



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

Annual Report

United States.
Alaska Road
Commission

Annual Report



ANNUAL REPORT OF THE
Board of Road Commissioners
for Alaska

1917



WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

Dr. G. 1000

TE24
A54UG
1916/17

LETTER OF SUBMITTAL.

BOARD OF ROAD COMMISSIONERS FOR ALASKA,
Juneau, Alaska, October 3, 1917.

From: President of the Board.

To: The Adjutant General, United States Army.

Subject: Road and trail work in Alaska.

1. The annual report of the Board of Road Commissioners for Alaska for fiscal year 1917 is submitted herewith.

2. The following changes in the personnel of the board have taken place since the close of the fiscal year and during the preparation of this report, due to the war. Lieut. Col. P. W. Davison has been relieved as secretary and disbursing officer of the board, this duty being devolved temporarily upon Capt. J. C. Mehaffey, C. E., engineer officer of the board. Capt. Mehaffey has been relieved from the duty of engineer officer by Capt. W. H. Waugh, Engineer O. R. C., and is expected to be relieved soon of the duties pertaining to the disbursing office by Capt. John Zug, Engineer O. R. C.

3. In addition to the detailed description of the year's work the present report again summarizes briefly the history of the board's operations, with such information "in respect to population, conditions, prospective benefits, etc., as will be necessary," it is believed, "to acquaint the department with the character and progress of the work," together with a general description of the physical and engineering features to be dealt with, and a brief statement of the method of accounting.

W. P. RICHARDSON,
Brigadier General, N. A.

REPORT

OF THE

BOARD OF ROAD COMMISSIONERS FOR ALASKA.

GENERAL STATEMENT BY THE PRESIDENT OF THE BOARD.

The Board of Road Commissioners for Alaska, constituted by law, act approved January 27, 1905, and composed of three officers of the Army, has been in existence 12 years. The War Department had constructed under appropriations made by Congress, and with the assistance of troops stationed in Alaska, a telegraph and cable system through the Territory connecting all the military posts as well as the principal mining towns, and, under the law creating the road commission, undertook the work of laying out and constructing a system of pioneer wagon roads and trails through the Territory. This procedure was in accordance with long established precedent of making use of the Army in aiding to open up our frontiers and giving support and confidence to the early pioneers and settlers.

Present indications are that the work of the road commission is approaching a conclusion, or, at least that material changes will be made in the near future in the organization for the conduct of the work and for its supervision, due in part to the existing state of war and in part to changed conditions in the Territory since the passage of the original law.

These changed and changing conditions are more political than physical. When the board of road commissioners came into existence Alaska had no Territorial legislature and no Delegate to Congress, but now has both. The commercial development of the Territory has been retarded through a variety of causes, and the physical conditions have been only slightly modified during this period by such development and by the limited mileage of wagon roads and trails which our board has been able to construct with the funds at its disposal.

In reviewing briefly the history of the work of our board some repetition will be made of matter contained in previous reports of the board, but this is necessary in order to give emphasis to the facts as they exist and to lay stress upon the one prime need of Alaska, which is a system of wagon roads and trails.

The Board of Road Commissioners for Alaska entered upon its work unfavored by any increased compensation to its members or promise of reward and unheralded except by way of demand throughout the Territory for immediate results. Endowed by law with broad powers and corresponding responsibilities, but without precedent in the history of the department in the way of organization and methods of accounting, and without adequate funds to work with, the board

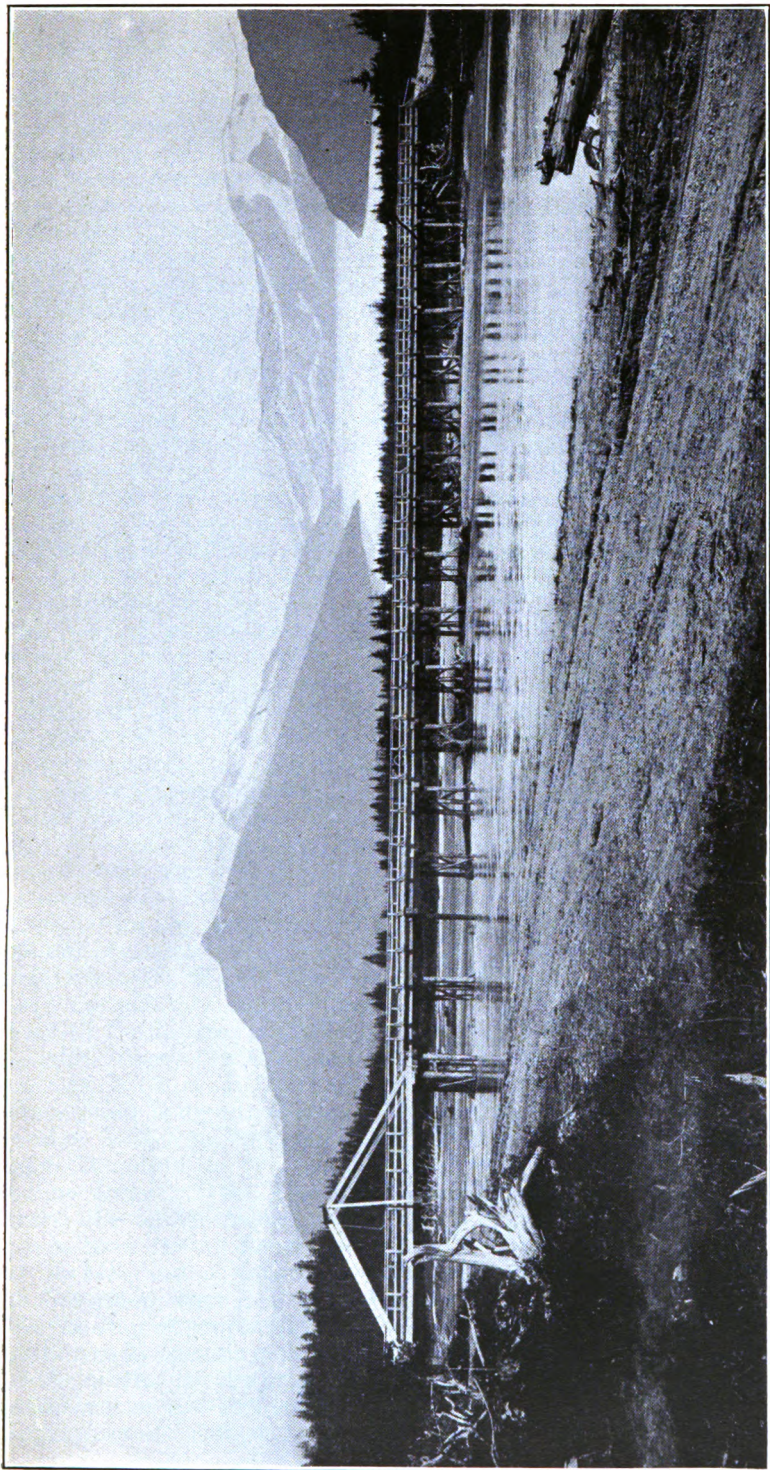
at the outset found itself confronted with a problem the magnitude of which was little short of discouraging. It would not be easy to conceive of a greater variety of difficulties to overcome from a physical viewpoint in a work of this character, or more vexatious phases of the "human equation" to deal with, than have come before the board in this work.

There presented itself as the field of operations a vast wilderness region of nearly 600,000 square miles, untracked for the most part by the foot of the white man, broken and rugged in many parts, heavily timbered and with dense undergrowth in the coastal belt, underlaid throughout most of the valleys of the interior with permanent frost to great depth protected by a thick blanket of moss, with the whole area buried under snow for many months of the year and in summer intersected by numerous deep and swift streams fed by the ice-cold waters of the melting glaciers and snows of the mountains, and throughout all the Territory less than a dozen miles of what might be called wagon road, with a few hundred miles of pioneer trail, mostly constructed by expeditions under the War Department prior to this time.

The population consisted chiefly, and still does, of mining and other industrial (mostly fishing) towns and camps along the shores of southeastern Alaska and scattered through the interior, separated in most cases by great distances, with but little of mutual sympathy or common interest, each with jealous eye upon the others and with firm intent to have its full share of any favor to be bestowed, and all needing and demanding roads. Little thought was given to the fact that it required money to build roads and time to perform the work.

There is probably no more mixed or restless population in the world than that which flocks to a new country following a great gold excitement. While it embraces many of the best types of manhood it includes also some of the most unstable. Along with the hardy pioneer, miner, and prospector and the venturesome spirit always seeking new fields, there accompanies a horde of ne'er-do-wells, discontents, and failures, or worse, elsewhere, led on only by the excitement and with no fixed purpose. These latter by reason of their natural tendencies and characteristics, failing to receive the reward which in some vague way they feel the Government owes them, readily become a fertile field for the political demagogue and muckraker, and the board has at times had this additional factor to deal with in its most venomous form.

On the other hand, the board has received much generous support and encouragement in its work, both from the people of Alaska and from Congress, as well as from the War Department, while the very character of the country carried with it an inspiration, and the manifest need for roads and trails throughout the Territory opened an inviting and fascinating field of effort and one calculated to evoke one's best energies toward accomplishment. One can not fail to realize upon a careful study of the situation that the absence of roads is one of the principal reasons why Alaska has so long remained a wilderness, nor fail to appreciate the great benefit which would result from the construction of a system of roads through the Territory; and strange as it may seem, evidence is not wanting to indicate that behind this latter fact—that a system of wagon roads would be of such bene-



MENDENHALL RIVER BRIDGE, NEAR JUNEAU.

fit—lies the explanation of some of the opposition in the past of the demagogue to the procuring of appropriations and of necessary amendment to the existing law to enable a suitable fund to be provided for carrying on the work, and to thus obtain more complete and satisfactory results. Such results would naturally have added further to the credit of the War Department which had already done much for Alaska and stood prepared to do a great deal more in this new field. The above statements respecting the opposition to the work of the board are made with no other purpose than to set forth the facts of a truly extraordinary situation.

The original act carried with it a provision for the expenditure of 70 per cent, later reduced to 65 per cent, of what is known as the "Alaska fund." This fund was so entirely inadequate, as well as uncertain in amount, that the president of the board, at the end of the first season, set forth the situation in a special report to the Secretary of War. The Secretary took the matter up with Congress with a view of obtaining some relief, and with the result that an appropriation of \$150,000 was made for the fiscal year 1907 in aid of the work, carried on the appropriation bill for the support of the Army under the caption of "Military and post roads, bridges, and trails."

Congress has continued to appropriate moneys in various amounts from year to year through the same channel, although no specific law was enacted in the matter, and on two occasions, or more, in the earlier years of the appropriation a point of order was raised on the floor of the House against the item. Thereafter no objection was raised until at the last session of Congress, although for a number of years, 1911 to 1916, inclusive, the appropriation had been scarcely more than sufficient to maintain work previously constructed.

Long-continued approval of the estimates, coupled with the failure to get any modification of the original law, led to the conclusion that Congress intended that the work should be carried forward indefinitely, as already provided for in the original law, and an estimate was therefore submitted and appropriation granted, of \$500,000 for the fiscal year 1917 to further improve the roads already constructed and to make extensions to meet the constantly growing demands. Upon the estimate of a similar amount for the fiscal year 1918 the point of order was again raised against the item upon the floor of the House, and the appropriation was finally obtained only by earnest representation of the need, to complete and maintain work already built or in progress, supported by appeals from various commercial bodies in Alaska, which procured the restoration of the item to the bill in the Senate, the appropriation for this reason being made available for two years.

The action of the House in thus sustaining the point of order under the circumstances caused the Secretary of War to notify the committees having the appropriation in charge—prior to the passage of the bill, and as expressing merely his desire to carry out the will of Congress—that he would not approve future estimates provided the pending appropriation should be granted, unless Congress should authorize by specific enactment further estimates for a proper conduct of the work. It is assumed, however, that sufficient moneys for the maintenance and protection of the work already constructed will be appropriated until such time as Congress shall enact the necessary

legislation either for a proper continuance of the work or for its abandonment. In this view of the matter an additional estimate of \$100,000 is being submitted for the fiscal year 1919 for maintenance, in addition to that already authorized, to meet the increased cost due to advance in wages and cost of materials.

The principal expenditures from the appropriations granted by Congress have been upon the military and post road from Fairbanks on the Tanana River to the coast at Valdez. In the annual report of the board for 1908 a brief description of this route was given, and this description is here repeated with modifications due to improvements and changes since that time:

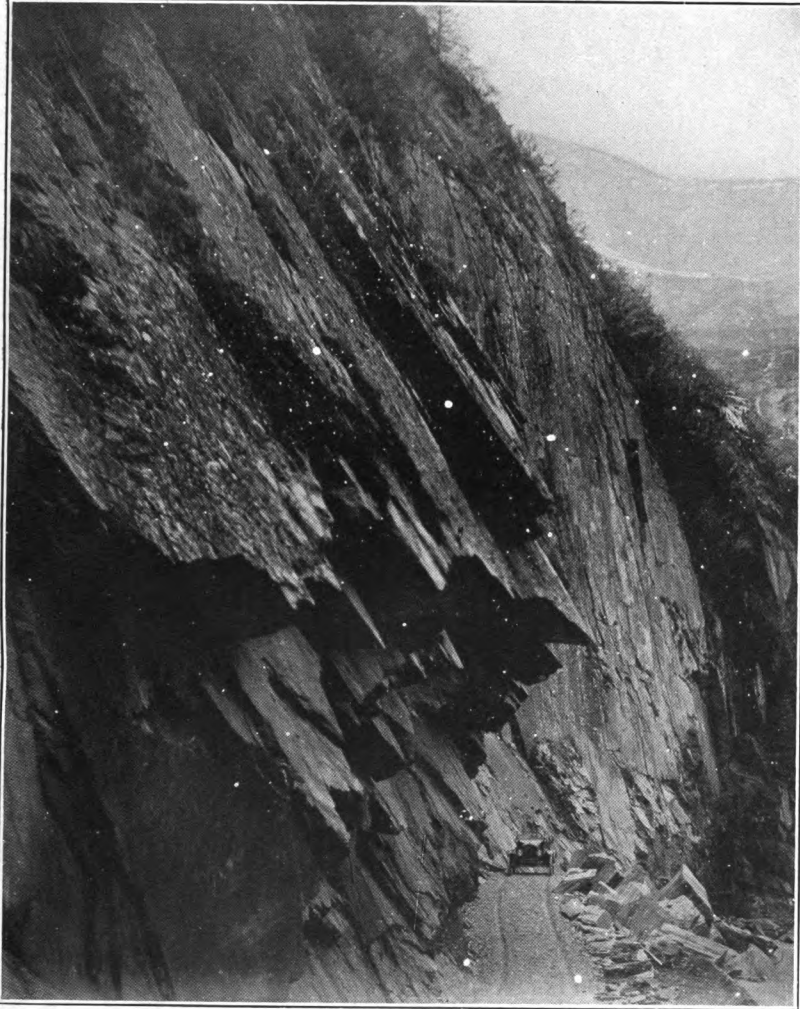
Leaving Fairbanks the road runs eastward up the "right," or north, bank of the Tanana River, following the course of the Tanana more or less closely for 90 miles, to the confluence of that river with the Big Delta. Here the route crosses the Tanana (by ferry) above the mouth of the Delta and continues up the "right," or east, bank of that stream in a southerly direction to the summit of the Alaska Range.

Fifty-nine miles from Fairbanks a winter cut-off leaves the summer route, and, crossing the Tanana at Washburn (mouth of the Little Delta), runs in a southeasterly direction across a low, swampy country, impracticable for traffic except when frozen, to a point on the Big Delta about 35 miles from its mouth, where it crosses and rejoins the main summer route. The saving in distance by this cut-off for the winter mail is about 13 miles. Its principal advantages are due to its level character and to the fact that it passes through a section protected from the winter storms. It has been the effort of the board to have the winter and summer routes coincide as far as possible.

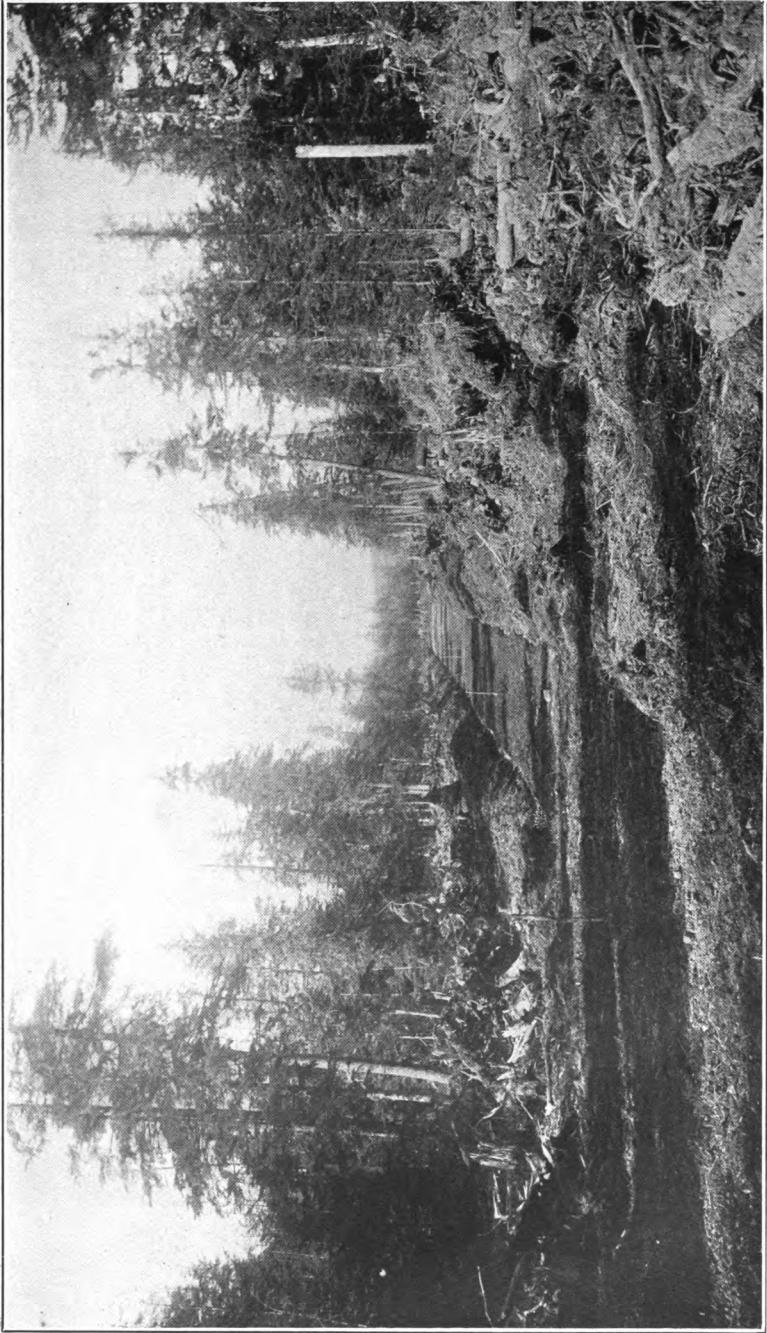
Continuing from Isabelle Pass, summit of the Alaska Range, the route descends to the headwaters of the Gulkana River, and runs along the valley and side hills to the eastward of that stream in a general southerly direction to the confluence of the Gulkana and Copper Rivers. Here it crosses the Gulkana near its mouth, and follows the right, or west, bank of the Copper, gradually diverging from it, crossing the Tazlina, Klutina, and Tonsina Rivers, and continuing into the valley of the Tiekhell, turns westerly through a broken and rugged country, and gradually ascends to the summit of the Coast Range at Thompson Pass. From here it descends to the valley of the Lowe River and through Keystone Canyon to Valdez. From Gulkana to Valdez much of the old Abercrombie trail is followed.

From Willow Creek, 92 miles from Valdez, a branch road leads to Chitina, a distance of 39 miles, there connecting with the Copper River & Northwestern Railway. The total length of the road, including the Willow Creek-Chitina branch, is 409 miles. The road crosses two mountain ranges, numerous rivers and small streams, and embraces in its course practically all the various problems of construction to be dealt with in the Territory. All streams of importance along the route have been bridged except the Salcha and Tanana Rivers, which are crossed by ferry. The road has been used by automobiles and motor trucks, increasing in number each year, but our board, while permitting such traffic, does not encourage it, for the reason that there has never been a sufficient fund appropriated to construct and maintain through this difficult wilderness a road suitable for such traffic.

In undertaking the construction of this road under all the circumstances of a scant and uncertain fund, procured from year to year in varying amounts and by personal pleading, the board undertook the well-nigh impossible. The need for its construction, however, was so manifest and its value to the Territory, even in its present incomplete state, is so great, as to fully justify the effort and the expendi-



THROUGH KEYSTONE CANYON.



CARRYING ROAD THROUGH DIFFICULT SECTION NEAR JUNEAU.

ture made upon it, and it is hoped that the additional moneys necessary to properly surface it throughout and to maintain it in the future will be appropriated.

The board has constructed and maintained since its organization 980 miles wagon road, 623 miles winter sled road, and 2,291 miles trail, and has expended for all purposes a total of \$3,969,611.23 to June 30, 1917, of which sum \$2,265,000 has been appropriated by Congress and \$1,704,611.23 has been derived from the Alaska fund. Funds already appropriated and otherwise to become available for the fiscal year 1919 will increase the wagon-road mileage to more than 1,000 miles, of which approximately 30 per cent may be classed as "improved" road, mostly gravel surfaced; this includes some stretches which traverse natural gravel benches, also a small mileage of macadam, plank, and corduroy. Mileage costs of construction and maintenance will be found in the report of the engineer officer of the board.

During the last session of the Territorial legislature an act was passed to provide for construction, maintenance, and protection of roads, bridges, ferries, etc., to provide funds, and to perfect a Territorial organization. Four hundred thousand dollars was appropriated for a period of two years. This, with the work under the Forestry Bureau, makes three separate organizations working on roads with practically no connection with each other except casual arrangements made by themselves. There is, however, no special reason why all the road work of the Territory should be under one head, provided the field of operation for each is clearly defined; in fact, there is good reason why it should not be so under present conditions.

As soon as the Territorial road organization is perfected and has proven itself, the local roads should, in my judgment, be transferred to that organization, under the supervision of the Public Roads Bureau of the Agricultural Department. The Territorial organization should then receive that portion of the Alaska fund for road construction which now comes to our board, and should also become a beneficiary of any general appropriations made by Congress to assist in road building in the States. It would be wise, in my judgment, for the War Department to retain supervision for the present of the Valdez-Fairbanks Road on account of its uses as a military and post road, its great length and cost of maintenance; also the military road leading out of Fort William A. Seward up the Chilcat River, both of which roads were constructed from funds appropriated by Congress through the military committees, for the "Construction of military and post roads, bridges, etc." The wagon roads and trails needed as feeders to the Government railroad, demand for which is rapidly growing, and without which the railroad can in no sense meet the expectations of success which have been created concerning it, constitute a separate problem, and should, in my judgment, be under the same directing head as the construction and operation of the railroad.

What has been accomplished by our board up to the present time constitutes only the beginning of a vast work, but it has pioneered the way, developed methods of construction and costs, and more than all has demonstrated the value and need of roads throughout the Terri-

tory if its available areas are to be occupied by home builders and its interior resources are to be developed. The cry that goes up from all parts of Alaska is for roads, trails—passable routes for man and beast—with the bridging of dangerous streams; and, as traffic and tonnage develop, improved roads for the use of wagons and motor cars.

For more than a generation the people of the United States almost forgot the need and value of wagon roads. This was the great period of railroad building, which spanned the continent with numerous lines and crossed great stretches of prairie that had little need for wagon roads to stimulate development. Any hope that a similar rapid development will follow the construction of the Alaska railroad is foredoomed to disappointment.

Alaska in recent years has in some respects been overadvertised and some wrong impressions given concerning the opportunities for settlement and home making, through lack of proper information or excess of enthusiasm, sometimes on the part of persons merely making brief trips through the Territory during the most favorable period of summer and occupied chiefly in observing the scenery. Such persons are apt to confuse scenery with the business of life. True, huge snow-capped mountains and great glaciers, with the cool summers of the coast, are an asset to the Territory as inviting tourist travel, but they are not an asset to the would-be farmer. What he needs is arable land which can be cleared and brought under cultivation without prohibitive cost, a market for his product, and transportation facilities to reach that market. These conditions exist in Alaska to a very limited degree at this time.

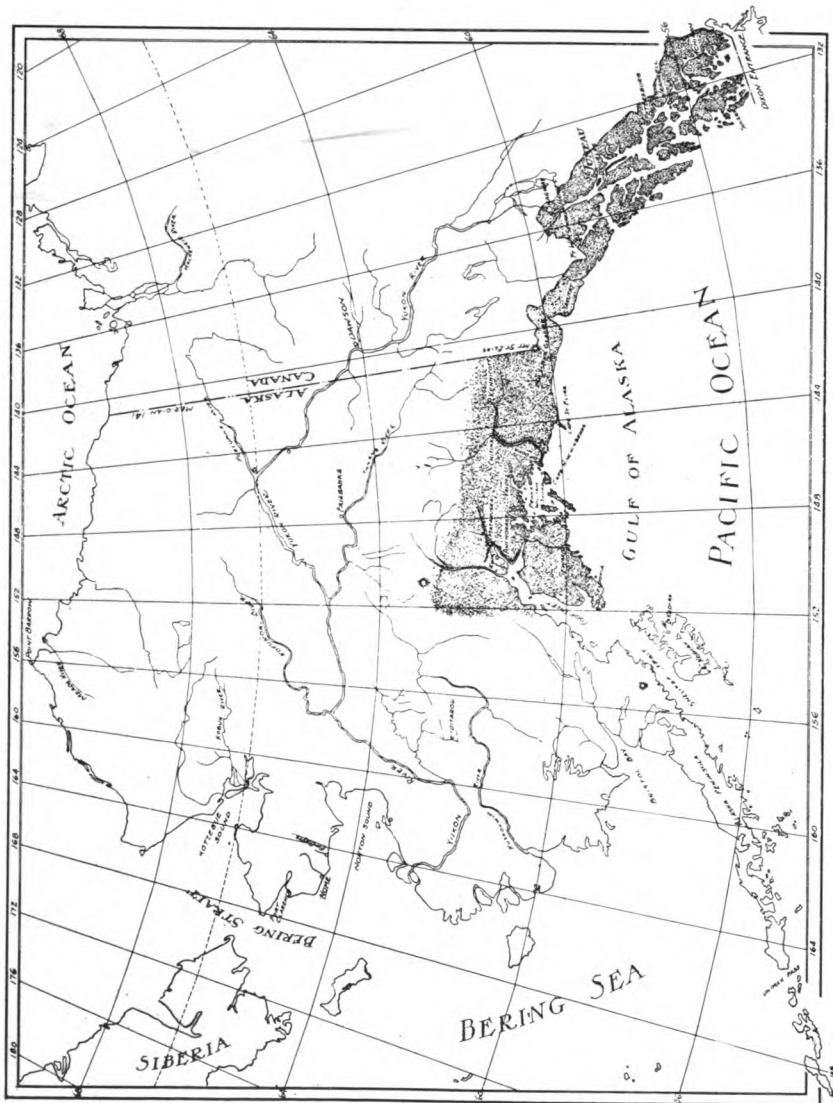
The expression "agricultural possibilities" has frequently been used concerning this aspect of Alaska's future, and it should be borne in mind that, with the exception of some very small and widely scattered areas of still doubtful value, the word "possibilities" accurately describes the condition at the present time.

One of the engineers of the road commission was sent to the Matanuska region during the past summer to further investigate the conditions in that vicinity, especially with reference to the repeated and insistent demands made upon our board for road work to aid the farmers in that section, involving an expenditure far in excess of what it was possible to make. The following extract is taken from his report:

Most of the farmers located in this region are old prospectors, and several of them with whom I came in contact gave me to understand that they would be willing to sell out their relinquishment for a stake that would allow them to go back to the hills again and that they had taken up these farms with that object in view, or with the view of selling out to some one for enough to allow them to get out to the States, where they could purchase a farm.

This represents one view, at least, of the situation, where there is a great need for roads, which need our board is entirely unable to meet with funds available or in prospect, unless the needs of all other sections of the Territory are ignored. It is somewhat doubtful even if the building of farm roads was contemplated in the law creating the road commission.

A romantic interest has always attached to the history of Alaska, and that same interest delights now to contemplate the unusual features of the Territory, such as the great low-grade lode proper-



OUTLINE MAP OF ALASKA.

Showing southeast portion and section between longitude 141° and 150° west, approximately 100 miles in width from main shore line, with connecting coastal strip.

ties of southeastern Alaska and the placer gold in the ocean sands of Bering Sea, both on tidewater; the wonderfully rich copper mine of Kennicott; the beautiful southeastern Alaska inland waterway; the salmon; the great glaciers; Mount McKinley; the hugh Kodiak bear and moose of Kenai Peninsula and other big game; but all these are special features, most of which have little direct connection with the general development of the Territory.

The section of Alaska known as "southeastern," together with a strip averaging approximately 100 miles in width inland from the coast and extending from the one hundred and forty-first to the one hundred and fifty-second meridian westward, including the Kennicott and adjacent copper deposits and the Bering River and Matanuska coal, constitutes perhaps less than 10 per cent of the area of Alaska. This section, on the other hand, including as it does the principal timber areas, the deep-sea fisheries (except Bristol Bay), vast low-grade gold deposits with the chief copper and coal deposits, and numerous small valleys suitable for tillage and dairying, embraces, I venture to say, 80 per cent of the real resources of Alaska; at least as now known, and until such time as a pressure of population in the States shall make mere land areas far more important than at present. The growing trade between the States and Alaska is confined almost entirely to this section, although the statistics on the subject have been published in such manner, at least in some instances, as to give the impression that the whole Territory is participating in this growing trade and development.

As stated in a former report, "the truth about Alaska is good enough." Any information disseminated on the subject, by exploitation through newspaper articles and other publicity agencies, which tends to give a wrong impression of the true conditions can only result in injury to the Territory in the end. Alaska is for the present, aside from the fisheries, essentially a mining country, and with encouragement and support to the miner and prospector and to capital as well, which is sorely needed to open up its resources, and with reasonable aid in the construction of wagon roads and trails, the Territory will develop and grow in population and in home building along normal lines; but slowly, and with much labor. The truth must be faced in the end, in spite of enthusiastic reports and glowing predictions and books of romance written on the subject. These latter are frequently interesting and doubtless well intentioned, but serve rather to entertain the tourist and sight-seer than to aid the investor and home seeker. The natural resources as they are developed can be levied upon to assist in bearing the expense of road building and eventually to carry it altogether.

The foregoing embraces only the briefest outline of past and existing conditions, together with some carefully considered views concerning the future, especially of this most important problem to Alaska of road construction, based upon 20 years of observation and experience in the Territory. Detailed description of the work follows in the report of the engineer officer of the board.

GENERAL CONDITIONS.

The Board of Road Commissioners for Alaska is now engaged upon the construction or maintenance of more than 50 distinct projects,

which, by subdivision in compliance with law, constitute over 100 routes of various lengths, distributed over a territory whose area is twelve times as great as that of New York State, with an air-line distance of over 1,300 miles separating the northernmost and southernmost projects.

The construction of wagon roads in Alaska presents several phases which are not met with in any other part of the United States; some of these unusual conditions have been fully described in previous reports, as well as the methods adopted in dealing with them, but a brief summary will be given here for convenient reference, and in order that certain minor modifications in the conclusions formerly reached, made in the light of further experience, may be recorded.

As was to be expected in an almost virgin wilderness, the problem of location has been a difficult one, due to the lack of definite information regarding the country, the varying soil and climatic conditions to be allowed for, and the necessity for such a location as would enable the road to be constructed with the funds available or likely to be available. In addition, there is ordinarily to be considered the extreme desirability of making the location quickly enough to permit of beginning construction the same season, as it is during the development period of a mining camp, when heavy machinery and large amounts of supplies are being shipped in, that a road will effect the greatest saving to the operators.

The locator should be a man of sound judgment, possessing a thorough knowledge of local conditions and methods of construction, in order that he may make intelligently the necessary compromise between the ideal location and that requiring the minimum expenditure. Unfortunately, it has not always been possible to secure men fulfilling these requirements.

Distance and elevation must often be sacrificed to secure the best ground for the roadbed, and the location must be so made as to afford protection from winter storms, and, if possible, freedom from springs and long wet sidehill cuts which in winter may be the source of extensive and dangerous accumulations of ice, locally termed "glaciers."

The maximum grade allowed is 10 per cent, except that where necessary to avoid very expensive construction, grades of 15 per cent are permitted when the length is less than 100 feet or where the slope is favorable to the greater portion of the heavily loaded traffic.

Only the simplest methods of location are used—usually a compass or transit and chain survey, with vertical angulation for all grades. Extreme accuracy is not striven for, and, as a rule, little topography is taken except in the rare cases where the construction can be done advantageously by contract. The expense and time required for more elaborate surveys would not be justified for the character of roads constructed, and although some minor changes in location have been necessary as the roads have been improved, it is believed that the additional expense is more than compensated for by the benefits secured to the operators by quicker construction.

The most unusual and troublesome feature encountered in construction is the permanently frozen ground which covers a large portion of the entire interior, and which is protected from thawing during the summer by a thick layer of moss, turf, or decayed vege-

table matter. The character of this frozen material varies largely in different sections of the Territory, and even in the same section. It may be gravel, clay, silt, peat, or clear ice, or a combination of two or more of these elements.

When gravel is encountered the problem presents no special difficulties; the moss or turf is stripped off, and the road graded in the usual manner. When the material is clay, experience has shown that the same procedure can usually be followed, but the grading is a slow and rather expensive process. After the protective covering of vegetable matter is removed, it is necessary to allow the soil to thaw and dry out somewhat before it can be worked, and unless a considerable period is allowed to elapse between the stripping and the grading, it will be found that the thawing has not extended to sufficient depth to permit of completing the grading in one operation. When the necessity for the road is not pressing, an appreciable saving can be effected by stripping the road bed and digging drainage ditches during one season, completing the construction the next year.

In those localities, however, where the frozen material is silt or peat, the stripping of the roadbed quickly results in the formation of a quagmire through which a man or horse, even without a load, can pass only with the greatest difficulty. Such soil has sufficient bearing value only as long as it remains frozen, which makes it desirable that the moss or turf overlying it be kept intact. This layer of vegetable matter is not of itself able to sustain traffic, necessitating the addition of a protective covering—usually pole or brush corduroy when timber is available. Fortunately the growth of scrub spruce timber which covers a large part of interior Alaska, except the Seward Peninsula, affords excellent material for this corduroy.

Where the trees are large enough pole corduroy is constructed by grubbing all stumps and roots from the road bed, leveling it, and laying perpendicularly to the axis of the road a single layer of poles from which the largest and stiffest branches have been trimmed. Ditches are then dug at a distance of 3 to 5 feet from the ends of the poles, and the material therefrom, after rejecting the top layer of vegetable matter, is placed on the corduroy for the double purpose of protecting it from wear and affording a smoother roadway. If the soil in the ditches is entirely unsuitable for this covering, other material, preferably gravel, is hauled on from the nearest available source.

Where the spruce timber is of very small size, or where only small willows are available, as on the Seward Peninsula, brush corduroy is used. The method of construction is similar to that described above, except that the single layer of poles is replaced by a mattress of untrimmed brush containing sufficient material to give a thickness of at least 6 inches when compressed.

When corduroy has been properly protected, its life in most parts of Alaska is quite long. Poles taken out of the road after 10 years of service have been found to be in excellent condition.

The 3 to 5 foot berm which is left between the ends of the corduroy and the ditches is very necessary to protect the corduroy from undermining, as the ditches, under the action of sun and rain, slough and cut rapidly. Ordinarily, as the frozen soil thaws and cuts away, the moss of the berm gradually assumes a gentle slope to the bottom of

the ditch, effectually protecting the corduroy, but where the cutting is severe, it often becomes necessary torevet the insides of the ditches with moss or turf. Frequent outlets from the ditches must be provided, and when the amount of water reaching the ditch on the upper side of the road is large it is advisable to construct an additional ditch parallel to the road and about 50 feet away, with sufficient outlets to culverts of ample size.

Aside from the roadbed itself, frozen ground encountered on hillsides is troublesome because of its tendency to thaw and slide, filling the ditches and covering the road with soft, sticky mud. The worst difficulties of this kind have been experienced near milepost 77 on the Valdez-Fairbanks Road, where at two different periods portions of the hillside 20 to 50 feet wide and extending back from 100 to 200 feet have slid into and across the road, carrying down trees and underbrush and compelling the construction and use of short temporary detours until the movement ceased. In their appearance and general characteristics, these "mud glaciers," as they are locally called, resemble on a greatly reduced scale the famous Cucaracha slide at Panama.

Along the Pacific coast of Alaska no frozen ground is encountered, but the mountainous character of the country, the excessive rainfall, and the difficulties of clearing, have made the work, as a rule, even more expensive than in the interior. Unless the soil encountered in this region is gravel, it will not stand up under traffic during the heavy and continuous rains, and some protective covering is required. Fortunately gravel is usually found at no great distance; otherwise corduroy or plank roads are constructed.

The numerous swift streams of glacial origin found in the Pacific coast section and throughout the Alaskan range in the interior have been the source of much trouble and expense. Flowing through gravel beds varying in width with the volume of water carried up to two miles or more, they rarely have any fixed channels. It is by no means uncommon for one of these streams to abandon an old channel and establish itself in a new one half a mile away almost over night. When warm weather causes rapid melting of snow and ice in the glaciers, these streams become raging torrents of enormous destructive force, and roads paralleling them are in constant danger of being washed away. Numerous methods of bank protection to prevent damage from this cause have been tried, of which the following has proved to be the cheapest and most effective: A layer of loose brush of sufficient length to give the requisite protection is placed on the threatened bank, perpendicular to the current, and weighted below the center with stone enveloped in galvanized-wire netting, the whole being anchored in place by wires extending to "deadmen." For emergency work when the water is too high to permit of placing the wire netting and rock, the brush is made into fascines inclosing sacks of earth, which are then placed against the threatened bank and wired to it and to each other. This form of protection is easily and quickly constructed and has repeatedly demonstrated its effectiveness.

When a glacial stream is to be crossed by the road, and a site can be found where the natural features confine it to one fixed channel, the construction of a bridge is as a rule comparatively easy. Where,



TWO VIEWS OF VALDEZ-FAIRBANKS ROAD, NEAR FAIRBANKS.

however, such a site is not to be found the problem becomes one of no little difficulty. No accurate records exist of the heights of previous high waters, nor would such records afford any sure guide to the future, as the accumulation of enormous volumes of water in glacial reservoirs and their discharge by the subsequent bursting of such reservoirs may give rise to floods whose magnitude can not be predicted. The constantly changing channels make necessary the construction of long bridges, unless the valley is narrow enough to permit with available funds the construction of diversion dikes concentrating and controlling the flow. Pile trestles are used for bridging minor streams of this character, but the many large boulders encountered prevent great penetration of the piles, and there is always danger that the changing channel will result in the washing out of part of the trestle, thus interrupting traffic and entailing additional expense.

The largest and most dangerous of these streams along the important roads have been spanned by bridges, but many of the smaller ones remain unbridged because of the cost and the fact that during the greater part of the year they are fordable.

Until 1916 all wagon bridges constructed by the board, with the exception of two suspension bridges, were of wood for the reason that suitable timber has usually been available near the site, while the cost of transporting other material from the United States has been excessive. The trusses have been of the Howe type, with iron or steel verticals, and have been built in spans up to 150 feet. The bridge seat is supported by piles, about which is constructed a rock filled log crib pier with sloping nose, supported and strengthened by additional piles. These piers have been subjected to severe tests by floods and spring ice runs, but in almost every case have emerged undamaged.

As most of the streams to be bridged are subject to sudden rises during the summer, bringing down much driftwood, with consequent danger to falsework, nearly all bridge construction is done during the winter. The additional expense caused by the difficulty of working in temperatures sometimes as low as 50° below zero, is partly compensated for by the greater facility with which falsework and piers can be erected on the ice.

With the improvement of the roads and the development of the country, it has been thought advisable to make all new bridges stronger than those constructed in the past, and a new standard design loading, including a 15-ton traction engine has been adopted. Standard plans conforming to this loading for spans varying from 30 feet to 150 feet are now being prepared. Spans 100 feet and over will have Pratt combination trusses. For bridges of smaller span, of the Howe truss type, alternative designs for the lower chords, using steel, are being prepared, for the reason that in some localities much of the suitable timber for these members has been logged or burned off, and the remainder can be secured only at great expense.

The first all-steel bridge to be constructed by the board was erected at Fairbanks during March of this year. The unusual circumstances of length of span—300 feet—and location on water transportation dictated the choice of steel in this case, but its general adoption is out of the question under present conditions.

As now constructed, the width of wagon roads varies with the formation of the ground and the amount of traffic expected, but as a general rule roads graded by other means than the road grader are given a minimum width of 20 feet between ditches, and those on which the road grader is used a minimum width of 24 feet. On steep side hills and where rock work is involved, the width is reduced to 10 or 12 feet. The standard width of clearing is 30 feet, but this is increased to 60 feet where necessary in order to secure the beneficial action of wind and sun on the roadbed.

Sled roads for winter traffic only are cleared for a width of 16 feet, with all stumps, hummocks, and similar obstacles removed for a width of 8 feet. They are constructed where the amount of traffic is not great enough to justify a wagon road, where the cost of building a wagon road would be prohibitive, or where the communities along the route are amply served by water transportation during the open season, as is the case with the Fairbanks-Fort Gibbon sled road. If it seems probable that future developments may demand or justify a wagon road, the location is made as for a wagon road, in order that work done on the sled road may be of use when the improvement is made.

Trails designed for travel by dog team in winter or by pack train in summer are given a width of 8 feet, with all stumps and underbrush cut off as close to the ground as possible.

In the past, the work of constructing and gradually improving the roads has been so generally intermingled with maintenance operations that a systematic plan for maintenance has not been put into effect, nor would such a plan have been feasible in view of the uncompleted state of the roads. At the present time, however, the condition of parts of the more important roads, notably the Valdez-Fairbanks Road, is such as to make practicable their maintenance by dragging. As Alaska has only a very small agricultural population, the method adopted in many States of contracting with farmers adjacent to the road for the necessary dragging can not be used, but it is intended to place on completed sections small maintenance crews consisting, as a rule, of two men each, supplied with a team, wagon, drag, and the necessary small tools. Two such crews have been employed on the Valdez-Fairbanks Road during the present summer, with very satisfactory results. On several of the gravel-surfaced roads in southeastern Alaska the patrol system of maintenance has been used in connection with more extensive repairs. The results show the method to be very effective for roads of this character.

The average costs per mile, including construction and maintenance of all roads and trails constructed by the board since its organization in 1905 are as follows: Wagon road, \$3,419; sled road, \$379; trail, \$113. A division of these amounts to show the exact cost of construction proper is impossible, but a careful analysis of the available data indicates that the following unit costs of construction, including bridges, may be accepted as approximately correct: Wagon roads, \$2,475 per mile; sled roads, \$300 per mile; trails, \$65 per mile. The average costs of maintenance during the past season were as follows: Wagon roads, \$250 per mile; sled roads, \$14 per mile; trails, \$8 per mile.

It is difficult to make a fair comparison of the above costs with the costs of work of the same class elsewhere in the United States, because of the modifying influences of local conditions in Alaska, among which are the short working season, peculiar soil conditions, glacial streams, high wages, and the very high freight charges on all supplies. It may safely be stated, however, that, due to the factors mentioned, the cost of work in Alaska is not less than twice the cost of similar work done under conditions ordinarily prevailing in other parts of the United States.

The funds available for the work of the board have been entirely inadequate to meet the demands, and it has seldom been possible to complete an important road in one season. This, however, has not always—or even ordinarily—operated to materially increase the cost of the completed work. As a road is gradually improved from year to year, the action of the sun and wind in thoroughly thawing and drying the roadbed and the adjacent right of way, has been of incalculable assistance in the construction. For this reason it is not believed that the Valdez-Fairbanks Road, in its present condition after 10 years' work, could be duplicated in one or two years with the total amount expended to date for its construction and maintenance.

Before proceeding to a description of the work of the year it seems advisable to again emphasize the often-repeated fact that the board has been endeavoring only to construct roads which would be classed merely as good country highways or wagon roads. The rapidly growing automobile traffic in Alaska, however, has led many people who are unfamiliar with the country to anticipate hard-surfaced boulevards over which an automobile can travel with ease under any weather conditions. The board has never professed to build such roads, nor would any considerable expenditure for such a purpose have been justifiable in view of the limited funds and the urgent need in so many localities. During the period covered by this report a larger appropriation than usual has been available, and the attempt has been made to place gravel on sections most needing it, but no general project for surfacing all roads can be commenced or carried to completion unless much larger appropriations are provided or assured. Very heavy and continuous rains during the fall of 1916 and throughout the greater part of the present summer have again demonstrated the necessity for surfacing, and it is to be hoped that sufficient funds may be provided in the near future to permit, at least, of so improving the most important roads, thus aiding greatly in the development of the Territory and also effecting a final saving to the Government due to reduced maintenance costs.

A detailed description of the work in the various districts follows:

SOUTHEASTERN DISTRICT.

(Mr. J. C. HAYES, Superintendent.)

Route 1—Prince of Wales Island Road (4.1-mile road, 6.8 miles trail).—The work of the year was confined to the wagon-road section, the greater part of which is planked. Worn planks were replaced and the remainder leveled where necessary. An extension of 200 feet at the western end of the road was constructed at a cost of \$2 per linear foot. The total expenditure was \$676.09.

Route 2—Juneau-Eagle River Road (16 miles road, 14 miles trail).—A branch road 3,600 feet in length was constructed during the year, connecting the main road with the bridge previously built over Mendenhall River. The new road was graveled throughout its entire length at a cost of 15 cents per linear foot, and a 200-foot framed trestle crossing a tidal slough was constructed at a cost of \$3 per foot. The work of continuing this branch to Auk Lake is now in progress.

General maintenance on the main wagon road included increasing the depth of surfacing to enable it to withstand the heavy automobile traffic, cleaning ditches, and replanking about 600 linear feet of bridges and culverts at a cost of \$1.50 per foot. A new bridge, consisting of one 50-foot pony-truss span and 50 feet of approaches, was built over Lemon Creek at a cost of \$650.

Route 3—Haines-Pleasant Camp Road (47.5 miles).—The year's work on this route was entirely maintenance and embraced resurfacing weak sections with gravel and repairing bridges and culverts. Gravel in place cost approximately 75 cents per cubic yard, the average haul being less than 3,000 feet. The total cost of all work averaged \$70 per mile.

Route 14—Sitka-Indian River Road (3.4 miles).—Approximately 3,000 feet of new road was constructed at a cost of \$1,300 in extending this route toward Sawmill Bay, and a small amount of work was done in protecting the piers of the Indian River bridge during high water.

Route 39—Juneau-Sheep Creek Road (3 miles).—The work of the year on this route consisted chiefly of widening the narrowest parts of the road and resurfacing it throughout the greater part of its length. Gravel in place cost \$1 per cubic yard, the average haul being about 1 mile. A 60-foot trestle bridge, destroyed by a snowslide during the winter, was replaced at a cost of \$600. The average cost of all work was \$1,864.80 per mile, the high cost being due to unfavorable weather conditions and the very heavy automobile travel over the road.

Route 40—Douglas-Gastineau Channel Road (2 miles).—A total of \$414.10 was expended for minor repairs to this road during the year.

Route 43—Petersburg-Scow Bay Road (.5 mile road, 1 mile planked trail).—Twenty-eight hundred feet of this road was graded during the year at a cost of \$2,285.70. The unusually high cost was due largely to the nature of the soil encountered, which was a blue glacial clay.

The completion of this road will be undertaken next year by the Forestry Service.

Route 44—Skagway Valley Road (2.5 miles).—The work of the year on this route was devoted chiefly to the construction of 2.5 miles of road extending north from the bridge previously built over the Skagway River. The new road is surfaced where gravel was available in the ditches. Some additional work was required during the year in protecting the bridge from damage by high water.

Route 45—Silver Bow Basin Road (4 miles).—This road extends from Juneau through the Silver Bow Basin to the Perseverance mine. It was constructed by the mining company, but was taken over by the board in 1915. The work of the past year consisted of



STRIPPING ROADBED, AUK BAY EXTENSION.



WESTERN TERMINUS, PRINCE OF WALES ISLAND ROAD.

surfacing with gravel the softest parts of the road, cleaning ditches, and reconstructing 600 feet of planked roadway at a cost of \$1 per linear foot. The cost of gravel averaged \$1.25 per cubic yard.

The average cost of all work was \$571.42 per mile.

VALDEZ DISTRICT.

[Mr. J. H. INGRAM, Superintendent.]

Route 4A—Donnelly-Washburn Sled Road (55 miles).—The construction of temporary winter bridges on the Big Delta and Little Delta Rivers and a small amount of grading on approaches to streams not bridged comprised the year's work on this route. The bridges were constructed by contract, those over the Big Delta costing \$2 per linear foot, and that over the Little Delta \$2.50 per linear foot.

Route 4B—Valdez-Ernestine Road (63 miles).—Throughout a great part of its length this route is subject to attack by glacial streams, and its construction and maintenance have been difficult and expensive. The work of the past year has embraced the repair of damage caused by these streams, general maintenance, and improvements of substantial and expensive character.

The 3-mile section crossing the glacial moraine adjacent to Valdez has been built up to a grade above the highest stage of water, and the embankment protected by brush and rock revetment. Two men were kept on this section during the entire working season, and all threatened portions were strengthened before any serious damage could result.

Extremely high water in Lowe River during the late summer washed out short sections of the road at the head of Keystone Canyon and at the 5-mile post. The repair of these sections necessitated a considerable amount of rock work.

The bursting of glacial reservoirs at the source of a small stream near the head of Keystone Canyon twice destroyed a short section of the road and changed the channel of the stream, requiring the reconstruction of the section and the removal of the bridge to the new channel.

The usual maintenance work comprised the removal of slides and snow, cleaning ditches, repairing culverts and bridges, etc. In addition, about 3 miles of road was graded, and a total of 10,000 cubic yards of gravel surfacing placed. The cost of the gravel depended largely upon the length of haul but averaged approximately \$1 per cubic yard.

The average cost of all work on this route was \$688.34 per mile.

Route 4C—Ernestine-Willow Creek Road (29.3 miles).—The work of maintenance and improvement was carried on over the entire route during the year, and embraced cleaning ditches and removing slides and windfalls, repairing bridges and culverts, grading approximately 2 miles of road, and placing 1,200 cubic yards of gravel surfacing. The average cost of the work was \$383.22 per mile.

Route 4D—Willow Creek-Gulkana Road (36 miles).—Work on this route during the year included grading about 2.5 miles of road, laying 1,100 linear feet of corduroy, cleaning ditches, and general repairs to the road and bridges. A maintenance crew of two men was employed on this route for the last six weeks of the year drag-

ging the road and repairing culverts. The average cost of all work during the year was \$487 per mile, but the cost of maintenance should be materially less in the future, as the entire route is now in good condition.

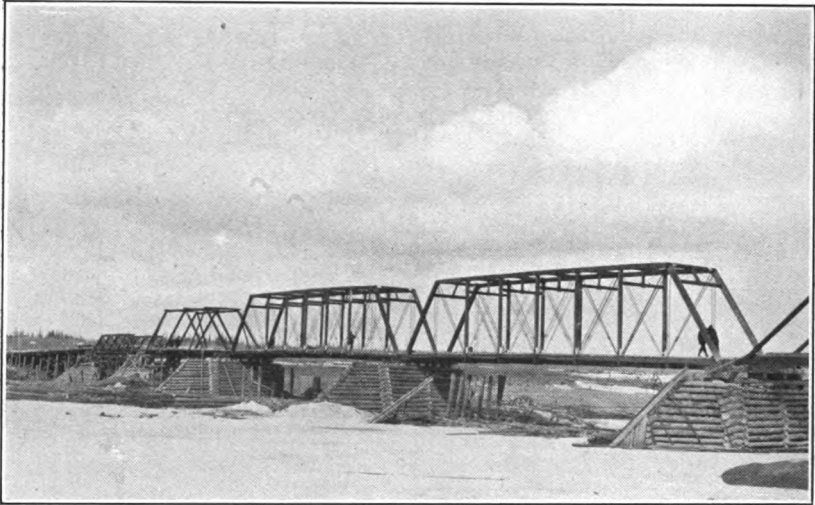
Tazlina Bridge.—The Tazlina River bridge was in part reconstructed during the spring of 1917. As originally built, together with additions made necessary by changes in the main channel, this bridge, exclusive of approaches, consisted of three 75-foot spans, two 108-foot spans, and one 50-foot span. The 108-foot spans were constructed in 1906, and it was thought advisable to replace them and to repair the entire bridge. The work done was as follows: The two south 75-foot spans were raised 2 feet to conform to the elevation of the new part of the bridge, which was adopted in order to give greater security during extreme high water. The 108-foot spans and the 50-foot span were demolished and the north 75-foot span was taken down and replaced by two 100-foot spans of the new standard type (Pratt combination trusses). The 75-foot span was reerected north of the 100-foot spans and the bridge continued northward to the bank by a 60-foot pony-truss combination span and 170 feet of pile trestle. The truss timbers and stringers of the new spans are Douglas fir; the remainder of the timber used in the bridge is Alaska spruce cut in the vicinity of the bridge site. Below is an itemized statement of the field cost of the bridge:

Material (steel, lumber, pile shoes, etc.)-----	\$5, 870. 57
Equipment -----	751. 05
Freight -----	1, 566. 11
Subsistence -----	1, 484. 96
Forage and care of animals-----	560. 15
Labor -----	8, 214. 63
Miscellaneous -----	51. 64
Total-----	18, 499. 11

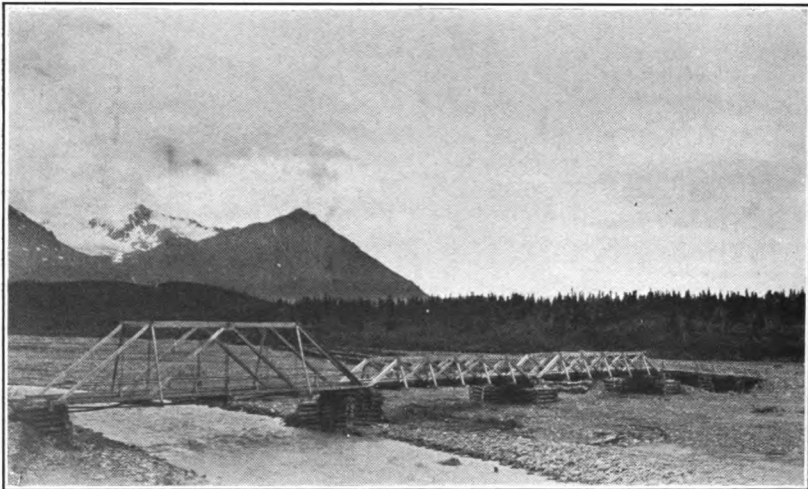
Route 4E—Gulkana-Sourdough Road (21.5 miles).—This is a difficult section to maintain, as the soil is largely clay and muck, and there is but little gravel available within a reasonable distance. The work of the year was devoted to widening the clearing, where necessary, to allow the sun to reach the road, grading with a road grader about 3.5 miles previously ditched by hand, and general repairs. Further grading on this route is being carried on this season. Because of the soil conditions the road is given a higher crown than is usual, and it is thought that after completion of the grading it can be kept in fair condition by a small maintenance crew. The cost of the work done during the year averaged \$682.65 per mile.

Route 4F—Sourdough-168 Milepost Road (18.2 miles).—In addition to ordinary maintenance, approximately 9 miles of road was graded with a road machine to a width of 24 feet. The clearing was widened to 60 feet along the greater part of this 9 miles, to allow the sun to reach the road. A small amount of gravel surfacing was laid at a cost of approximately \$2.25 per cubic yard, the high cost being due to the scarcity of gravel and the long hauls necessary.

Route 4G—168 Milepost-Delta River Road (38.8 miles).—The work of the year on this route consisted chiefly of ordinary maintenance, embracing the removal of slides, cleaning ditches, and repairing culverts. Approximately 2 miles of road was graded and 9,200 feet



TAZLINA BRIDGE, VALDEZ-FAIRBANKS ROAD.



BRIDGE OVER GLAZIER STREAM NEAR MILLERS, VALDEZ-FAIRBANKS ROAD.

surfaced with gravel. A short pile bridge was built over the glacial stream near mile 202, and a dike 700 feet in length was constructed for the purpose of confining the stream to its present channel. The average cost of all work was \$306.72 per mile.

Route 4H—Delta River-McCarty Road (73.4 miles).—The work performed on this route during the year embraced the removal of slides, repairing bridges damaged by high water, grading 2 miles with a grader, and surfacing 1 mile with gravel.

The bridge over the glacier stream near Miller's was lengthened by the construction of two 60-foot spans and 66 feet of approach. The added spans are of the new pony truss type, with steel lower chords and native timber compression members. The cost of this work, exclusive of freight, was as follows:

Material	\$1, 714. 10
Labor :	
Cutting and getting out timber.....	831. 29
Whipsawing timber.....	416. 10
Constructing piers.....	506. 30
Framing trusses.....	143. 29
Erecting trusses.....	107. 43
Placing floor system.....	206. 15
Total.....	3, 924. 66

To confine this stream to its present channel, a dike 585 feet long and 5 feet high was constructed, with its upstream slope protected by a heavy layer of brush secured at the top to the dike and weighted with rock held in place by wire netting. The total cost of the dike was \$588.73.

Route 4I—McCarty-Richardson Road (20.6 miles).—In addition to general repairs to the road between McCarty and Shaw Creek, the work of the year was confined chiefly to the ferry and bridges in the vicinity of McCarty.

A new ferry scow, 16 by 35 by 3 feet, was constructed of native whipsawed lumber, at a cost of \$778.95.

Improvements to the bridge over the north slough near McCarty included replacing the existing 30-foot span by a standard 60-foot pony truss span, reerecting the 30-foot span north of the new 60-foot span, and constructing 56 feet of pile trestle approach. The total cost of this work was \$1,027.97, exclusive of freight from Seattle.

A pile bridge, 204 feet in length, constructed over the middle McCarty Slough, cost \$828.37.

Route 6A—Willow Creek-Tonsina Road (24 miles).—The greater part of this route was graded with a road grader during the year. Culverts were repaired and new ones built where necessary; ditches were cleaned out and a small amount of gravel surfacing placed. During May and June of this year two maintenance men, with a team, were employed in dragging the road, repairing culverts, etc. The cost of the year's work averaged \$328.27 per mile.

This route, which traverses naturally good soil, is now in good condition and should require little work in the near future outside of that performed by a small maintenance crew.

Route 6B-Tonsina-Chitina Road (15 miles).—Ordinary maintenance work was done on this route, but the chief expenditure was devoted to improvement, which is expensive, because of the rugged

and difficult country through which the road runs. The long grade leading to the Tonsina River Valley was widened and surfaced, involving the construction of 1,760 linear feet of corduroy, costing 78 cents per foot, and the removal of 1,400 cubic yards of solid rock, which was made use of in surfacing 5,570 linear feet of the road. Approximately 3,500 cubic yards of gravel surfacing was placed, at an average cost of \$1.10 per cubic yard. In addition, ditches were cleaned, slides removed, culverts repaired, driftwood removed from the Tonsina River Bridge, and 1½ miles of road graded.

The dike constructed last year above the Tonsina Bridge (see annual report for 1916, p. 11) was partly destroyed by high water during the summer of 1916. It was rebuilt and strengthened this spring, and has successfully withstood the high water and accomplished its purpose.

Chisana Trail.—This is a winter trail from McCarty, on the Copper River & Northwestern Railroad, to the Chisana mining district. The best route for travel varies from year to year, and the trail is marked each winter with temporary stakes. The staking last fall was done under the supervision of local parties, \$500 being expended by the board and \$500 contributed by interested persons in the vicinity.

SOUTHWESTERN DISTRICT.

(Mr. ANTON EIDE, Superintendent.)

Route 10—Seward-Kenai Lake Road (14 miles).—The work of improvement on this route begun in 1915 by the Territorial road commissioner was continued by the board during the past year. The first 3 miles were improved, and extensive new construction was undertaken between mileposts 3 and 7. A total of 4.4 miles was graded with the road grader, 0.8 mile graveled, 520 feet of bridges redecked, and 7 new culverts constructed. The work was greatly hampered by very heavy rains and high water. Unit costs of various classes of work were:

Clearing and grubbing (heavy), per acre.....	\$230.00
Grading, per linear foot.....	.12
Redecking bridges, per linear foot.....	2.50
Graveling, per linear foot.....	.19

Maintenance work during the spring, embracing the repair of washouts, surfacing soft spots, and dragging, cost \$1,339.60.

The reconstruction of the bridge over Resurrection River (annual report, 1916, p. 11) was completed during July. The three 75-foot spans are of Douglas fir and the remainder of the bridge of native spruce timber. An itemized statement of the field cost is given below; freight on material obtained in Seattle is not included.

Material:	
Piling.....	\$237.60
Fir lumber.....	693.40
Native lumber.....	659.41
Rods, bolts, etc.....	600.00
Drift bolts and spikes.....	105.50
Dynamite, fuse, and caps.....	33.00
Tools.....	10.00
Total.....	2,338.91

Driving piles:	
Rent of driver with fuel and oil.....	\$160.00
Labor.....	753.67
	\$913.67
Planking and capping piers and lowering approaches.....	330.00
Getting out stringers and caps for approaches.....	317.00
Framing and raising trusses.....	340.00
Placing stringers and decking.....	325.20
Placing hand and guard rails.....	107.40
Cutting and blasting out old trestle.....	50.00
	4,722.18

A 72-foot Howe truss span of native spruce was constructed over a stream near the Ole Martin ranch. The detailed cost was:

Getting out timber for crib abutments and lower chord.....	\$52.50
Constructing abutments.....	23.00
9,500 feet b. m. native lumber, at \$22 per M.....	209.00
Rods, bolts, and spikes.....	47.83
Framing and raising trusses.....	55.00
Placing decking and handrails.....	30.00
	417.33

Route 12—Mile 34 A. N. R. R.-Hope Road (31 miles road, 9 miles sled road).—The usual maintenance work on the wagon-road section included the widening of the road, cleaning ditches, redecking 420 linear feet of bridges at a cost of \$2.75 per foot, and general repairs. On the sled-road section a small amount of work was done, principally in removing windfalls. The total cost was \$4,526.35, of which \$514 was expended in repairing and protecting the road during the spring.

Route 19—Kern Creek-Knik Trail (86 miles).—During the summer of 1916, forest fires and landslides caused by excessive rains destroyed a large part of this trail along Turnagain Arm. The work of repairing this damage covered about 20 miles, and included removing slides, replacing and repairing bridges and culverts, clearing windfalls and rebuilding cribbing. During the winter two men were employed on the Turnagain Arm section of the trail, repairing it, and keeping it clear of slides and dangerous accumulations of ice.

Upon completion of the new Government railroad from Seward to Matanuska the larger part of this route can be abandoned, but until the gap between Kern Creek and Anchorage is closed winter traffic over it will be very heavy.

Route 20A—Knik-Susitna Trail (30 miles).

Route 20B—Susitna-Rainy Pass Trail (127 miles).

Two hundred and fifty dollars was expended on route 20A during the year, chiefly in clearing windfalls and bridging small streams which are difficult to cross during the spring and fall.

Route 20C—Rainy Pass-Tacotna Trail (130 miles).

Route 20D—Tacotna-Kaltag Trail (145 miles).

No work was done on these routes during the year.

Route 24—Mile 29 A. N. R. R.-Moose Pass Road (29.5 miles).—The improvement of 14.5 miles of sled road to wagon road standards constituted the work of the year on this route. Grades were cut down, the road bed was widened and drained, culverts were con-

structed, and corduroy laid where necessary. The average cost of the work was \$592.64 per mile. The average unit costs were:

Clearing and grubbing, per acre.....	\$120.00
Ditching and grading, per linear foot.....	.07
Corduroy, per linear foot.....	.60

Route 32A—Tacotna-Flat Creek Trail (87 miles).—No work was done on this route during the year.

Route 35—Knik-Willow Creek Road (34 miles).—General repairs were made to the entire route during the year. A small amount of corduroy was laid, and a quantity of culvert timber was cut and hauled for future use on the section above timber line. One mile of new road was constructed to reduce a steep grade at mile 33.

A standard 60-foot pony truss bridge of native spruce was constructed over the Little Susitna River, replacing an old stringer bridge. The cost was as follows:

Material (steel and hardware, Seattle)	\$408.00
Cutting and hewing timber.....	478.80
Hauling steel, etc., to bridge site.....	70.00
Constructing and filling timber abutments.....	75.00
Framing and raising trusses and placing decking.....	280.00

Total

1,312.13

The freight on steel and hardware from Seattle is not included in the above total.

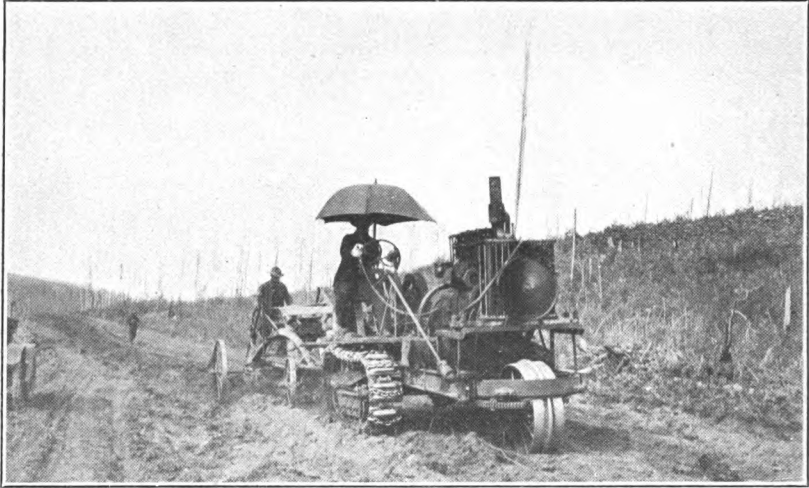
Extensive improvement work on this road is now in progress from Wasilla, where it crosses the new Government railroad, in order that it may better serve the growing needs of the Willow Creek mining district.

Route 35A—Archangel extension (2 miles).—This route will connect mile 32 on the Knik-Willow Creek Road with the Archangel Creek Valley, where a number of lode mines are developing. The entire road will be above timber line, necessitating the transportation of all culvert material and wood for fuel from considerable distances, and thus increasing the cost. A total of \$1,003.50 was expended during the past year, and the work of completing the road is now in progress.

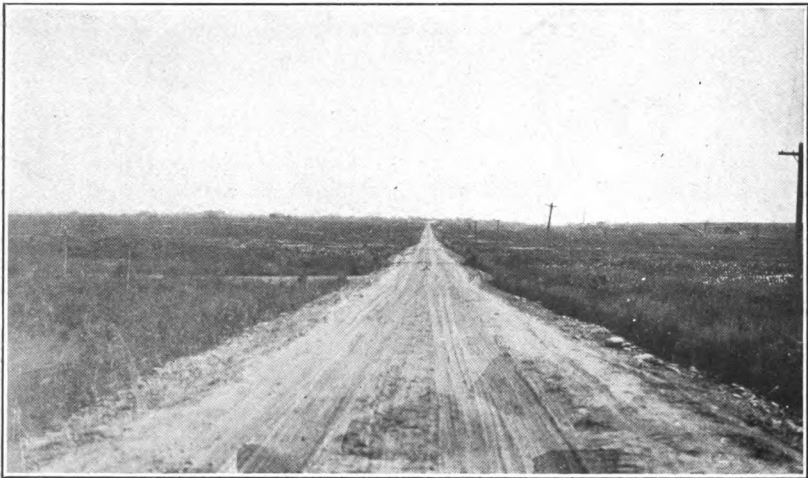
McDougall-Cache Creek Trail.—This trail leads from McDougall, on the Yentna River, to the Cache Creek placer mining district, a distance of approximately 30 miles, and was constructed by operators in the district. During September and October, 1916, a location for a wagon road following the same general route was made and a bridge 120 feet long was constructed over Cache Creek, at a total cost of \$1,329.15.

Travel to and from this district is dependent upon uncertain and slow, small boat service from Anchorage up the Susitna and Yentna Rivers. Upon the completion of the Government railroad a more suitable route will lead from some point on the railroad near Talkeetna overland to Cache Creek. A reconnaissance of this route is now being made, with a view to the probable construction of a sled road if a suitable location is found.

Palmer-Mile 26 survey.—During the late fall of 1916 a location survey was made for a road 8 miles in length from Palmer, on the Government railroad, to mile 26 on the Knik-Willow Creek Road,



GRADING WITH CATERPILLAR TRACTOR, ESTER CREEK ROAD.



NOME-BESSIE ROAD.

to serve a considerable number of farmers who have taken up homesteads along the proposed route. The cost of the survey was \$96.20. Construction of the road is now under way.

YUKON DISTRICT.

(Mr. R. J. SOMMERS, Superintendent.)

Route 4J—Richardson-Salchaket Road (30 miles).—Extensive improvement of that portion of the road between mileposts 312 and 330, except 1 mile, constituted the work of the year on this route. The road was straightened, widened to 30 feet, and graded with a road grader. A change in the location was made between mileposts 318 and 319, involving the construction of approximately a quarter of a mile of new road around a steep bluff. The old road at this point was located on the flat along the Tanana River, where it was subject to overflow during high water. Two other short relocations were also made, the road in each case being shifted from the flat to the hillside, where better soil and drainage could be obtained. Sixty-eight culverts were constructed at an average cost of \$20 each, and 560 linear feet of corduroy was laid at a cost of \$60 per foot. The average cost of all the work was \$1,955.95 per mile for the 17 miles improved.

Route 4K—Salchaket-Fairbanks Road (40 miles).—Eighteen and a half miles of this road, from mile 352 to mile 370, were reconstructed during the year. The road was widened, straightened, and graded with a road grader; fills were made across small swales, and 8,470 linear feet of drainage ditch constructed. Sixty-one culverts, two 36-foot pony truss bridges, and seven 16-foot stringer bridges were built, and 4,050 linear feet of corduroy laid.

Owing to the continuous cutting away of the road near mile 357, a relocation was made between mileposts 353 and 360. The new location is 0.5 mile longer than the old road, but it is on higher ground, with better soil conditions, and is well back from the river. This relocation also eliminated about 3 miles of narrow corduroy which is subject to overflow by the Tanana River during high water, and which could not be satisfactorily repaired except at great expense.

Average unit costs of the work were:

Clearing and grubbing to 30-foot width, per mile-----	\$289.20
Grading, including small fills, per mile-----	1,289.36
Drainage ditches, per foot-----	.15
Carduroy, per foot-----	.60
Culverts, each-----	20.00
Bridges, 16-foot, each-----	40.00
Bridges, 36-foot, each-----	200.00

Route 5—Ester-Fort Gibbon Sled Road (148 miles).—The year's work on this route consisted of general repairs and maintenance. Slides, windfalls, and stumps were removed between the 12 and 49 mileposts and 4 bridges, ranging in length from 19 to 31 feet, were constructed, at an average cost of \$5 per foot, the high cost being due to the scarcity of suitable timber. Repairs to bridges near Hot Springs cost \$157. Seven bridges near Tanana, varying from 18 to 36 feet in length, were reconstructed with sawed lumber, at a cost of \$858.78.

Route 7A—Summit-Cleary Road (11 miles).

Route 7B—Fox-Olnes Road (13 miles).

Route 7C—Summit-Fairbanks Creek Road (11 miles).

Route 7E—Vault Creek Road (2 miles).

Route 7F—Vault Creek-Treasure Creek Road (1.5 miles).

Route 7H—Little Eldorado Creek Road (1.5 miles).

Route 7I—Gilmore-Summit Road (6 miles).

These routes were maintained by the Territorial road commissioner for the fourth judicial division, and no work was done on them by the board.

Route 7D—Ester Creek Road (13 miles).—The work of the year on this route consisted of the improvement of 2,000 feet of the road on mile 3, where it traverses a mattress of decayed vegetable matter, or peat, several feet deep, for a distance of over 0.5 mile. Two thousand feet of corduroy was laid and covered, at a cost of 85 cents per foot. Four bridges, with an aggregate length of 89 feet, were built, at a cost of \$239.

During the present year the improvement of the road is being continued as far as the Government experimental farm.

Route 7G—Fairbanks-Gilmore Road (13 miles).—The work done by the board on this route was confined to the construction of a pile bridge over Noyes slough to replace a 70-foot Howe truss span which collapsed. A part of the material from the old bridge was used in the new construction, and other material was furnished by the Territorial road commissioner, who also performed general maintenance work on the road.

Route 7J—Fairbanks-Chena Hot Springs Trail (64 miles).

Route 7K—Olnes-Livengood Sled Road (54 miles).

No work was done on these routes during the year.

Route 9—Rampart-Eureka Road (6.5 miles road, 21.5 miles sled road).—General maintenance work on this route was carried on during July and August, and included redecking 19 culverts and 3 bridges, the reconstruction of 2 bridges, aggregating 54 feet in length, and widening and repairing the road between the 6 and 10 mileposts.

Route 11A—Eagle-O'Brien Creek Road (17 miles).

Route 11B—O'Brien Creek-Fortymile Sled Road (30 miles).

Work on these routes during the year consisted of general repairs and maintenance. On the wagon-road section, culverts were rebuilt, bridges repaired, and one new bridge constructed, ditches cleaned and extended, and a small amount of gravel surfacing placed. Maintenance work on the sled-road section included the removal of rock slides, widening the road, and ditching some sections.

Route 11C—Steel Creek-Jack Wade Road (2.5 miles).

Route 11D—Canyon Creek-Walkers Fork Sled Road (10 miles).

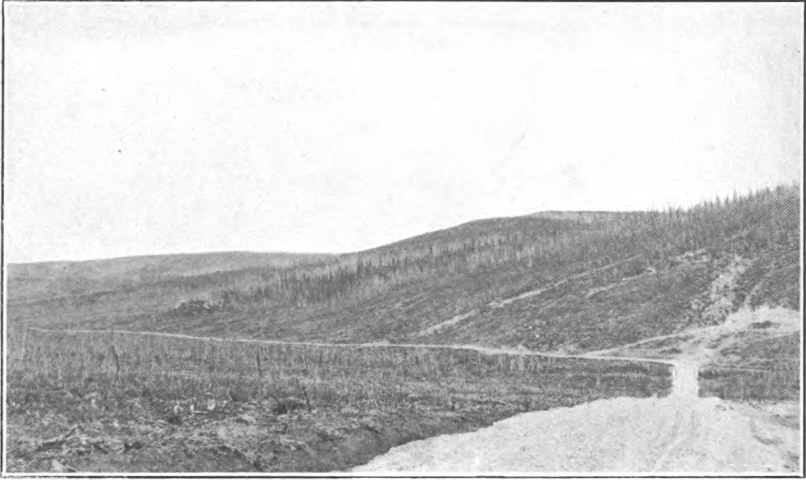
No work was done on these routes during the year.

Route 11E—Eagle-Seventy Mile Sled Road (20 miles).—A total of \$502 was expended on this route, chiefly in constructing three bridges, repairing culverts and bridges, and ditching.

Route 15—Circle-Miller House Road (49 miles).—Annual maintenance work on 34 miles of this route was performed during the summer and included cleaning and constructing ditches, laying 1 mile of light corduroy, repairing damage caused by washouts, and re-

0
0-34

1
2



TWO VIEWS OF RUBY-LONG CREEK ROAD.

decking and repairing culverts and bridges. The average cost of the work was \$137 per mile for the 34 miles on which work was done.

Route 16—Chatanika-Miller House Sled Road (81 miles).—The year's work on this route consisted chiefly in repairing bridges and removing slides. Six bridges were repaired, and one new bridge 24 feet long was constructed. The total cost of the work was \$500.

Route 17—Fort Gibbon-Kaltag Trail (257 miles).—The temporary staking of this trail for the guidance of winter travel was done by contract, at a cost of \$300.

Route 17A—Lewis Landing-Dishkaket Trail (108 miles).

Route 17B—Nulato Dishkaket Trail (90 miles).

No work was done on these routes during the year.

Route 22—Hot Springs-Sullivan Creek Road (9 miles wagon road, 6 miles trail).—The work of the year on this route was confined to the wagon-road section. Bridges, culverts, and corduroy were repaired, ditches were cleaned, and a small amount of new ditching was done. Grading was done on sections between Kemperville and Sullivan Creek where the road had settled and a grader could be used to advantage. The average cost of the work was \$127 per mile.

Route 23A—Chatanika-Beaver Trail (120 miles).

Route 23B—Beaver-Chandler Sled Road (25 miles).

Route 29—Fort Gibbon-Koyukuk Trail (100 miles).

No work was undertaken on these routes during the year.

Route 30—Hot Springs Landing-Eureka Creek Road (32 miles).—The year's work on this route was confined to the section between the Landing and Hot Springs, and comprised laying 180 feet of corduroy, cleaning ditches, filling ruts, and repairing several small bridges and culverts.

Route 31—Salchaket-Caribou Creek Sled Road (46 miles).—No work was done on this route during the year.

Route 32B—Iditarod-Flat Creek Road (8 miles).

Route 33A—Otter Creek Towpath (22 miles).

Route 33B—Summit-Otter Creek Road (6 miles).

The work of the year on these routes was devoted to maintenance on the main Iditarod-Flat Creek Road, with some improvements on the first 6 miles of that road. Bridges and culverts were repaired, 4,010 linear feet of corduroy laid, and 9,481 feet of road graveled. The total expenditure was \$4,500.

Route 38—Ruby-Long Creek Road (19.5 miles road, 10.5 miles sled road).—The year's work on this route embraced repairs to the main street of Ruby, the maintenance and improvement of the 6 miles of wagon road previously constructed, and the improvement to wagon road standards of approximately 13.5 miles of sled road.

The extension of the road which forms the main street of Ruby (not an incorporated town) was reconstructed for a distance of 1,300 feet, or practically its entire length. The steep approaches at either end of the street were graded down and ditched and the entire street was surfaced with rock. Six culverts were constructed, the material for five of which was furnished by adjacent property owners. The total cost of this work was \$1,501.09.

From Ruby to milepost 6 extensive maintenance and improvement work was done. Sidehill cuts were widened, holes filled, corduroy

repaired and renewed, and 240 linear feet of road surfaced with rock. The average cost of the work was \$466.84 per mile.

From the 6 milepost to a point 0.5 mile beyond the 19 milepost, a wagon road was completed, largely following the old sled road. The work was accomplished under very trying weather conditions, the rainfall throughout the summer being without precedent in the history of Ruby. This heavy rainfall greatly increased the difficulty of overcoming the miles of glacial muck formation traversed, and was chiefly responsible for the unusually high cost of the work.

In the construction of the new road 183 culverts were constructed, 24,506 linear feet of corduroy laid, 46,603 linear feet of road graded and ditched, and two bridges having a total length of 298 feet built. The road varies in width from 16 to 30 feet, according to the formation of the ground. All of the culverts, with the exception of 12, were constructed of poles secured on the ground. Pole or brush corduroy was used, depending upon the timber available where required.

Average costs of the work were:

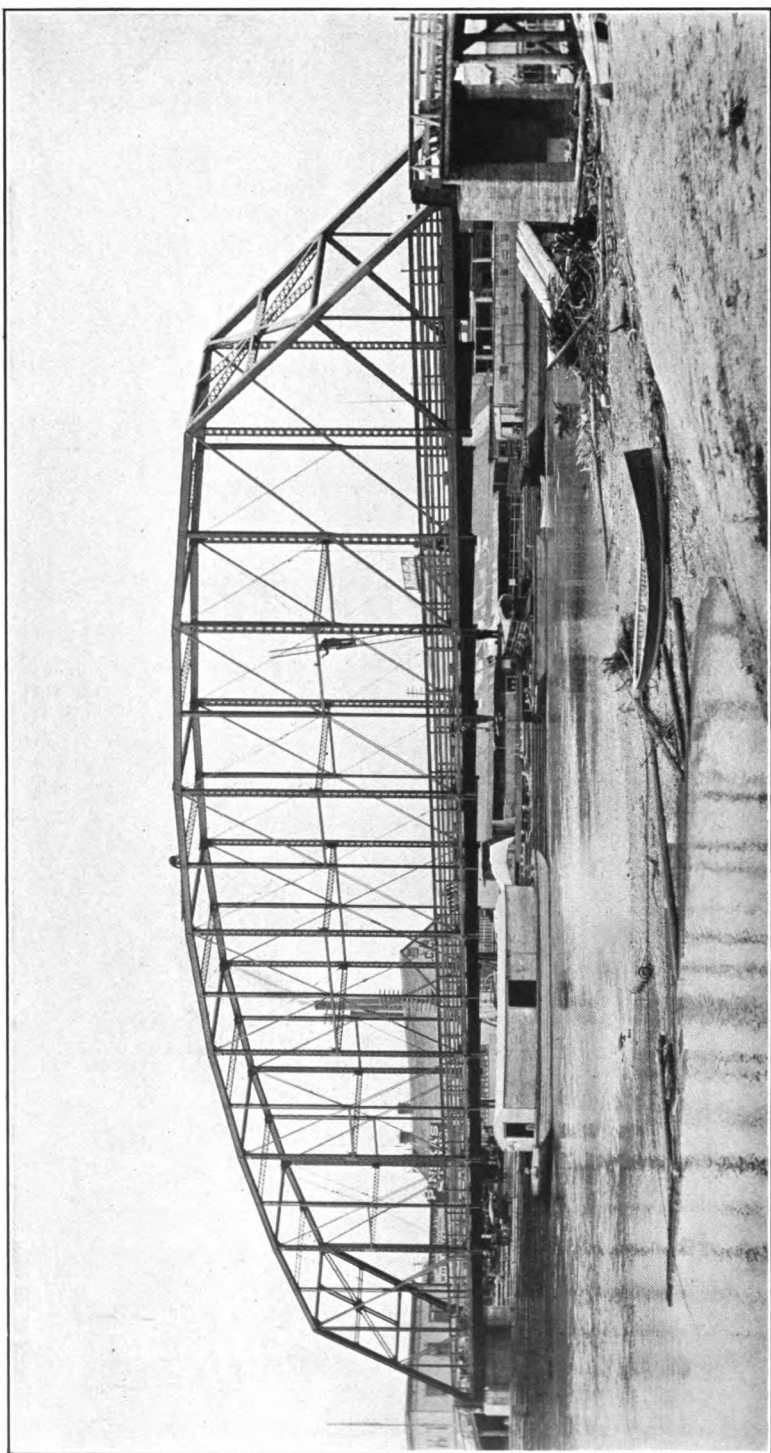
Clearing, grubbing, and grading, per linear foot.....	\$0.78
Corduroy, per linear foot.....	.90
Culverts, each.....	27.88
Bridges, per linear foot.....	1.81

A permanent cache or warehouse 16 by 48 by 10 feet, with a corrugated iron gable roof, was constructed near the 19 milepost for the storage of supplies, equipment, and forage, no building being available for the purpose along the entire length of the road. The cost was \$484.61.

Maintenance work during the past spring on the entire 19.5 miles of wagon road comprised thawing ice out of culverts, opening channels under bridges, and repairing damage done to the new work during the break-up. The soil in this region cuts very rapidly when the moss is removed, and it is subjected to the action of running water, and a large part of the corduroy was seriously threatened by cutting ditches. Where this was found to be the case, the inner sides of the ditches were thoroughly revetted with moss and sod covered with earth. It is thought that in the future any damage from this source can be largely eliminated by leaving a wider berm—at least 5 feet—between the ends of the corduroy and the inner edges of the ditches, and this will be done. The cost of this spring work can not be given, as part of the expenditures had not been reported at the close of the period of this report.

Prior to last year the prevailing summer freight rate from Ruby to Long Creek was 7 cents a pound, the freight being hauled over ridges which in wet weather became almost impassable, horses often sinking to their bellies in the mud. At the present time light motor trucks are delivering freight in ton lots at the 20 milepost under favorable weather conditions, for 1½ to 1½ cents a pound, and the rate to Long City when the road is completed will probably not exceed 2 to 2½ cents per pound, the saving resulting directly from the road thus amounting to at least \$70 per ton.

The work of completing the road to Long Creek is now in progress. A further extension from Long Creek to Poorman, a distance of approximately 24 miles, is urgently needed, but its construction will be expensive and can not be undertaken by the board with the funds now available or in prospect.



BRIDGE OVER CHENA SLOUGH, FAIRBANKS.

Route 32B—Long Creek-Cripple Trail (60 miles).—The work of the year on this route embraced the construction of a 25-foot bridge over Ophir Creek, repairing the bridge over Monument Creek, and filling in washouts between the Solatna River and Poorman. The total cost was \$196.

Route 46—Kantishna Trail (75.75 miles).—This is a trail constructed during the past winter from the Thirty-mile Roadhouse, 26 miles from Nenana on the proposed route of the new Government railroad, to the Kantishna mining district. From the initial point to the Toklat River, 26 miles, an old Indian or prospectors' trail was followed. This trail was widened where necessary, and tripods were placed at intervals of 200 feet in open country for the guidance of travel.

From the Toklat River to Diamond City, 37.75 miles, the work was entirely new construction. The trail was cleared for a width of 8 feet through all timbered sections, trees being cut as close to the ground as the depth of snow permitted, and other obstacles to traffic removed. All open country was staked with tripods, and 10 permanent bridges, aggregating 315 feet in length, were constructed.

Between Diamond City and Glacier, the terminus of the route (12 miles), the location follows an old trail, which was widened and straightened where most necessary.

The work was done during February and March of this year under the efficient supervision of Mr. Thomas Lloyd. The total cost was \$4,571.63.

Route 47—Coldfoot-Wiseman Sled Road (11.25 miles).—This is a winter sled road from Coldfoot, the ordinary head of navigation on the Koyukuk River for light-draft boats, to Wiseman, which is the supply point for the Koyukuk mining district. Freight is landed at Coldfoot during the summer and a small amount is transported to Wiseman on small gasoline or poling boats or on horse scows. The greater part of the freight, however, is stored at Coldfoot and hauled to Wiseman and the adjacent producing creeks during the winter.

Construction work was carried on during September and comprised clearing and grubbing over the entire distance, and the construction of 3 foot bridges, with a total length of 445 feet, and 18 wagon bridges, aggregating 384 feet in length.

The total cost of the work was \$5,000, or \$444.44 per mile.

Eagle-Circle Mail Trail.—A total of \$206 was expended on this trail during the year. The work consisted of grading approaches to streams and widening and clearing the trail between mileposts 6 and 10 and between mileposts 15 and 22 north of Eagle.

Bridge over Chena Slough, Fairbanks.—The project for this bridge was described in the annual report for 1916 (p. 15). The superstructure is a 300-foot steel span, with Petit trusses, designed for a uniform live load of 50 pounds per square foot or for two 8-ton motor trucks passing. The abutments are of concrete, each consisting of two columns with stepped reinforced footings, supported on piles. The columns are connected at the top by a reinforced concrete curtain wall. The north approach is a framed trestle 180 feet in length; the south approach, constructed by the city of Fairbanks, is combined earth fill and trestle.

Excavation for the abutments was commenced August 9, 1916, being delayed until that date by the difficulty of securing proper lumber

for the cofferdams, which were constructed of Wakefield sheet piling. Work on the south abutment, which was constructed first, was greatly hampered by a mass of brush and refuse extending to a depth of 15 feet below mean water level, through which the cofferdam and excavation had to be carried. As a consequence of the delays, cold weather set in before the north abutment could be completed, making it necessary to heat the concrete materials and to keep the abutment covered and heated until the concrete had thoroughly set.

The structural steel for the bridge reached Fairbanks on the last boat to arrive there during the open season of 1916, but seven eye-bars were found to have been so badly damaged as to make their use inadvisable. Duplicate bars were ordered immediately, shipped by express to Seattle and thence by freight to Chitina, from which place they were hauled on sleds to Fairbanks, arriving only two days before they were needed in the erection.

Pile falsework was driven, braced, and capped before the freeze up. The usual falsework employed in the interior of Alaska is merely a trestle supported on the ice, but in this case the weight of the bridge and the fact that several sewers discharging hot water have their outlets near the bridge site made the use of piles advisable.

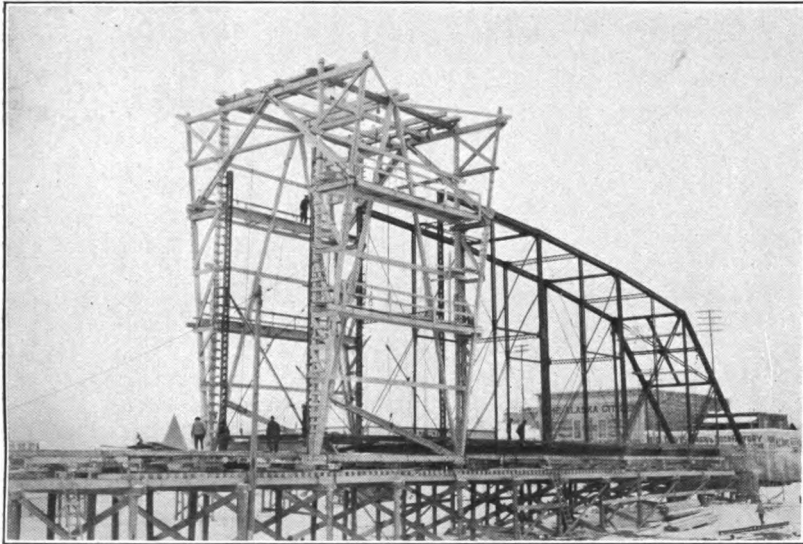
A wooden gantry traveler for erecting the trusses was framed and erected during the latter part of February of this year. The cost of the traveler was considerably increased by the inability of local lumber dealers to furnish timbers of requisite size, which necessitated the use of many built-up members.

The erection of the trusses, starting at the north end, was begun March 1. No unusual difficulties were experienced, although the greater part of the crew had had no previous experience in such work. The bridge was swung March 22 and opened to vehicular traffic on April 19.

The total net cost of the bridge was \$51,489.19. This was much greater than the first estimate, the increase being due to various causes, some of which, such as the necessity for replacing damaged I bars, the difficulty of excavating for the south abutment, etc., have been mentioned above. It was originally intended to construct the bridge during the winter of 1915-16, but the destruction by fire of the almost completed plans in July, 1915, caused the postponement of the project for a year, during which time prices underwent a considerable advance, making the cost of all structural materials greater than had been anticipated.

A detailed report of the cost has not yet been received; the general distribution was as follows:

Material	\$23, 190. 14
Freight	7, 689. 88
Equipment	839. 67
Engineering, superintendence, and inspection.....	2, 941. 81
Labor	15, 395. 22
Hire and care of animals.....	1, 250. 03
Fuel and power.....	1, 032. 31
Miscellaneous.....	662. 21
Total	53, 001. 27
Received from sales.....	1, 512. 08
Total net cost	51, 489. 19



FAIRBANKS BRIDGE DURING CONSTRUCTION.

NOME DISTRICT.

(Mr. DANIEL A. JONES, Superintendent.)

Route 8—Nome-Council Road (approximately 82 miles; 57 constructed).—Maintenance work on the Nome-Fort Davis section included blasting the ice under bridges in the spring and resurfacing 3,300 feet of road with gravel. The Rocker Creek Bridge was repaired by constructing two new crib supports and replacing old stringers.

No expenditure was made on the Fort Davis-Cape Nome section, which, as noted in previous reports, was very badly damaged by the storm of 1913. The Territorial road commission is now engaged upon the reconstruction of this section.

Work on the Cape Nome section, which was reconstructed in 1915 by the Territorial road commission, consisted of removing slides, cleaning ditches, and constructing 1,575 feet of approaches to the new road, at a cost of \$2,826.99.

General maintenance and the construction of 6,945 feet of gravel-surfaced corduroy constituted the year's work on the Solomon-East Fork section. The total expenditure was \$5,041.23.

Maintenance of the Fox River-Council section, which is entirely corduroy, cost \$445.10 per mile.

The maintenance and operation of the Safety Ferry cost \$885.80, of which \$385.80 was expended for new cable and minor repairs to the scow.

The cost of maintaining and operating the Bonanza Ferry was \$537.70; of this amount, \$162.70 was for new cable and repairs to the ferry scow.

Route 13A—Nome-Bessie Road (3.3 miles).—General maintenance on this route, including resurfacing 7,335 linear feet with gravel, cleaning ditches, and opening channels through the ice under bridges during the spring, cost \$696.97 per mile. In addition, 400 cubic yards of material in the fill over Dry Creek, washed out by high water, was replaced at a cost of 51 cents per cubic yard. The maintenance cost for the year was greater than usual, largely because of the heavy rains during the summer of 1916.

During June of this year 1,200 tons of freight were transported over this road, and the daily average freight movement throughout the year was approximately 30 tons.

Route 13B—Bessie-Banner Road (3.5 miles).—The work of the year on this route was confined to surfacing 2.3 miles with gravel, at a cost of \$3,797.07.

Route 13C—Bessie-Little Creek Road (1.25 miles).

Route 13D—Bessie-Dry Creek Road (1.25 miles).

No work was done on these routes during the year.

Route 13E—Dry Creek-Newton Road (0.33 mile).—Repairs to culverts on this road cost \$27.

Route 13F—Nome-Osborne Road (4 miles).—General maintenance work on this route cost \$45.18 per mile.

Route 13G—Grass Gulch Road (1.75 miles).—No work was undertaken on this route during the year.

Route 13H—Center Creek Road (1.37 miles).—The cost of resurfacing 625 feet of this road with gravel was \$386.84.

Route 13I—Nome River Road (5 miles).—The protection of this road during the spring break-up cost \$13.05 per mile. No other work was done during the year.

Route 13J—Wonder-Flat Creek Road (2 miles).—General repairs and maintenance on this route cost \$178.05 per mile.

Route 13K—Bessie-Buster Road (5 miles).—The work of the year on this route consisted of general maintenance and surfacing 1 mile with gravel 12 inches thick, at a cost of \$0.36 per foot.

Route 18—Kaltag-Solomon Trail (2.48 miles).—On the Topkok-Unalaklik section of this trail 2,818 permanent stakes, each 3 inches in diameter at the butt and 9 feet long, were cut and set. In addition the permanent stakes on 79 miles were repaired and reset where necessary and 4½ miles of new trail cleared through timber. The total cost was \$961.85.

Route 21—Unalaklik-St. Michael Trail (approximately 65 miles).—The temporary staking of 18 miles on the ice between St. Michael and Klikitarick cost \$16. The remainder of the work embraced restaking 27 miles with permanent stakes and the construction of a light tram over the Golsovia River, at a total cost of \$381.40.

Route 25A—Cripple River Road (13.5 miles, total A and B).

Route 25B—Penny River Road.

Route 25C—Nome-Wireless Road (0.25 mile).

No work was done on these routes during the year.

Route 25D—Mouth of Center Creek Road (2 miles).—General maintenance and repairs on this road cost \$87.66 per mile.

Route 25E—Submarine Paystreak Road (2.5 miles).—As originally built this road extended from near the mouth of Snake River for a distance of approximately 1 mile along the submarine paystreak. A total of only \$620.84 has been expended on it since its location in 1907, and no work has been done on it for several years. At the present time a new road, following a better location, is being constructed from the Snake River bridge to the submarine paystreak. This road will be designated by the same name and route number as the old road, which has been abandoned.

The work of the year consisted chiefly in the construction of fills leading to the Snake River bridge approaches, containing 1,460 cubic yards of material. A branch road 1,200 feet in length was also constructed from the west approach to a point near the mouth of Snake River. The total cost of all work was \$1,765.07.

Route 25F—Anvil-Glacier Road (3 miles).—General repairs to this route included cleaning ditches and hauling 480 cubic yards of gravel surfacing. The average cost was \$395.85 per mile.

Route 25G—Snake River Extension Road (3 miles).—The work of the year on this route embraced general repairs and the surfacing of 2,380 linear feet of road with gravel. A suspension foot bridge over Snake River at the mouth of Boulder Creek, having a span of 130 feet, and two 18-foot bridges over Sledge Creek were constructed at a cost of \$294.73. The material used was largely obtained from the old Snake River bridge.

Route 25H—Otter Creek Road (1.25 miles).—No work was done on this route during the year.

Route 25—Sinrock Ferry.—The total cost of maintaining and operating this ferry was \$321.90, of which \$71.90 was expended for minor repairs to the scow.

Route 26—Candle-Candle Creek Road (5 miles).—The year's work on this route consisted of cutting and tying 3,382 fifty-pound bundles of willows, which were hauled and distributed along the road during the winter for use in constructing corduroy this year.

Route 27—Deering-Inmachuck Road (25 miles).—General maintenance covering the whole route, together with some new construction on the left bank of the Inmachuck River, eliminating seven crossings of the river, constituted the work of the past year. The center pier of the bridge over the lagoon near Deering had been undermined and was removed and replaced by piles. Eight new culverts were constructed, 0.5 mile of road graded and ditched, and 2,700 feet of corduroy laid and graveled.

Route 28—Dahl Creek-Candle Trail (140 miles).—The repair and replacement, where necessary, of permanent stakes throughout the entire length of the route cost \$1 per mile.

Route 37—Topkok-Candle Trail (141 miles).—Twenty-six miles of this route were restaked with permanent stakes and 3 miles cleared through timber, at a total cost of \$460.

Route 42—St. Michael-Kotlik Trail (approximately 70 miles).—Those portions of this route not on the ice were marked with permanent stakes, 40 to the mile. The work was done by contract and cost \$350.

Route 49—Davidsons Landing-Taylor Creek Road (40 miles; 24 constructed).—This road extends from the head of navigation on Marys River to Taylor Creek, in the Kougarok mining district. Only light construction work was undertaken, covering the first 24 miles of the route, and consisting of clearing out the road, eliminating creek crossings by grading, and laying gravel-surfaced willow corduroy over soft spots. Since the work was done teams have been able to haul loose loads 1,500 pounds greater than the average before the improvement was made.

Marshall Road.—This road when completed will extend from a tributary slough of the Yukon to the placer mines of the Marshall district and will be about 3 miles in length. The work done during the past year consisted of cutting and hauling poles for approximately 2 miles of corduroy. Only a part of the accounts covering this work have been received, and the total cost can not be reported.

This project has been taken over and will be completed this year by the Territorial road commission.

Flagging trails.—Approximately 550 miles of trails, in addition to those permanently marked, were temporarily staked or flagged for the guidance and safety of winter travel. The total cost, including cost of inspection trips by the superintendent of the district, was \$4,225.30.

Snake River Bridge.—The construction of this bridge (see annual report 1916, p. 18) was begun June 17 and completed August 19, 1916. Nearly all of the material used, including piles, lumber, and steel, had to be obtained and shipped from Seattle, largely increasing the cost. The two 100-foot spans are of the combination Pratt truss type. All truss timbers, stringers, and planks are Douglas fir.

The total cost, including the expenditure reported last year, was \$16,949.93, distributed as follows:

Material.....	\$5, 646. 72
Equipment.....	400. 21
Freight on material and equipment.....	3, 441. 05
Engineering.....	600. 00
Labor.....	6, 188. 39
Hire of animals.....	453. 31
Miscellaneous (fuel, telegraph, etc.).....	220. 25
Total.....	16, 949. 93

Of the above amount \$526.50 was expended during the winter in protecting the piers by cutting away the ice and placing riprap around them.

ACCOUNTING.

The expenditures of the Alaska Road Commission during the fiscal year July 1, 1916, to June 30, 1917, amounted to \$576,747.90, of which \$76,716.15 was received from the Alaska fund, \$500,000 from a special appropriation made by Congress, and \$31.75 from collections reverting to that fund.

As the Territory of Alaska covers approximately 590,000 square miles, and road work is done in all parts thereof, it is, of course, impossible for the disbursing officer to make all disbursements personally, although all accounts eventually pass through his office and are verified there before being forwarded to the War Department.

In order to pay promptly all accounts in outlying districts, each superintendent, one at Nome, Fairbanks, Seward, and a disbursing clerk at Ruby, acts as disbursing agent for his district.

Checks on local banks or commercial companies are given by the local disbursing agent for bills as they are incurred, and at the end of each month the total amount of checks cashed in payment of bills is telegraphed and the disbursing officer issues a Treasury check to cover the overdraft.

Proper vouchers to offset the overdrafts are forwarded by the superintendents, who are held responsible for a proper accounting for the indebtedness incurred by them.

The above system has been in operation for several years and has proven satisfactory and has enabled prompt settlement of accounts.

On June 11, 1917, the main office of the commission was moved from Valdez, where it had been for several years, to Juneau, the capital of the Territory. This transfer became necessary on account of certain additional duties being assigned to Lieut. Col. Davison, secretary and disbursing officer, in connection with the militia affairs of the Territory, which required his presence at the capital.

The office at Valdez was left in charge of a disbursing clerk, who handles all accounts of the Valdez-Chitina-Fairbanks Road.

On June 29, 1917, at a meeting of the entire board, funds to the amount of \$420,000 were allotted for various projects in the Territory for the period July 1, 1917, to June 30, 1918. Several small allotments have been made since that date.

The following statement shows in detail the receipts and disbursements from July 1, 1916, to June 30, 1917, inclusive:

STATEMENT OF RECEIPTS AND DISBURSEMENTS.

This report covers vouchers received and placed in the account, including June 30, 1917:

Balance on hand July 1, 1916.....	\$54,137.28
Received from the Treasurer of the United States:	
Appropriation "Military and post roads, bridges, and trails" (act Aug. 29, 1916).....	500,000.00
Alaska fund.....	50,000.00
Correction of vouchers:	
Alaska fund.....	1.00
Special appropriation.....	31.75
Sales of property, Alaska fund.....	2,375.40
Total.....	606,545.43
Disbursed as per tabulated statement below.....	576,747.90
Balance on hand.....	29,797.53

Expenditures in detail.

Routes, etc.	Wagon roads, bridges, and trails, Alaska fund.	Construction and mainte- nance of military and post roads, bridges, etc., Alaska.	Total.
Offices.....	\$2,536.93	\$13,414.08	\$15,951.01
Auto trucks.....	3,542.32	2,394.74	5,937.06
Route 1.....	50.00	626.09	676.09
Route 2.....	1,939.30	10,724.18	12,663.48
Route 3.....	236.35	3,126.89	3,363.24
Route 4A.....	251.10	932.01	1,183.11
Route 4B, first section.....	4,321.20	12,312.20	16,633.40
Route 4B, second section.....	3,201.12	10,211.11	13,412.23
Route 4B, third section.....	3,120.00	10,200.00	13,320.00
Route 4C.....	1,087.60	10,140.82	11,228.42
Route 4D.....	5,041.88	12,490.30	17,532.18
Route 4E.....	1,560.25	13,107.41	14,667.66
Route 4F.....	928.09	11,684.02	12,612.11
Route 4G.....	670.47	11,077.12	11,747.59
Route 4H, first section.....	2,320.32	13,322.19	15,642.51
Route 4H, second section.....	2,232.44	11,414.10	13,646.54
Route 4I.....	2,919.94	6,251.37	9,171.31
Route 4J, first section.....	422.33	17,452.50	17,874.83
Route 4J, second section.....	332.30	10,541.41	10,873.71
Route 4K, first section.....	2,025.42	15,511.25	17,536.67
Route 4K, second section.....	2,027.20	12,500.32	14,527.52
Tazlina Bridge.....	74.05	17,550.75	17,624.80
Route 5.....	48.00	2,584.85	2,632.85
Route 6A.....	1,683.43	6,185.08	7,878.51
Route 6B, first section.....	1,409.11	10,528.04	11,937.15
Route 6B, second section.....	1,306.12	8,608.40	9,914.52
Route 7A.....	9.09	.....	9.09
Route 7B.....	9.09	.....	9.09
Route 7C.....	9.09	.....	9.09
Route 7D.....	9.09	1,900.00	1,909.09
Route 7E.....	9.09	.....	9.09
Route 7F.....	9.09	.....	9.09
Route 7G.....	9.09	237.10	246.19
Route 7H.....	9.09	.....	9.09
Route 7I.....	9.09	.....	9.09
Route 7J.....	9.09	.....	9.09
Route 7K.....	9.09	.....	9.09
Route 8.....	552.14	12,181.33	12,733.47
Route 9.....	.....	1,000.00	1,000.00
Route 10.....	2,730.86	10,451.59	13,182.45
Route 11A.....	100.00	1,348.08	1,448.08
Route 11B.....	.....	194.00	194.00
Route 11E.....	.....	502.00	502.00
Eagle-Circle Mail Trail.....	.....	206.00	206.00
Route 12.....	7.00	4,519.35	4,526.35
Route 13.....	4.00	.....	4.00

Expenditures in detail—Continued.

Routes, etc.	Wagon roads, bridges, and trails, Alaska fund.	Construction and maintenance of military and post roads, bridges, etc., Alaska.	Total.
Route 13A.....	\$649.83	\$1,927.46	\$2,577.29
Route 13B.....	154.03	3,694.38	3,848.41
Route 13E.....		27.00	27.00
Route 13F.....	60.00	133.20	193.20
Route 13H.....		388.80	388.80
Route 13I.....	50.00	65.25	115.25
Route 13J.....	28.50	71.50	100.00
Route 13K.....		1,986.55	1,986.55
Route 14.....	18.00	1,401.29	1,419.29
Route 15.....	166.00	4,493.32	4,659.32
Route 16.....		500.00	500.00
Route 17.....		300.00	300.00
Route 18.....		573.85	573.85
Route 19.....		4,769.08	4,769.08
Route 20A.....		120.00	120.00
Route 20B.....		130.00	130.00
Route 21.....	51.00	881.00	932.00
Route 22.....		1,140.51	1,140.51
Route 24.....	46.22	8,824.03	8,870.25
Route 25D.....	64.00	78.25	142.25
Route 25E.....		1,780.07	1,780.07
Route 25F.....	154.02	1,039.36	1,193.38
Route 25G.....	104.03	2,281.95	2,385.98
Route 25, Sinrock Ferry	98.36	206.50	304.86
Bull Creek Bridge.....		49.50	49.50
Snake River Bridge.....	10,925.90	5,241.73	16,167.63
Route 26.....	121.35	1,142.85	1,264.20
Route 27.....	14.00	3,061.99	3,075.99
Route 28.....		139.00	139.00
Route 30.....		359.49	359.49
Route 32B.....		4,500.00	4,500.00
Route 35.....		7,822.80	7,822.80
Route 35A.....		1,003.50	1,003.50
Route 35A, first section.....	653.19	18,115.50	18,768.69
Route 35A, second section.....	489.89	16,901.25	17,391.14
Route 35A, third section.....	293.96	15,750.04	16,044.00
Route 35A, fourth section.....	195.95	16,150.00	16,345.95
Route 38B.....	18.50	13.50	32.00
Route 39.....	1,075.75	3,918.64	5,594.39
Route 40.....		414.10	414.10
Route 43.....		2,285.70	2,285.70
Route 44.....	627.99	4,394.40	5,022.39
Route 45.....	850.25	1,729.26	2,579.51
Route 46.....		4,571.63	4,571.63
Route 47.....		5,000.00	5,000.00
Route 48.....		328.50	328.50
Route 49.....		5,009.82	5,009.82
Chisina Trail.....		500.00	500.00
Taylor Creek Bridge.....	184.49		184.49
Gastineau Channel Bridge investigation.....	286.67	2,732.98	3,019.65
Fairbanks Bridge.....	9,190.61	42,632.55	51,823.16
Brooks-Terminal Sled Road.....	71.00	4,468.57	4,539.57
Taku Road reconnaissance.....		60.00	60.00
Flagging trails.....	681.39	3,543.89	4,225.28
McDougal-Cache Creek Trail.....		1,622.15	1,622.15
Matanuska reconnaissance.....		353.75	353.75
Palmer-Mile 26 survey.....		113.70	113.70
Marshall Road.....		320.25	320.25
Long-Ophir survey.....		1,837.18	1,837.18
Total.....	76,716.15	500,031.75	576,747.90

Distribution of expenditures.

Salaries (superintendents and clerks)-----	\$27, 494. 80
Wages (all other labor)-----	266, 100. 33
Transportation (persons)-----	3, 365. 63
Transportation (freight)-----	32, 564. 62
Hire of animals (horses and dogs)-----	46, 207. 56
Subsistence (persons, meals and beds)-----	14, 833. 22
Provisions (all food supplies)-----	51, 291. 29
Forage and care of animals (horseshoeing, veterinary supplies)-----	39, 049. 37
Telegraph, telephone, and postage-----	824. 44
Fuel (coal and wood) and light-----	3, 443. 44
Construction material-----	48, 238. 80
Equipment, tools, camp equipage, wagons, harness, etc-----	34, 998. 82
Stationery and drafting supplies, maps, printing, toilet and cleaning articles-----	1, 277. 87
Rents (offices, post-office boxes, barns, or equipment)-----	4, 286. 77
Motor vehicles, repairs, gas, operation, maintenance-----	1, 576. 69
Miscellaneous-----	1, 194. 25
Total-----	576, 747. 90

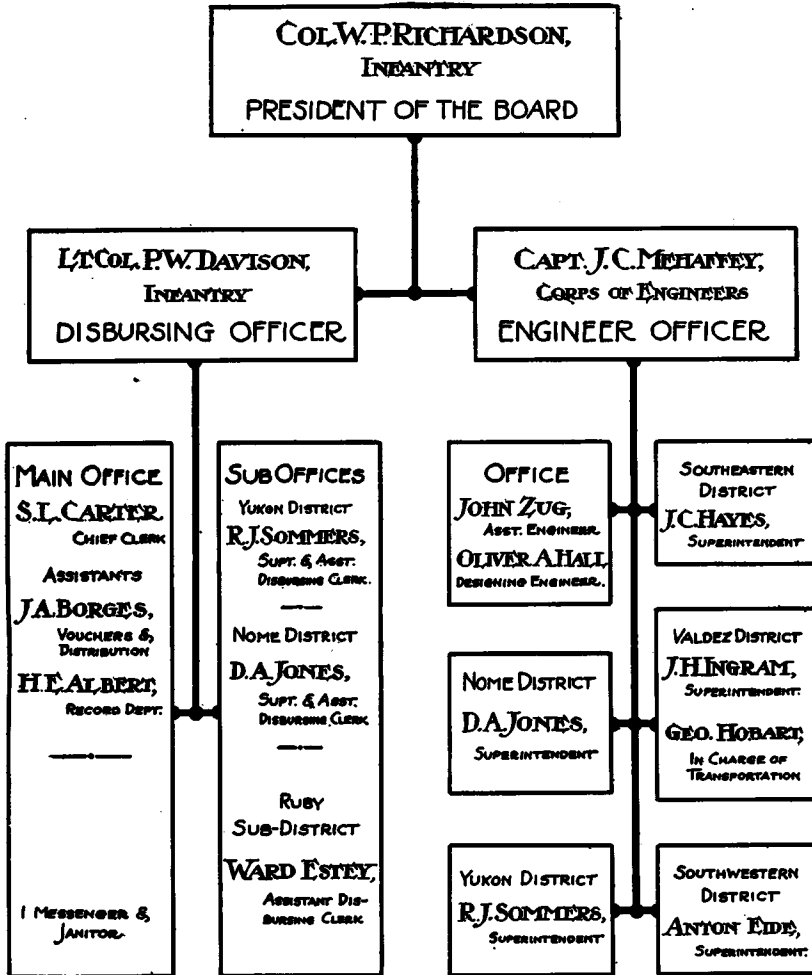
W. P. RICHARDSON,
Brigadier General, National Army, President.

P. W. DAVISON,
Lieutenant Colonel, Infantry, Disbursing Officer.

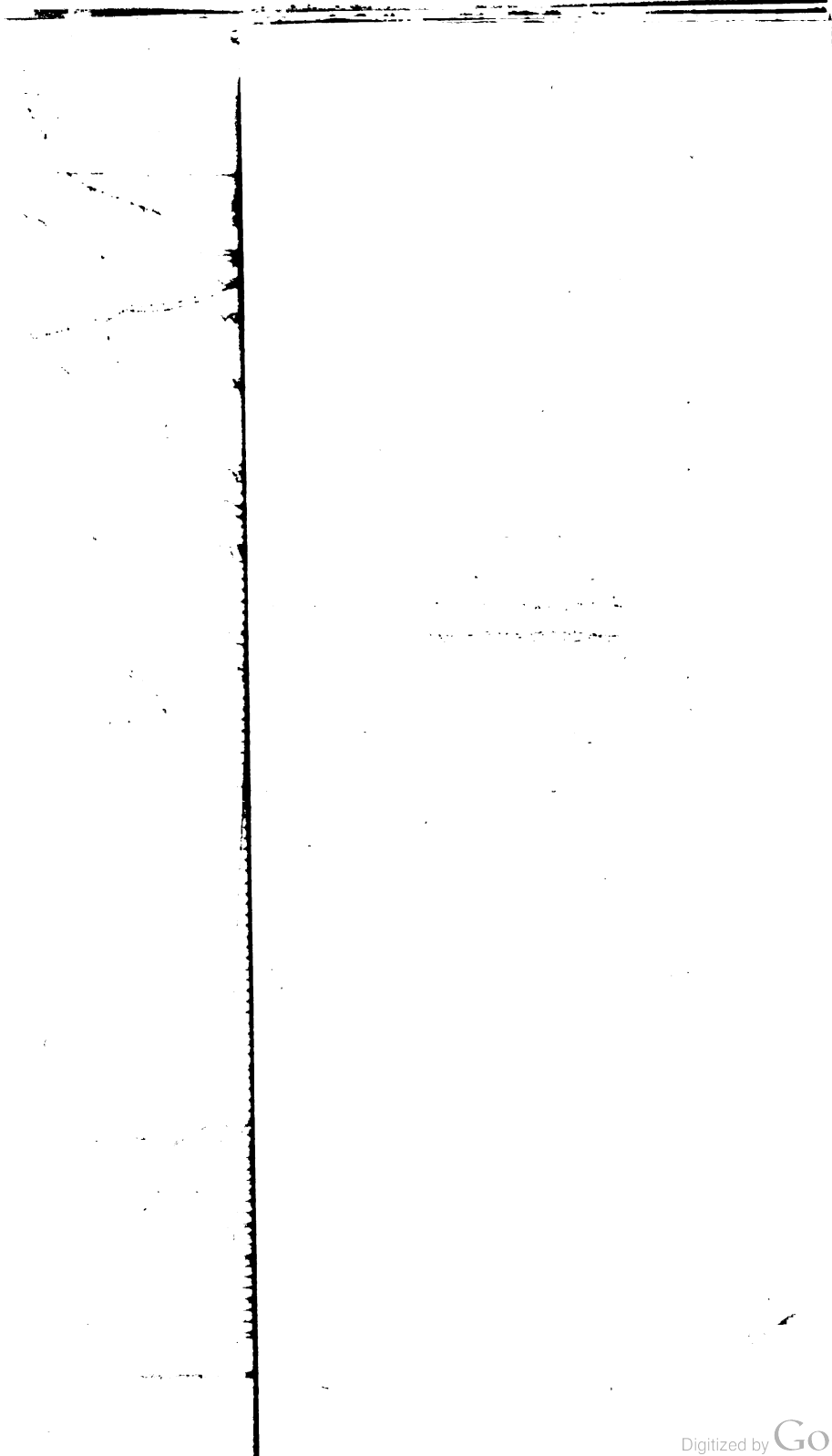
J. C. MEHAFFEY,
Captain, Corps of Engineers, Engineer Officer.

JUNEAU, ALASKA.





ORGANIZATION AS OF JUNE 30, 1917





YE 15689

