

This bridge was designed to carry an irrigation siphon pipe over the Sun River. Unlike the St. Mary River Bridge (Description 30) which carried a roadway and two pipes side-by-side, this structure carried the narrow roadway along the top chord and the pipe along the lower chord. The Sun River Bridge or Pishkin Canal Siphon was built as part of the Sun River Irrigation Project for which work began in 1905. The Pishkin Canal has since been modified so the siphon is no longer necessary and the bridge

The Main Channel Bridge (Description 67) was built in 1911 in association with the Thompson Falls Power Plant downstream. (Photograph Jet Lowe).

carries only vehicular traffic. The structure consists of two 112-foot riveted Warren trusses.

TOOLE COUNTY

77. Marias River Bridge

The history of this bridge is not known except that it was moved off the Marias River in 1954 when the river was dammed to form the Tiber Reservoir. The structure is approximately 160 feet long and is the only Whipple double intersection Pratt truss in the state. Judging from its portal bracing, it appears to have been built by the King Bridge Company of Cleveland, Ohio.

VALLEY COUNTY

78. Tampico Bridge

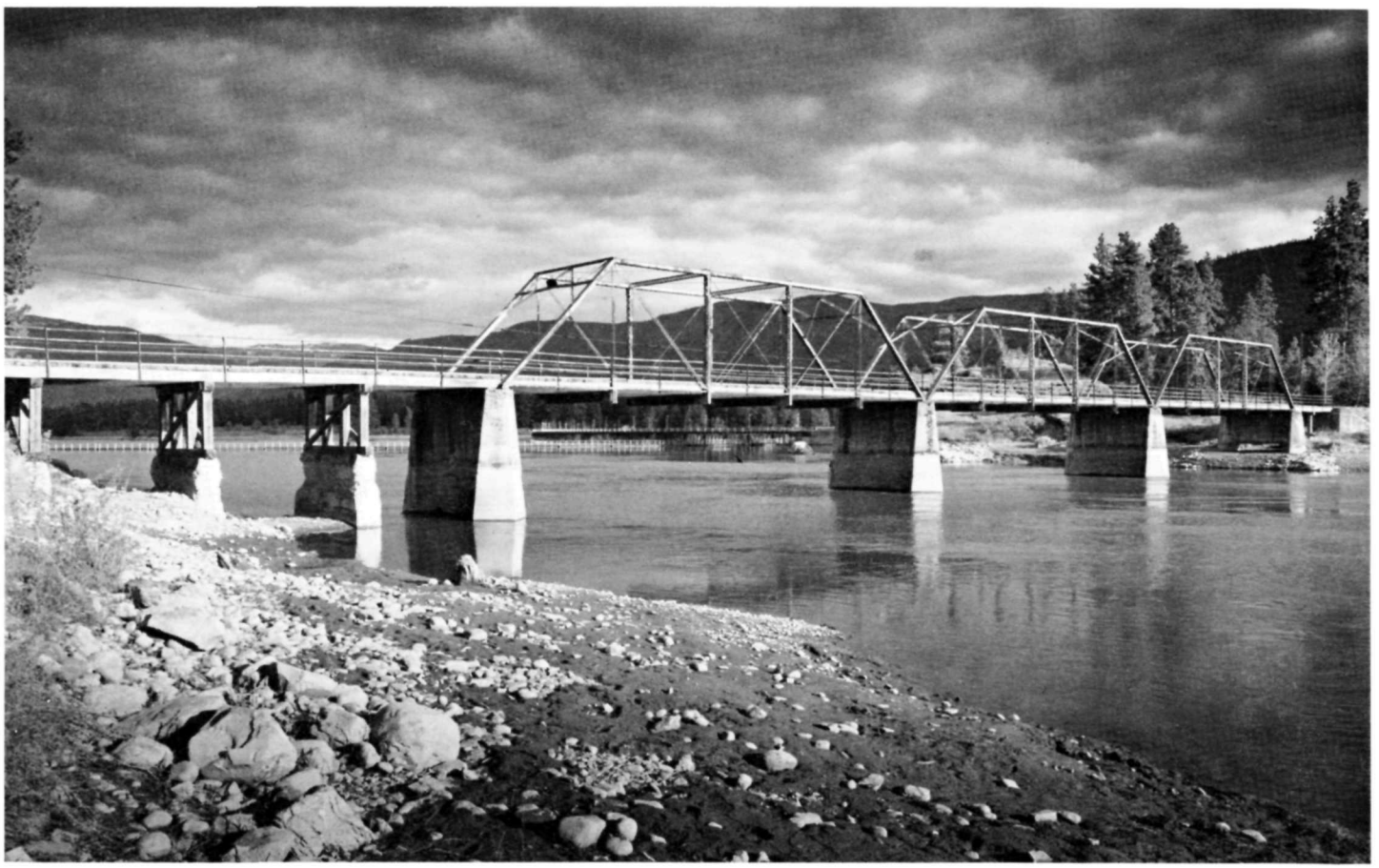
The "Highline," of which Valley County is a part, was rapidly settled during the homestead era. Numerous bridges were built across the Milk River and smaller streams to get agricultural produce to the Great Northern Railway station and then on to distant markets. This three-span structure was built in 1911 by the Illinois Steel Bridge Company of Jacksonville, Illinois and is the earliest of several similar truss bridges over the Milk River. The main span is a 200-foot, pin-connected Parker through truss with a 25-foot steel stringer approach span at either end. The main span of this bridge is identical to the main span of the Milk River bridge south of Whatley which was erected by the same company in 1912.

YELLOWSTONE COUNTY

79. Pompey's Piller Bridge, and

80. Duck Creek Bridge

Both structures, crossing the Yellowstone near Billings, were built in 1915 by the Security Bridge Company of Minneapolis and Billings. The last of the great Yellowstone River truss bridges built during the homestead boom, these two are the oldest riveted Warren through truss vehicular bridges in Montana. Pompey's Piller Bridge has three main spans of 190 feet each and a 37-foot plate girder stringer approach span at each end. The three main spans of the Duck Creek Bridge are each 152 feet long with a 39-foot, plate girder span at either end.



The Dry Channel Bridge (Description 68) is typical of Pratt through truss bridges built throughout Montana around the turn of the century. (Photograph Jet Lowe).

FOOTNOTES

1. K. Ross Toole, Montana: An Uncommon Land (Norman: University of Oklahoma Press, 1959), p. 43.

2. Toole, p. 56.

3. Toole, p. 53.

4. M. A. Leeson, History of Montana: 1739-1885, (Chicago: Warner, Beers and Company, 1885) p. 837.

5. Toole, Montana: An Uncommon Land, p. 87.

6. Montana State Highway Department (MSHD), History of the Montana State Highway Department: 1913-1942 (Helena: Montana State Highway Department, 1943), p. 1.

7. Leeson, History of Montana: 1739-1885, p. 837.

8. Toole, Montana: An Uncommon Land, p. 79.

9. Toole, p. 157.

10. Helena F. Sanders, History of Montana (Chicago: Lewis Publishing Company, 1913), p. 280.

11. Toole, Montana: An Uncommon Land, p. 69.

12. Toole, p. 72.

13. Michael P. Malone and Richard B. Roeder, Montana: A History of Two Centuries (Seattle: University of Washington Press, 1976), p. 51.

14. Malone and Roeder, p. 145.

15. M. Betty Madsen and Brigham D. Madsen, North to Montana, (Salt Lake City: University of Utah Press, 1980), p. xvi.

16. Madsen and Madsen, p. 145.

17. Sanders, History of Montana, p. 289.

18. Patricia M. Ingram, Historic Transportation Routes through Southwest Montana (Dillion: Bureau of Land Management, 1976), see maps.

19. MSHD, History of the Montana State Highway Department: 1913-1942, p. 2.

20. MSHD, p. 4.

21. MSHD, pp. 5-7.

22. Leeson, History of Montana: 1739-1885, p. 837.

23. Toole, Montana: An Uncommon Land, p. 83.

24. Malone and Roeder, Montana: A History of Two Centuries, pp. 130-131.

25. Clark C. Spence, Montana: A History (New York W. W. Norton and Company, Inc., 1978) p. 131.

26. Spence, p. 132.

27. Malone and Roeder, Montana: A History of Two Centuries, p. 112.

28. Malone, and Roeder, p. 117.

29. Malone and Roeder, pp. 115-116.

30. Toole, Montana: An Uncommon Land, p. 151.

31. Toole, Montana: An Uncommon Land, p. 152.

32. Spence, Montana: A History, p. 40.

33. Malone and Roeder, Montana: A History of Two Centuries, p. 59.

34. Sanders, A History of Montana, p. 289.

35. Malone and Roeder, A History of Two Centuries, p. 60.

36. Sanders, A History of Montana, p. 290.

37. Leeson, Montana: An Uncommon Land, p. 568.

38. Leeson, p. 852.

39. Audra Bowman, "Bridges and Ferries" (unpublished ms from early newspapers and County Commissioners' Minutes during the period 1860-1885, Surveyors Office, Missoula County Courthouse, Missoula).

40. Leeson, Montana: An Uncommon Land, p. 608.

41. Merrill Burlingame, "A Brief Background Sketch of the Three Forks Area: (unpublished ms, History Department, Montana State University, Bozeman).

42. Gallatin County Commissioners Minutes Clerk and Recorder's Office, Gallatin County Courthouse, Bozeman, MT, 1 March 1880.

43. Leeson, Montana: An Uncommon Land, p. 767.

44. Madison County Commissioners' Minutes (Clerk and Recorder's Office, Madison County Courthouse, Virginia City) 22 September 1886. Until its reorganization in 1906, the King Bridge Company was known as the King Iron Bridge and Manufacturing Company.

45. Madison County Commissioners' Minutes, 16 June 1887.

46. The Age (early Jefferson County newspaper, Jefferson County Courthouse, Virgina City, Montana), 27 March 1889, p. 4.

47. Fergus County Commissioners' Minutes (Clerk and Recorder's Office, Fergus County Courthouse, Lewistown, Montana), 5 April 1887.

48. Yellowstone County Commissioners' Minutes (Clerk and Recorder's Office, Yellowstone County Courthouse, Billings, Montana), 1 January 1888.

49. Anaconda Standard (Butte-Silver Bow Public Archives, Butte, Montana), 12 March 1916, p. 5.

50. Yellowstone County Commissioners' Minutes, 2 April 1888.

51. Billings Gazette (Billings Public Library, Billings, Montana), 17 January 1932, Sunday Supplement p. 1; 21 August 1955.

52. Yellowstone County Commissioners' Minutes, 5 March 1888.

53. Yellowstone County Commissioners' Minutes, 15 April 1887.

54. Benton Record (Offices of the River Press, Fort Benton), 15 April 1875.

55. Union Pacific Bridge Records (Office of the Chief Engineer, Omaha, Nebraska).

56. Union Pacific Bridge Records.

57. Leeson, History of Montana: 1739-1885, p. 421.

58. Leeson, p. 422.

59. Toole, Montana: An Uncommon Land, p. 160.

60. Ross K. Toole, Twentieth Century Montana: A State of Extremes (Norman: University of Oklahoma Press, 1972), p. 157.

61. Toole, Montana: An Uncommon Land, p. 160.

62. Letter from I. S. P. Weaks, Northern Pacific Division Engineer, to S. D. Mason, Principle Assistant Engineer, Northern Pacific Railroad, 6 September 1888, (Minnesota Historical Society Archives, Box NP 10, B. L. 7B, File 62.

63. Marent Trestle name plate.

64. Malone and Roeder, Montana: A History of Two Centuries, p. 133.

65. Malone and Roeder, p. 134.

66. Malone and Roeder, p. 135.

67. Malone and Roeder, p. 135.

68. Joaquin Miller, An Illustrated History of the State of Montana (Chicago: Lewis Publishing Company, 1894), p. 189.

69. Ira L. Swett, Montana's Trolleys, Vol. 2 (South Gate, California: Interurbans Magazine, Winter, 1969), p. 107.

70. Malone and Roeder, Montana: A History of Two Centuries, p. 139. The railroad was nicknamed the "Jawbone Railroad" because Richard Harlow, its owner, provided more fast talk than money to his employees.

71. Ira L. Swett, Montana's Trolleys, Vol. 3 (South Gate, California: Interurbans Magazine, Spring, 1970), p. 107.

72. Interview with Jack Walsh, Montana State Highway Department, 9 January 1981.

73. Richard Shelton Kirby, Engineering in History (New York: McGraw-Hill Book Company, Inc., 1956), p. 381.

74. Swett, Montana's Trolleys, Vol. 3, p. 107.

75. Swett, Montana's Trolleys, Vol. 2, p. 108.

76. Malone and Roeder, Montana: A History of Two Centuries, p. 139.

77. Sanders, A History of Montana, p. 540.

78. Swett, Montana's Trolleys, Vol. 3, p. 109.

79. Sanders, A History of Montana, pp. 475, 763.

80. Leeson, History of Montana: 1739-1885, p. 872.

81. Department of Agriculture and Publicity, Resources and Opportunities of Montana (Helena: Department of Agriculture and Publicity, 1918), p. 203.

82. Fergus County Commissioners' Minutes, 5 April 1887.

83. Fergus County Commissioners' Minutes, 14 December 1887, 10 April and 9 June 1888.

84. River Press (Offices of the River Press, Fort Benton) 28 September 1887.

85. Fergus County Commissioners' Minutes, 3 June 1889.

86. Fergus County Commissioners' Minutes, 10 April 1888, 6 December 1889, 21 April and 1 September 1, 1890.

87. Fergus County Commissioners' Minutes, 20 September 1899.

88. Yellowstone County Commissioners' Minutes, 22 July and 6 September 1893.

89. Fergus County Commissioner's Minutes, 21 July and 31 August 1899.

90. Spence, Montana: A History, p. 132.

91. Department of Agriculture and Publicity, Resources and Opportunities of Montana, p. 78.

92. Sanders, History of Montana, pp. 503-04.

93. Toole, Twentieth Century Montana: A State of Extremes, p. 209.

94. Malone and Roeder, Montana: A History of Two Centuries, p. 181.

95. Spence, Montana: A History, p. 133.

96. Toole, Twentieth Century Montana: A State of Extremes, p. 40.

97. Toole, p. 104.

98. William Goodheart Breitenstein, "A History of Early Journalism in Montana" (M.A. Thesis, University of Montana, Missoula, 1915).

99. Sanders, History of Montana, p. 517.

100. Toole, Twentieth Century Montana: A History of Extremes, p. 42.

101. Toole, p. 43.

102. Toole, p. 61.

103. Spence, Montana: A History, p. 132.

104. Spence, p. 138.

105. Toole, Twentieth Century Montana: A State of Extremes, p. 26.

106. Toole, pp. 92-93.

107. Toole, p. 92.

108. The Montana Almanac, 1959-60 ed. (Missoula: The Montana State University Press, 1958), p. 176.

109. Musselshell County Commissioner's Minutes (Clerk and Recorder's Office, Musselshell County Courthouse, Roundup, Montana), 5 September 1911.

110. Spence, Montana: A History, p. 138.

111. Toole, Twentieth Century Montana: A State of Extremes, p. 26.

112. Spence, Montana: A History, p. 140.

113. Malone and Roeder, Montana: A History, p. 217.

114. Toole, Twentieth Century Montana: A State of Extremes, p.93.

115. Patrick M. Morris, "The Good Road Movement and Montana to 1916" (M. A. thesis, University of Montana, Missoula, 1967), p. 128.

116. Thesis, p. 128.

117. MSHD, History of Montana State Highway Department, p. 9.

118. MSHD, p. 44.

119. Deer Lodge County Commissioner's Minutes (Clerk and Recorder's Office, Deer Lodge County Courthouse, Anaconda, Montana), 23 June 1870.

120. Madison County Commissioner's Minutes, 1 April 1887.

121. Madison County Commissioner's Minutes, 22 September 1886.

122. Letter 30 July 1895; Contract 8 September 1905 (Bridge File Montana, Madison County Clerk and Recorder's office, Virginia City, Montana), Fergus County Commissioner's Minutes, 20 September 1899 and 4 May 1903.

123. Ketchum, Milo S., The Design of Mine Structures (New York: McGraw Hill, 1912), pp. 114-132. Gillette-Hertzog's office in Butte, Montana also manufactured steel head frames (truss structures very similar to bridges) for mining companies.

124. Dawson County Commissioners' Minutes (Clerk and Recorder's Office, Dawson County Courthouse, Glendive, Montana), 2 April 1900.

125. Sanders County Commissioners' Minutes (Clerk and Recorder's Office, Sanders County Courthouse, Thompson Falls, Montana), 6 November 1909.

126. R. Budd, Assistant to the President of the Great Northern, to E. Gray, President of the Great Northern, 22 May 1913, (Great Northern Presidents' Files #5173, Minnesota Historical Society Archives, St. Paul, Minnesota).

127. Otis Ellis Hovery, Moveable Bridges, Vol. 1 (New York: John Wiley and Sons, 1926), pp. 146-72.

128. R. Budd to E. Gray 10 September 1913, (Great Northern Presidents' Files #5173).

129. Ernest E. Howard, "Vertical Lift Bridges" (American Society of Civil Engineers, May, 1921), pp. 6-7.

130. Sanders, Montana: A History of Two Centuries, p. 745.

131. Polk's Livingston City Directory, 1910 ed. (not listed in 1906 or 1914 editions).

132. Contract, 20 July 1910, (Bridge File at Madison County, Clerk and Recorder's Office, Virginia City Montana).

133. Missoula Sentinel (University of Montana Archives, Missoula) 26 September 1929, p. 2.

134. Missoula Sentinel, 4 April 1905.

135. History of Dallas County, Iowa (Des Moines: Union Historical Company, 1879), p. 561.

136. Interview with Edna Peppard Binner, 5 March 1981, (Tape in possession of author).

137. Eugene B. Peppard, letter, October 1, 1980, (Letter in possession of Author).

138. Missoula Sentinel, 26 September 1929, p. 2.

139. Eugene B. Peppard, Letter, 1 October 1980.

140. Deer Lodge County Commissioners' Minutes, 18 October 1889.

141. Missoula Sentinel, 26 September 1929, p. 2.

142. Interview with Edna Peppard Binner, 5 March 1981.

143. Missoula Sentinel Polk's Missoula City Directory, 26 September 1929, p. 2.

144. Maurice W. Hewett, "William S. Hewett: A Biography", (unpublished biography, 1956, Minnesota Historical Society, St. Paul, Minnesota), p. 1.

145. Harold R. Hewett, "The Saga of the William S. Hewett Family" (unpublished ms, available from the author, Great Falls, Minnesota), p. 2.

146. Maurice W. Hewett, p. 2.

147. Hewett, p. 3.

148. William S. Hewett, "The Hewett System" (Chicago: promotional literature of the William S. Hewett Company, in the possesion of Harold R. Hewett, Great Falls, Minnesota).

149. Dobell, "Prestressed Concrete Tanks" Proceedings of the First United States Conference on Prestressed Concrete (Massachusetts Institute of Technology, Cambridge, Massachusetts, 14-16 August 1951), pp. 9-10.

150. Tom Stout, ed., Montana: Its Story and Biography (Chicago: American Historical Society, 1921), p. 212-213.

151. Sara H. Stedman, Letter, 23 April 1980 (daughter of Arthur L. Hewett, Columbia Falls, Montana).

152. Carbon County Commissioners' Minutes (Clerk and Recorder's Office, Carbon County Courthouse, Red Lodge, Montana), 24 March 1906 and 2 October 1907.

153. Bid 20 July 1910 (Bridge Files, Clerk and Recorder's Office, Madison County Courthouse, Virginia City, Montana).

154. Carbon County Commissioners' Minutes, 3 June 1925.

155. Interview with Harold Hanson, 17 October 1980.

156. Harold R. Hewett, "William S. Hewett," p. 8.

157. Morris, "The Good Road Movement and Montana to 1916."

158. MSHD, History of the Montana State Highway Department: 1913-1942, p. 10.

159. MSHD, p. 12.

160. MSHD, p. 13.

161. Early Bridge Plans, (Bridge Bureau, Montana State Highway Department, Helena, Montana).

162. MSHD, History of the Montana State Highway Department: 1913-1942, p. 14.

163. MSHD, p. 103.

164. Fromberg Service Club, Fromberg: Fruit Basket of Carbon County (Fromberg: Fromberg Service Club, 1976), p. 7.

165. Toole, Montana: An Uncommon Land, p. 31.

166. Early Bridge Plans, (Bridge Bureau, Montana State Highway Department, Helena, Montana).

167. Carl W. Condit, American Building (Chicago: University of Chicago Press, 1968), p. 143.

168. Condit, p. 98.

169. Condit, p. 101.

170. Condit, p. 216.

171. Interview with Harold Hanson, 17 October 1980.

172. Department of Agriculture and Publicity, Resources and Opportunities of Montana, p. 147.

173. Fromberg Service Club, Fromberg: Fruit Basket of Carbon County, pp. 7-8.

174. Condit, American Building, p. 251.

175. H. J. Hopkins, A Span of Bridges (New York: Praeger Publishers, 1970), p. 251.

176. Collier Engineering Company, The Elements of Bridge Engineering, Vol. 2 (New York: Burr Publishing House, 1897), p. 688.

177. J. A. L. Waddell, Bridge Engineering, Vol. 1 (New York: John Wiley and Sons, 1916), pp. 717-46.

BIBLIOGRAPHY

Collier Engineering Company. The Elements of Bridge Engineering, Vol. 2. New York: Burr Publishing House, 1897.

Condit, Carl W. American Building. Chicago: University of Chicago Press, 1968.

Department of Agriculture & Publicity. Resources and Opportunities of Montana. Helena: Department of Agriculture & Publicity, 1918.

Fromberg Service Club. Fromberg: Fruit Basket of Carbon County. Fromberg: Fromberg Service Club, 1976.

History of Dallas County, Iowa. Des Moines: Union Historical Company, 1879.

Hopkins, H. J. A Span of Bridges. New York: Praeger Publishers, 1970.

Hovery, Otis Ellis. Moveable Bridges, Vol. 1. New York: John Wiley and Sons, 1926.

Ingram, Patricia M. Historic Transportation Routes Through Southwest Montana. Dillon: Bureau of Land Management, 1976.

Kirby, Richard Shelton. Engineering in History. New York: McGraw-Hill Book Company, Inc., 1956.

Lesson, M. A. History of Montana: 1739-1885. Chicago: Warner, Beers and Company, 1885.

Madsen, Betty M. and Brigham D. Madsen. North to Montana Salt Lake City: University of Utah Press, 1980.

Malone, Michael P. and Richard B. Roeder. Montana: A History of Two Centuries. Seattle: University of Washington Press, 1976.

Miller, Joaquin. An Illustrated History of the State of Montana. Chicago: Lewis Publishing Company, 1897.

The Montana Almanac. 1959-60 Missoula: The Montana University Press, 1958.

Montana State Highway Department. History of the Montana State Highway Department: 1913-1942. Helena: Montana State Highway Department, 1943.

Sanders, Helena Fitzgerald. History of Montana. Chicago: Lewis Publishing Company, 1913.

Spence, Clark C. Montana: A History. New York: W. W. Norton & Co., Inc., 1978.

Stout, Tom, Editor, Montana: Its Story and Biography, Vol. 2. Chicago: American Historical Society, 1921.

Swett, Ira L. Montana's Trolleys. Vol. 2-3. South Gate, California: Interurbans Magazine, 1970.

Toole, K. Ross. Montana: An Uncommon Land. Norman University of Oklahoma Press, 1959.

Toole, K. Ross. Twentieth Century Montana: A State of Extremes. Norman: University of Oklahoma Press, 1972.

Waddell, J. A. L. Bridge Engineering. Vol. 1. New York: John Wiley & Sons, 1916.

PUBLIC DOCUMENTS

Carbon County Commissioners' Minutes. Clerk and Recorder's Office, Carbon County Courthouse, Red Lodge, Montana.

Dawson County Commissioners' Minutes. Clerk and Recorder's Office, Dawson County Courthouse, Glendive, Montana.

Deer Lodge County Commissioners' Minutes. Clerk and Recorder's Office, Deer Lodge Courthouse, Anaconda, Montana.

Fergus County Commissioners' Minutes. Clerk and Recorder's Office, Fergus County Courthouse, Lewistown, Montana.

Gallatin County Commissioners' Minutes. Clerk and Recorder's Office, Gallatine County Courthouse, Bozeman, Montana

Madison County Bridge Files. Clerk and Recorder's Office, Madison County Courthouse, Virginia City, Montana.

Madison County Commissioners' Minutes. Clerk and Recorder's Office, Madison County Courthouse, Virginia City, Montana.

Massachusetts Institute of Technology. Proceedings of the First United States Conference on Prestressed Concrete. Cambridge: Massachusetts Institute of Technology, 1951.

Musselshell County Comissioners' Minutes. Clerk and Recorder's Office, Musselshell County Courthouse Roundup, Montana.

Polk's Livingston City Directory. Livingston Public Library, Livingston, Montana, 1906, 1910, and 1914.

Polk's Missoula City Directory. University of Montana Archives, Missoula, Montana

Sanders County Commissioner Minutes. Clerk and Recorder's Office, Sanders County Courthouse Thompson Falls, Montana.

Yellowstone County Commissioners' Minutes. Clerk and Recorder's Office, Yellowstone County Courthouse, Billings, Montana.

UNPUBLISHED REPORTS

Breitenstein, William Goodheart. "A History of Early Journalism in Montana." M. A. Thesis, University of Montana, 1915.

Browman, Audra. "Bridges and Ferries." Unpublished ms, from early newspapers and county commissioners minutes during 1861-1885, Surveyor's Office, Missoula County Courthouse, Missoula, Montana.

Burlingame, Merrill. "A Brief Background Sketch of the Three Forks Area." Unpublished ms, History Department, Montana State University.

Hewett, Harold R. "The Saga of the Wm S. Hewett Family." Unpublished ms, Minnesota Historical Society, St. Paul, Minnesota, 1956.

Hewett, William. "The Hewett System." Unpublished ms, private collection, Harold R. Hewett, Great Falls, Minnesota.

Morris, Patrick M. "The Good Road Movement and Montana to 1916." M.A. thesis, University of Montana, 1967.

INTERVIEWS

Binner, Edna Peppard, Daughter of O. E. Peppard, Grass Valley, California, Interview, March, 1981.

Hanson, Harold. Former president of W. P. Roscoe Company, Billings, Montana. Interview, 17 October 1980.

Walsh, Jack. Maintenance Division, Montana State Highway Department, Helena, Montana. Interview, 1 January 1981.

PERIODICALS

Howard, Ernest E. "Vertical Lift Bridges." American Society of Civil Engineers, 1921.

Journal of the Montana Society of Engineers. Rare Books Collection, Montana State University Library, Bozeman, Montana.

MANUSCRIPT COLLECTIONS

Minnesota State Historical Society Archives. Great Northern Railroad President's Files. R. Budd, "Letters to the President of the Great Northern Railroad."

___. Northern Pacific Railroad. Box NP 10 B.L. 7B, File 62. Weaks, I.S.P. "Letter to Principle Assistant Engineer, Northern Pacific Railroad."

Omaha, Nebraska. Union Pacific Railroad Bridge Records. Office of the Chief Engineer.

NEWSPAPERS

The Age. Jefferson County Courthouse, Virginia City, Montana.

Anaconda Standard. Butte-Silver Bow Public Archives, Butte, Montana.

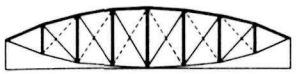
Benton Record. Offices of the River Press, Fort Benton, Montana.

Billings Gazette. Billings Public Library, Billings, Montana.

Missoula Sentinel. University of Montana Archives, Missoula, Montana.

Rivers Press. Offices of the River Press, for Benton, Montana.

GPO 836-148

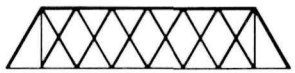


LENTICULAR (PARABOLIC)

1878 - EARLY 20TH CENTURY

A PRATT WITH BOTH TOP AND BOTTOM CHORDS PARABOLICLY CURVED OVER THEIR ENTIRE LENGTH.

LENGTH: 50 - 360 FEET
5 - 110 METERS



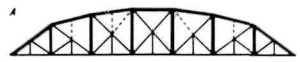
DOUBLE INTERSECTION WARREN

(LATTICE)

MID 19TH - 20TH CENTURY

STRUCTURE IS INDETERMINATE. MEMBERS ACT IN BOTH COMPRESSION AND TENSION. TWO TRIANGULAR WEB SYSTEMS ARE SUPERIMPOSED UPON EACH OTHER WITH OR WITHOUT VERTICALS.

LENGTH: 75 - 400 FEET
23 - 120 METERS



PENNSYLVANIA (PETIT)

1875 - EARLY 20TH CENTURY

A. A PARKER WITH SUB - STRUTS.
B. A PARKER WITH SUB - TIES.

LENGTH: 250 - 600 FEET
75 - 180 METERS

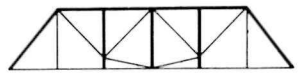
WARREN

WITH VERTICALS

MID 19TH - 20TH CENTURY

DIAGONALS CARRY BOTH COMPRESSIVE AND TENSILE FORCES. VERTICALS SERVE AS BRACING FOR TRIANGULAR WEB SYSTEM.

LENGTH: 50 - 400 FEET
15 - 120 METERS

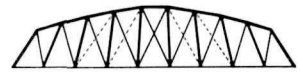


GREINER

1894 - EARLY 20TH CENTURY

PRATT TRUSS WITH THE DIAGONALS REPLACED BY AN INVERTED BOWSTRING TRUSS

LENGTH: 75 - 250 FEET
23 - 75 METERS

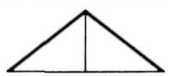


PEGRAM

1887 - EARLY 20TH CENTURY

A HYBRID BETWEEN THE WARREN AND PARKER TRUSSES. UPPER CHORDS ARE ALL OF EQUAL LENGTH

LENGTH: 150 - 650 FEET
45 - 195 METERS

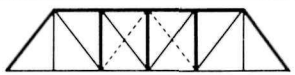


KING POST

(WOOD)

A TRADITIONAL TRUSS TYPE WITH ITS ORIGINS IN THE MIDDLE AGES.

LENGTH: 20 - 60 FEET
6 - 18 METERS

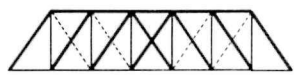


PRATT

1844 - 20TH CENTURY

DIAGONALS IN TENSION, VERTICALS IN COMPRESSION. (EXCEPT FOR HIP VERTICALS ADJACENT TO INCLINED END POSTS)

LENGTH: 30 - 250 FEET
9 - 75 METERS



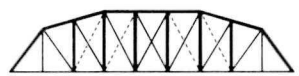
HOWE

1840 - 20TH CENTURY

(WOOD, VERTICALS OF METAL)

DIAGONALS IN COMPRESSION, VERTICALS IN TENSION

LENGTH 30 - 150 FEET
9 - 45 METERS

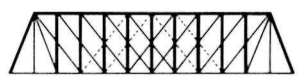


CAMELBACK

LATE 19TH - 20TH CENTURY

A PARKER WITH A POLYGONAL TOP CHORD OF EXACTLY FIVE SLOPES

LENGTH 100 - 300 FEET
30 - 90 METERS



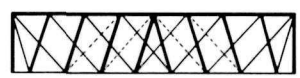
DOUBLE INTERSECTION PRATT

1847 - 20TH CENTURY

(WHIPPLE, WHIPPLE - MURPHY, LINVILLE)

AN INCLINED END POST PRATT WITH DIAGONALS THAT EXTEND ACROSS TWO PANELS.

LENGTH: 70 - 300 FEET
21 - 90 METERS

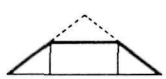


POST

1865 - LATE 19TH CENTURY

A HYBRID BETWEEN THE WARREN AND THE DOUBLE INTERSECTION PRATT.

LENGTH: 100 - 300 FEET
30 - 90 METERS

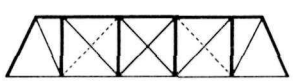


QUEEN POST

(WOOD)

A LENGTHENED VERSION OF THE KING POST.

LENGTH: 20 - 80 FEET
6 - 24 METERS

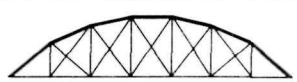


PRATT HALF-HIP

LATE 19TH - EARLY 20TH CENTURY

A PRATT WITH INCLINED END POSTS THAT DO NOT HORIZONTALLY EXTEND THE LENGTH OF A FULL PANEL.

LENGTH: 30 - 150 FEET
9 - 45 METERS

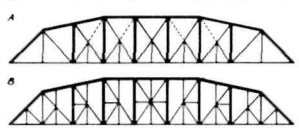


BOWSTRING ARCH - TRUSS

1840 - LATE 19TH CENTURY

A TIED ARCH WITH THE DIAGONALS SERVING AS BRACING AND THE VERTICALS SUPPORTING THE DECK.

LENGTH 50 - 130 FEET
15 - 40 METERS



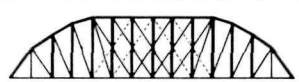
CAMELBACK

WITH SUBDIVIDED PANELS

LATE 19TH - EARLY 20TH CENTURY

A. A PENNSYLVANIA TRUSS WITH A POLYGONAL TOP CHORD OF EXACTLY FIVE SLOPES
B. SAME AS A. WITH HORIZONTAL STRUTS.

LENGTH 100 - 500 FEET
30 - 150 METERS

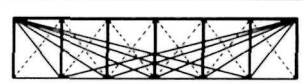


SCHWEDLER

LATE 19TH CENTURY

A DOUBLE INTERSECTION PRATT POSITIONED IN THE CENTER OF A PARKER.

LENGTH: 100 - 300 FEET
30 - 90 METERS



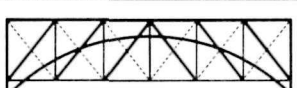
BOLLMAN

1852 - MID - LATE 19TH CENTURY

(RARE)

VERTICALS IN COMPRESSION, DIAGONALS IN TENSION. DIAGONALS RUN FROM END POSTS TO EVERY PANEL POINT.

LENGTH: 75 - 100 FEET
23 - 30 METERS



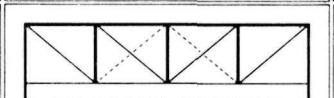
BURR ARCH TRUSS

1804 - LATE 19TH CENTURY

(WOOD)

COMBINATION OF A WOODEN ARCH WITH A MULTIPLE KING POST. (ARCH ALSO COMBINED WITH LATER WOODEN TRUSSES).

LENGTH: 50 - 175 FEET
15 - 50 METERS

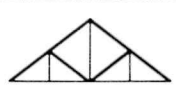


TRUSS LEG BEDSTEAD

LATE 19TH - EARLY 20TH CENTURY

A PRATT WITH VERTICAL END POSTS IMBEDDED IN THE FOUNDATIONS.

LENGTH: 30 - 100 FEET
9 - 30 METERS

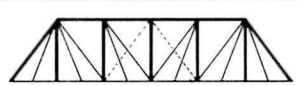


WADDELL "A" TRUSS

LATE 19TH - EARLY 20TH CENTURY

EXPANDED VERSION OF THE KING POST TRUSS. USUALLY MADE OF METAL

LENGTH: 25 - 75 FEET
8 - 23 METERS

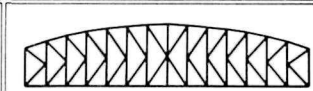


KELLOGG

LATE 19TH CENTURY

A VARIATION ON THE PRATT WITH ADDITIONAL DIAGONALS RUNNING FROM UPPER CHORD PANEL POINTS TO THE CENTER OF THE LOWER CHORDS.

LENGTH: 75 - 150 FEET
23 - 30 METERS

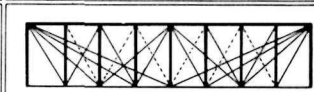


K - TRUSS

EARLY 20TH CENTURY

SO CALLED BECAUSE OF THE DISTINCTIVE OUTLINE OF THE STRUCTURAL MEMBERS.

LENGTH: 200 - 800 FEET
60 - 240 METERS



FINK

1851 - MID - LATE 19TH CENTURY

(RARE)

VERTICALS IN COMPRESSION, DIAGONALS IN TENSION, LONGEST DIAGONALS RUN FROM END POSTS TO CENTER PANEL POINTS.

LENGTH: 75 - 100 FEET
23 - 45 METERS

TOWN LATTICE

1820 - LATE 19TH CENTURY

(WOOD)

A SYSTEM OF WOODEN DIAGONALS WITH NO VERTICALS. MEMBERS TAKE BOTH COMPRESSION AND TENSION

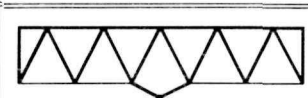
LENGTH: 50 - 220 FEET
15 - 66 METERS

PARKER

MID - LATE 19TH - 20TH CENTURY

A PRATT WITH A POLYGONAL TOP CHORD

LENGTH: 40 - 250 FEET
12 - 75 METERS

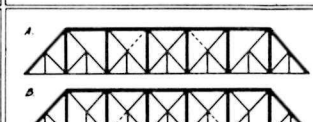


WICHERT

1952 - MID - LATE 20TH CENTURY

IDENTIFIED BY A CHARACTERISTIC PIN-CONNECTED SUPPORT SYSTEM OVER THE PIERS. TRUSS IS CONTINUOUS OVER PIERS

LENGTH: 400 - 1000 FEET
122 - 305 METERS

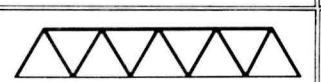


BALTIMORE (PETIT)

1871 - EARLY 20TH CENTURY

A. A PRATT WITH SUB - STRUTS
B. A PRATT WITH SUB - TIES

LENGTH: 250 - 600 FEET
75 - 180 METERS



WARREN

1848 - 20TH CENTURY

TRIANGULAR IN OUTLINE. THE DIAGONALS CARRY BOTH COMPRESSIVE AND TENSILE FORCES. A "TRUE WARREN" TRUSS HAS EQUILATERAL TRIANGLES.

LENGTH: 50 - 400 FEET
15 - 120 METERS

STEARNS

1890 - EARLY 20TH CENTURY

SIMPLIFICATION OF FINK TRUSS WITH VERTICALS OMITTED AT ALTERNATE PANEL POINTS.

LENGTH: 50 - 200 FEET
15 - 60 METERS

TRUSSES

A STUDY BY THE

HISTORIC AMERICAN ENGINEERING RECORD

- BOLLER, ALFRED P. PRACTICAL TREATISE ON THE CONSTRUCTION OF IRON BRIDGES. NEW YORK: JOHN WILEY & SONS, 1881.
- BOWMAN, H. L. AND SUTHERLAND, MILES STRUCTURAL THEORY. NEW YORK: JOHN WILEY & SONS, 1928.
- COMMITTEE ON HISTORY AND HERITAGE OF AMERICAN CIVIL ENGINEERING. ED. AMERICAN WOODEN BRIDGES. ASCE HISTORICAL PUBLICATION NO. 4. NEW YORK: ASCE, 1976.
- CONDIT, CARL W. AMERICAN BUILDING ART. NEW YORK: OXFORD UNIVERSITY PRESS, 1960.
- COOPER, THEODORE. "AMERICAN RAILROAD BRIDGES." ASCE TRANSACTIONS. NO. 498, VOL. 21 (JULY 1889) 1 - 58.
- DIESLER, DAN G. A SURVEY AND PHOTOGRAPHIC INVENTORY OF METAL BRIDGES IN VIRGINIA. 1985 - 1992. VOLS. 1 & 2. CHARLOTTESVILLE: VIRGINIA HISTORIC AND TRANSPORTATION RESEARCH COUNCIL, 1978.
- HOPKINS, H. J. A SPAN OF BRIDGES. NEW YORK: PRAEGER PUBLISHERS, 1970.
- JACOBY, HENRY S. AND MERRIMAN, MANSFIELD. A TEXT BOOK ON ROADS AND BRIDGES. PART II. GRAPHIC STATICS. NEW YORK: JOHN WILEY & SONS, 1901.
- PLOWDEN, DAVID. BRIDGES: THE SPANS OF NORTH AMERICA. NEW YORK: THE VIKING PRESS, 1974.
- SWEDO, THOMAS J. ARCHITECT TRUSS DESIGN. NEW YORK: JOHN WILEY & SONS, 1992.
- TYRRELL, HENRY GRATTAN. HISTORY OF BRIDGE ENGINEERING. CHICAGO: H.G. TYRRELL, 1911.
- WADDELL, J. A. L. BRIDGE ENGINEERING. VOL. I. NEW YORK: JOHN WILEY & SONS, 1916.

DEVELOPED BY: T. ALLAN COMP · DONALD C. JACKSON · ARNOLD DAVID JONES · APPRECIATION TO: CHARLES E. LANIER · ROBERT M. VOGEL · ERIC H. DE LONY

1st PRINTING 1976, REVISED OCT. 1976

OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION
TECHNICAL INFORMATION PROJECT
UNDER DIRECTION OF THE NATIONAL PARK SERVICE, UNITED STATES DEPARTMENT OF THE INTERIOR

TRUSS IDENTIFICATION: BRIDGE TYPES

RECORD NO. HAER TI-1

HISTORIC AMERICAN ENGINEERING RECORD
SHEET 2 OF 2 SHEETS