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RAILWAY ROUTES IN ALASKA

MESSAGE FROM THE PRESIDENT OF THE UNITED STATES

TRANSMITTING

REPORT OF ALASKA RAILROAD COMMISSION



FEBRUARY 6, 1913.—Read; message and accompanying papers, maps, and charts referred to Committee on the Territories; and message ordered to be printed

FEBRUARY 7, 1913.—*Resolved*, That the message of the President, transmitting the report of the commission appointed to conduct an examination into the transportation question in the Territory of Alaska, together with the report of the commission, and accompanying papers and illustrations, be printed as a document



WASHINGTON

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MESSAGE OF THE PRESIDENT.

To the Senate and House of Representatives:

In accordance with the provisions of section 18 of an act of Congress (Public, No. 334) approved August 24, 1912, I appointed a commission—

to conduct an examination into the transportation question in the Territory of Alaska; to examine railroad routes from the seaboard to the coal fields and to the interior and navigable waterways; to secure surveys and other information with respect to railroads, including cost of construction and operation; to obtain information in respect to the coal fields and their proximity to railroad routes; and to make report of the facts to Congress on or before the first day of December, nineteen hundred and twelve, or as soon thereafter as may be practicable, together with their conclusions and recommendations in respect to the best and most available routes for railroads in Alaska which will develop the country and the resources thereof for the use of the people of the United States.

Under the requirements of the act, this commission consisted of—

an officer of the Engineer Corps of the United States Army, a geologist in charge of Alaska surveys, an officer in the Engineer Corps of the United States Navy, and a civil engineer who has had practical experience in railroad construction and has not been connected with any railroad enterprise in said Territory.

The date when the act was passed was late in the summer season, thus allowing a very limited time for the preparation of a report for presentation at the present session of Congress. Nevertheless, within a week after the act was approved the commission had been appointed, as follows:

Maj. Jay J. Morrow, Corps of Engineers, United States Army, chairman.

Alfred H. Brooks, geologist in charge of Division of Alaskan Mineral Resources, Geological Survey, vice chairman.

Civil Engineer Leonard M. Cox, United States Navy.

Colin M. Ingersoll, consulting railroad engineer, New York City.

This commission has transmitted to me a report, which is herewith submitted to Congress in accordance with the provisions of the act. An examination of this report discloses that the following are among the more important of the findings of the commission:

The Territory of Alaska contains large undeveloped mineral resources, extensive tracts of agricultural and grazing lands, and the climate of a large part of the Territory is favorable to permanent settlement and industrial development. The report contains much specific information and many interesting details with regard to these resources. It finds that they can be developed and utilized only by the construction of railways which shall connect tidewater on the Pacific Ocean with the two great inland waterways, the Yukon and the Kuskokwim Rivers. The resources of the inland

region and especially of these great river basins are almost undeveloped because of lack of transportation facilities. The Yukon and Kuskokwim Rivers system include some 5,000 miles of navigable water, but these are open to commerce only about three months in the year. Moreover, the mouths of these two rivers on Bering Sea lie some 2,500 miles from Puget Sound, thus involving a long and circuitous route from the Pacific Coast States. The transportation of freight to the mouths of these rivers and thence upstream will always be so expensive and confined to so limited a season as to forbid any large industrial advancement for the great inland region now entirely dependent on these circuitous avenues of approach.

From these considerations the commission finds that railway connections with open ports on the Pacific are not only justified, but imperative if the fertile regions of inland Alaska and its mineral resources are to be utilized; but that with such railway connections a large region will be opened up to the homesteader, the prospector, and the miner. So far as the limited time available has permitted the commission has investigated, and in its report describes all of the railway routes which have been suggested for reaching the interior, including the ocean terminals of these routes. The relative advantages and disadvantages of these routes are compared. The principal result of this comparison may be stated to be that railroad development in Alaska should proceed first by means of two independent railroad systems, hereafter to be connected and supplemented as may be justified by future development. One of these lines should connect the valley of the Yukon and its tributary, the Tanana, with tidewater; and the other should be devoted to the development and needs of the Kuskokwim and the Susitna.

The best available route for the first railway system is that which leads from Cordova by way of Chitina to Fairbanks; and the best available route for the second is that which leads from Seward around Cook Inlet to the Iditarod. The first should be connected with the Bering coal field and the second with the Matanuska coal field. Other routes and terminals are discussed, but are found not to have the importance or availability for the development of the Territory possessed by the two mentioned. Thus, the route extending inland from Haines, in southeastern Alaska has value for local development, though chiefly on the Canadian side of the boundary, but the distance to Fairbanks is found to be too great to permit of its being used as a trunk line to the Yukon waters. The route from Iliamna Bay also has value for local use, but is too far to the southwest to permit of its use as a trunk line into the interior. The proposed terminals at Katalla and Controller Bay are found to be very expensive both as to construction and maintenance, besides furnishing very inferior harbors. The route inland from Valdez is at a disadvantage because it would not serve any of the coal fields, although as hereafter noted Valdez is regarded by the commission as an important alternative terminal in the possible future development of the Chitina-Fairbanks route.

The investigations of the commission indicate that the route from Cordova by way of Chitina to Fairbanks would furnish the best trunk line to the Yukon and Tanana waters: (1) Because Cordova has distinct advantages as a harbor; (2) because this route requires

the shortest actual amount of construction, but chiefly (3) because the better grades possible on this route should give the lowest freight rates into the Tanana Valley. The Copper River & Northwestern Railroad is now constructed from Cordova to Chitina and thence up the Chitina River. The commission recommends the building of a railway from Chitina to Fairbanks, 313 miles, estimated to cost $13,971,000, with the provision that if this railway is built by other interests than those controlling the Copper River & Northwestern Railroad, and if an equitable traffic arrangement can not be made with it, connection should be made with Valdez by the Thompson Pass route, 101 miles, estimated to cost $6,101,479.

The commission finds that Cordova offers the best present ocean terminal for the Bering River coal. The commission also points out that it would not be economical to haul the Matanuska coal to either Valdez or Cordova, and that therefore the logical outlet for that field is Seward. If commercial development of these two fields should disclose that the quality of the coal is the same in both, the Bering River field would have the advantage of greater proximity to open tidewater. A branch line from the Copper River Railway to the Bering River field, a distance of 38 miles, at an estimated cost of $2,054,000, is recommended to afford an outlet for the coal on Prince William Sound and into the Copper River Valley and the region where there is at present the largest market for Alaska coal.

The commission finds that a railway from Chitina to Fairbanks will not solve the transportation problem of Alaska, because it will not give access to the Matanuska coal field, the fertile lands and mineral wealth of the lower Susitna, or the great Kuskokwim basin. This province properly belongs to an independent railway system based on the harbor at Seward. The commission recommends a railway from Kern Creek, the present inland terminal of the Alaska Northern Railway, to the Susitna River (distance, 115 miles; estimated cost, $5,209,000), with a branch line to the Matanuska coal field (distance, 38 miles; estimated cost, $1,618,000); and an extension of the main line through the Alaska Range to the Kuskokwim River (distance, 229 miles; estimated cost, $12,760,000).

The entire railways thus recommended will constitute two independent systems involving 733 miles of new construction at a cost of $35,000,000. Eventually these systems will be tied together and there will be earlier demands for branch and local lines as the country develops. One of these systems will find an outlet to the coast over the Copper River & Northwestern Railroad; the other over the Alaska Northern. If these new lines are constructed by others than those financially interested in these two railroads respectively, satisfactory traffic arrangements would have to be made with them. If the new railways recommended should be constructed by the Government, the question is necessarily presented as to whether the Government should acquire the whole or any part of the existing lines, or either of them, or should endeavor to make appropriate traffic agreements. Much would depend upon whether the Government would operate its own railroads or would make operating agreements with those operating existing lines. The commission has not discussed these questions for the reason pointed out in its report that the act of Congress omits questions of this sort from those upon which the commission was instructed to report.

The report of the commission contains the following statement:

Its instructions from Congress do not contemplate that any recommendation should be made as to how railroads in Alaska should be constructed, i. e., by private corporate ownership or by one of the many forms in use whereby Government assistance is rendered. The commission disavows any intention of making such recommendations, believing that Congress, in its wisdom, desired to reserve to itself the solution of that problem; but it has been impossible to form any estimates of costs of operation without some assumption as to the interest rate on the capital required for construction. This interest rate would obviously differ in two cases—construction by Government or bond guaranty, and construction by private capital. Moreover, were construction carried on by private capital unassisted, the necessity of earning sufficient income to pay operating expenses and interest on bonded indebtedness might make it the duty of the directors of the corporation to impose rates on traffic that would seriously retard the development which the Territory so greatly needs.

The commission has therefore been forced to base its studies upon two hypotheses, viz: That the capital necessary for construction is obtained at 6 per cent interest, assumed as possible if construction is carried out by private corporate ownership unassisted; and that capital is obtained at 3 per cent interest, assumed as possible if the construction is done either by the Government itself or by private capital with bonded indebtedness guaranteed both as to principal and interest.

On similar grounds the commission did not feel justified in discussing the use of the Panama Canal machinery and equipment or in including in its estimates the effect of such use; but a list of the machinery and equipment available at Panama is given in an appendix.

Upon the assumption that the railroad from Chitina to Fairbanks is built by private capital, eliminating promotion profit, but assuming the necessity of earning 6 per cent on the capital invested, it is the judgment of the commission that on estimated available traffic the road could be operated from Cordova to Fairbanks without loss at a passenger rate of 7 cents per mile and an average freight rate of 8 cents per ton-mile. This would mean a through freight rate of $36.94 per ton from Cordova to Fairbanks and a through passenger rate of $31.15. It is the opinion of the commission that—

an average freight rate exceeding 5 cents per ton-mile and passenger rate in excess of 6 cents per mile would defeat the immediate object of the railroad, namely, the expeditious development of the interior of Alaska, and, furthermore, would introduce the question as to whether or not the Seattle-Cordova-Fairbanks freight route would be able to compete with the present all-water route via the Yukon River system, except on shipments in which the time element is of such importance as to warrant the payment of a higher freight rate.

To meet the requirements of expeditious development and water competition the estimate of the commission involves a through freight rate from Cordova to Fairbanks at $22.25 per ton, and a through passenger rate of $26.70. The report further says:

Were the road to be constructed by the Government, or by private corporate ownership with a Government guaranty of principal and interest on bonded indebtedness, the capital required should be obtained at a much lower rate of interest, thus materially reducing the annual expenditures.

Using 3 per cent on the investment as fixed charges, and omitting mileage tax of $100, on the assumption that this tax would not be levied in the case of a Government owned or aided road, the commission estimates that the road would pay on the basis of a passenger rate of 6 cents per mile, and a freight rate of 5.49 cents per ton-mile, making the average through freight rate from Cordova to Fair-

banks $24.43 per ton and the through passenger rate $26.70. I give these figures as illustrations. The report contains similar estimates of freight and passenger rates and traffic for the road recommended from Seward to the Kuskokwim.

After recommending the construction of the two principal systems and their extensions already mentioned, the commission states, in conclusion that it—

> is unanimously of the opinion that this development should be undertaken at once, and prosecuted with vigor; that it can not be accomplished without providing the railroads herein recommended under some system which will insure low transportation charges and the consequent rapid settlement of this new land and the utilization of its great resources.

The necessary inference from the entire report is that in the judgment of the commission its recommendations can certainly be carried out only if the Government builds or guarantees the construction cost of the railroads recommended. If the Government is to guarantee the principal and interest of the construction bonds, it seems clear that it should own the roads, the cost of which it really pays. This is true whether the Government itself should operate the roads or should provide for their operation by lease or operating agreement. I am very much opposed to Government operation, but I believe that Government ownership with private operation under lease is the proper solution of the difficulties here presented.

I urge the prompt and earnest consideration of this report and its recommendations.

WM. H. TAFT.

THE WHITE HOUSE, *February 6, 1913.*

LETTER OF SUBMITTAL.

ALASKA RAILROAD COMMISSION,
Washington, D. C., January 20, 1913.

The PRESIDENT: I have the honor to transmit herewith the report of the Alaska Railroad Commission.

The act creating the Commission expressed the desire of Congress for information at as early a date as practicable. It therefore seems desirable to submit the text of the report at once, notwithstanding the fact that certain of the maps and profiles necessary to its completion will require additional time. It is the purpose of the Commission to submit these at an early date, as Part II of the report.

Very respectfully,

(For the Commission)

JAY J. MORROW,
Major, Corps of Engineers, United States Army, Chairman.

REPORT OF
ALASKA RAILROAD COMMISSION.

JANUARY 20, 1913.

REPORT OF THE ALASKA RAILROAD COMMISSION.

ORGANIZATION AND FIELD WORK.

The Alaska Railroad Commission was created by section 18 of act of Congress (Public, 334) creating a legislative assembly for the Territory of Alaska, approved August 24, 1912. The section of the act is as follows:

SEC. 18. *Creating railroad commission.*—That an officer of the Engineer Corps of the United States Army, a geologist in charge of Alaska surveys, an officer in the Engineer Corps of the United States Navy, and a civil engineer who has had practical experience in railroad construction and has not been connected with any railroad enterprise in said Territory, be appointed by the President as a commission hereby authorized and instructed to conduct an examination into the transportation question in the Territory of Alaska; to examine railroad routes from the seaboard to the coal fields and to the interior and navigable waterways; to secure surveys and other information with respect to railroads, including cost of construction and operation; to obtain information in respect to the coal fields and their proximity to railroad routes; and to make report of the facts to Congress on or before the first day of December, nineteen hundred and twelve, or as soon thereafter as may be practicable, together with their conclusions and recommendations in respect to the best and most available routes for railroads in Alaska, which will develop the country and the resources thereof for the use of the people of the United States: *Provided further*, That the sum of $25,000, or so much thereof as may be necessary is hereby appropriated, out of any money in the Treasury not otherwise appropriated, to defray the expenses of said commission.

Following is the personnel of the Commission, which was appointed August 31, 1912:

Maj. Jay J. Morrow, Corps of Engineers, United States Army, chairman.

Alfred H. Brooks, geologist in charge of Division of Alaskan Mineral Resources, Geological Survey, vice chairman.

Civil Engineer Leonard M. Cox, United States Navy.

Colin M. Ingersoll, consulting railroad engineer, of New York City.

It will be noted that the act creating the Commission was passed very late in the summer season. The Commission, with exception of the chairman, who was stationed on the Pacific coast, met in Washington and provisionally organized on September 3, communicating with the chairman by wire.

It was decided that as complete and thorough report as Congress desired could not be prepared unless the commission proceeded to Alaska, and this course was taken for the following reasons:

While a large mass of data existed and could have been obtained without this trip, much of it was conflicting, and a decision as to its accuracy could only be made by a personal examination. Further more nearly all of the engineers and surveyors who had personally made the examinations and surveys that resulted in the reports containing data, could be reached by a trip into parts of Alaska, and in no other way. Further, by this procedure the Commission felt that it

could acquire from residents of Alaska a first-hand knowledge of actual conditions and resources and the possibilities of development, and could get an intimate acquaintance with probable difficulties to be encountered in construction and operation and that these could not otherwise be obtained. And, finally, this seemed the only way to secure accurate information as to the exact physical condition of such railroads as were already existent. It was appreciated that time was of importance and that the season was late, so the trip was necessarily restricted to one with only the briefest stops, the elimination of all work that had no direct bearing on the problem, and an undertaking to perform without regard to hours, an amount of travel and work that, in advance, seemed almost impossible of accomplishment.

Further, on arrival at Seattle, early in September, the Commission decided that on its return from Alaska, unless the work was delayed beyond its anticipation, it would be well to examine into some Canadian railroad operations, as it was believed that valuable data could be secured in regard to construction costs, operating costs, tonnage that might be expected from railroad development in virgin country, and kindred matters. It was known that the Canadians had done much work in projecting and constructing railroads through undeveloped country; and moreover two of the routes under consideration traversed Canadian territory. This investigation was made, consumed about a week, and, as anticipated, valuable information was secured.[1]

The Commission employed a statistician and left him at Seattle to secure and compile data in regard to Alaskan commerce and other related matters.

It is a pleasure to state here that a great deal of valuable information has been secured by the commission that could not possibly have been obtained had it not been that every corporation and individual, without exception, who had any data or information, placed it at the Commission's disposal, it being apparent at all times and places that everybody was tremendously interested in the questions the Commission was investigating, and showed a disposition to assist in the work in all possible ways, even at considerable sacrifice.

The question of attempting to visit the two most important coal fields (Bering River and Matanuska) was considered, and the commission decided that it would not attempt to visit either field. It is certain that visits as hurried as would be necessary under the circumstances would have added but little to the considerable data on hand and would have consumed time which could be used to much better advantage in other ways.

Itinerary.

The Commission left Washington on September 3, arriving in Seattle in the evening of September 7, where the chairman joined it.

Departure from Seattle was made September 10, on the United States revenue cutter *McCulloch*, with the intent of proceeding first to examine Katalla and Controller Bay. On reaching Cape St. Elias in a heavy southerly sea, it was decided that time would be lost

[1] See Appendix C, p. 165, this report.

in attempting to land at either of these places. The Commission therefore began its inspection of Alaska routes at Seward, in Resurrection Bay, September 15, 1912.

This day was spent in Seward, the town and harbor were looked over, and examination was made of the terminal structures of the Alaska Northern Railroad and of all records available at their Seward office. The people of the town were met and their views heard in the evening of the same day.

The next day an examination of the railroad as far as its present terminus at Kern Creek was made. From Kern Creek a gasoline launch was used for the trip down Turnagain Arm and up Knik Arm to Knik, this trip occupying the following day. At Knik the commission arranged for horses and pack transportation and proceeded inland over the newly constructed Government road to the Willow Creek mining district, and examined this country as far inland as this district, in the headwaters of the Little Susitna River. From points on this road good views were obtained of the Matanuska valley and of the bottom lands of the lower Susitna. This trip occupied three days, Knik being reached again on the 20th.

The following day the commission returned to the *McCulloch*, which had proceeded around from Resurrection Bay to an anchorage in Knik Harbor (Ship Creek), and the next day proceeded down Cook Inlet to Iliamna Bay and Iniskin Bay. Iliamna Bay and the entrance to Iniskin Bay were examined, as they had been proposed for the coastal terminus of a railroad route to the Kuskokwim Valley by way of Iliamna Lake.

The Commission then proceeded to Katalla, reaching there about noon September 24. Landing was made and the construction work and abandoned shops of the Copper River & Northwestern Railroad and structures erected by the Alaska Pacific Railway & Terminal Co. were examined. Arrangements were made for a launch to take the Commission for an examination of Controller Bay the following day. The next morning it was extremely stormy, the master of the launch reporting that, in his opinion, an attempt to examine Controller Bay on that day would be not only hazardous, but, even though successful, the weather conditions were such as to make it difficult to obtain any valuable information. As the captain of the *McCulloch* concurred in this view, the Commission abandoned the idea of an examination of Controller Bay at this time, except such as could be made from outside, and, completing this, started for Valdez, arriving there on September 26.

At Valdez considerable valuable data were obtained from the office of the Alaska Road Commission. Arrangements had been made by Lieut. Col. W. P. Richardson, chairman of this board, for the Commission to start overland for Fairbanks by buckboard transportation, but the start was delayed two days by an extremely heavy rainfall, which flooded the road in Keystone Canyon, a few miles from Valdez, and the start therefore was not made until the morning of September 30. While in Valdez the opinions of the residents were obtained at a hearing.

The Commission proceeded from Valdez in buckboards without change of horses over the military road to Paxson's Roadhouse, 195 miles from Valdez, and almost on the summit of the Alaskan range; from Paxson's to Munson's, 145 miles, the regular stages of the Orr

Stage Co. furnished the transportation, and from Munson's to Fairbanks, 40 miles, an automobile was used. Fairbanks was reached about noon October 12. The Commission was accompanied on this and the return trip by Mr. Henry Deyo, the engineer who had made preliminary reconnoissances and location surveys through this country.

Two and a half days were spent in the Fairbanks district, during which time the road and plant of the Tanana Valley Railroad were examined, as was the Government farm, and a trip was taken up Gold Creek and into Cleary Creek, where several quartz mines were examined. The views of the people of Fairbanks were obtained at various meetings.

The return trip was begun on the morning of October 15, by regular stages of the Orr Stage Co. Progress out was satisfactory, although considerable snow was encountered. Horse sleds were used for a part of the way near the summit of the Alaskan Range. The outward route was the same as the inward route, until Willow Creek was reached (90 miles from Valdez). From this point the newly constructed road to Chitina was followed, and the latter point was reached on October 24.

It is an interesting fact to record that in every one of the 25 days consumed by this trip the Commission traveled some distance in either a buckboard, a wheel or sled stage, or an automobile, and on several days traveled over 35 miles, on one day covering 57 miles from 4 a. m. to 8 p. m. This was made possible through the efforts of Col. Richardson, at Valdez, who kept in communication with the commission and arranged in many ways to facilitate progress, and through assistance given by Messrs. Volney Richmond, of the Northern Commercial Co., and Falcon Joslin, of the Tanana Valley Railway Co.

The succeeding two days were spent in examination of the Copper River Railroad's extension from Chitina to Kennicott out to mile 175, beyond which point traffic was interrupted by a small washout. The two days, October 27 and 29, were occupied by an examination of the main line between Chitina and Cordova. October 28 and later all available information was obtained from the company's Cordova office, and an examination was made of the terminal structures, the shops, and the harbor. A longer stop than actually necessary in Cordova was enforced by the delay in the arrival of the Alaska Steamship Co.'s steamer *Alameda*, four days late. Part of this time would have been utilized in a visit to Controller Bay had there been any transportation available.

The Commission sailed on the *Alameda* for Haines November 4, and reached Fort William H. Seward on the evening of the 6th. This was made possible through the courtesy of Col. Charles McClure, Thirtieth Infantry, who sent the United States quartermaster's tug *Petersen* down to Point Retreat, where the Commission transferred from the steamer, and thus avoided a four day's delay at Juneau.

Two days were spent at Haines and Pyramid Harbor, examining these harbors and going over the plans of the Alaska Midland Railroad Co. A short trip by buckboard was taken over the military road up the Chilkat River, and by climbing the hills a fine view of the valley was had. Again through the courtesy of Col. McClure the tug *Petersen* took the Commission to Skagway, where one day (November 9) was spent examining the terminal structures of the White

Pass & Yukon Railway, its roadbed to and beyond the international boundary line, and in studying plans and profiles.

On the night of the 9th the Commission sailed on the steamer *Spokane* for Prince Rupert, which was reached November 13. At Prince Rupert the Commission examined the terminal plans and development of the Grand Trunk Pacific Railway, and through the courtesy of the officials of this road traveled along their line to and from Nichols, in the heart of the mountain section, 119 miles inland. This brief trip was most impressive.

The Commission then proceeded to Seattle by the Grand Trunk steamer *Prince Rupert*, arriving November 17. Here considerable data were obtained from officials of the various railroads and from several engineers with Alaskan experience.

From Seattle, by way of Vancouver, British Columbia, where the Canadian terminals were examined, the Commission proceeded to Ottawa, Ontario, where, through the courtesy of the Hon. Frank Cochrane, minister for railways and canals, the Commission was furnished much valuable information concerning the treatment of railroads by the Dominion Government and by the various provincial governments and municipalities of Canada. The Commission then proceeded to Washington, D. C., where it convened December 2 for the preparation of its report.

The Commission made careful examination of railroad structures at all points covered in its travels, and also of all available plans, records, and data of cost of construction and operation. The utmost possible assistance was rendered in this work by the local and Seattle offices of all railroads examined. The harbors visited were examined and the possibilities for terminal development considered. The Commission secured from the people of the different communities traversed much information in regard to resources and plans for development. Where possible, first-hand information was secured from engineers who had made reconnoissances or surveys, or done construction work in Alaska.

The officials of the Canadian lines examined were most courteous in placing facilities at the disposal of the Commission, and the authorities at Ottawa furnished much valuable information to assist the Commission in the study of transportation in Canada.

Weather conditions interfered only slightly with the progress of the work. Two attempts to examine Controller Bay were unsuccessful by reason of stormy weather making landing unsafe; two days were lost in getting away from Valdez by the excessive precipitation of the three days just prior to the start, and some delay was occasioned in the examination of the Copper River lines by the interruption to traffic sustained by that railroad from heavy slides at about mile 86 of their line. Two or three days were lost at Cordova by a delay in arrival of a steamer.

The United States Revenue-Cutter Service very kindly placed the cutter *McCulloch* at the disposal of the Commission, and the work of the commission, until Valdez was reached, was greatly facilitated thereby. As the Commission's plans called for a month's work inland after arrival at this port, it was believed that the retention of the cutter would not be justified and it was released, as the remaining travel could be made by commercial steamers without considerable delay. Had this not been done, another attempt to reach Controller Bay would have been made after return to Cordova.

The Commission has previously acknowledged its obligations to the Revenue-Cutter Service, to the Alaska Road Commission, and to the many individuals and corporations who so willingly assisted in its work, but deems it necessary to here record its appreciation of the assistance given by the United States Geological Survey in the loan of temporary quarters in Washington at no little inconvenience to that service, in the furnishing of maps and much data, and in the temporary transfer to the Commission's working force of several draftsmen who, under the supervision of Mr. R. H. Sargent, of the Geological Survey, prepared the maps.



MAP OF ALASKA SHOWING RAILWAY ROUTES CONSIDERED BY ALASKA RAILROAD COMMISSION

ENGRAVED AND PRINTED BY THE U.S. GEOLOGICAL SURVEY

House Doc. 1346; 62d Cong., 3d Sess.

PRESENT TRANSPORTATION ROUTES.

A treatment of the great question of transportation in Alaska requires careful studies of topography, existing inland water transportation as well as the ocean approaches thereto, existing and possible rail routes, other land transportation routes, commerce, industries, climate, population, and resources.

The instructions of Congress contemplate a broad consideration of the general question of transportation in the Territory, but the time fixed for the submission of the report was so short that, in advance, the Commission decided that it must largely limit its work to a consideration of the plans by which the country and its resources could be best developed "for the use of the people of the United States"; and that this largely resolved itself into the treatment of plans for connecting the large inland valleys, which contain most of Alaska's resources, with ice-free seaports, by rail lines, so located, if possible, as to give convenient access to the two most important coal fields.

A brief statement of the topography is first desirable. Alaska is a Territory of great size, about one-fifth that of the total area of the United States. About a quarter of its area lies north of the Endicott Range, which is itself north of the Arctic Circle. This portion of the Territory is Arctic, and it alone presents the bleak and frozen aspect popularly associated with Alaska. South of this range in Alaska there is an area greater than that of all the States east of the Mississippi and north of the Ohio River and Mason and Dixon's line, which is as capable of high development as many well-settled and rich countries.

The Pacific mountain system fronts the coast, extending from British Columbia in a huge arc and tailing out in the Alaska Peninsula. This system is widest in the several ranges which divide central Alaska from southern Alaska, just north of Prince William Sound, and stands as a barrier separating the comparatively small coastal valleys from the two great inland valleys of the Yukon and the Kuskokwin which themselves are separated by a comparatively low divide. Both these great valleys may be described as regions characterized by broad open bottom lands and gently rolling uplands.

River Navigation.

The Yukon River, draining the greater of these basins, enters the Bering Sea at a latitude which prohibits the use of the stream as a connection with ocean-borne commerce excepting during three summer months. The same may be said of the Kuskokwim, though ocean commerce may reach its mouth for an additional month. Both of these rivers have difficult entrances; that of the Yukon being a shifting channel of little depth across mud flats; and the entrance to the Kuskokwim, while deep enough for the smaller ocean steamers, is

extremely tortuous and not well known. Once inside, however, each presents a long stretch of navigable water for the ordinary river boat. The Yukon is navigable up to White Horse in Canada, about 2,200 miles, and its greatest tributary, the Tanana, is navigable without difficulty to Chena, near Fairbanks, and at times has been navigated much farther, though with difficulty. The Kuskokwim is navigable to the Forks, about 50 miles above the Takotna, or about 650 miles from the mouth. Both of these streams have navigable tributaries which extend their scope as transportation routes and together provide about 5,000 miles of navigable waters in the two systems. The open season is about three to three and a half months, and although short and though navigation is subject to occasional brief interruption in places by low water, there is a possibility of their utilization as transportation routes in the development of the two great valleys that will suffice for years to come.

There are other lesser valleys with navigable waters. Of these the Copper and Susitna are the most important. These two rivers are more important as offering the best possibilities of penetrating the coastal range by rail lines than for purposes of navigation. The Copper River breaks through the Chugach Range, but with a slope so steep as to make navigation difficult and hazardous, though not impossible. It is believed that the transportation possibilities of the stream are not worthy of serious consideration, although some stretches of it may be used to some extent for local business. The Susitna, in its lower reaches, is navigable for river boats, though its entrance from Cook Inlet is difficult. It has possibilities of assisting as a transportation route on a small scale.

There are a few other minor streams which are now navigable for short reaches and will continue to be so used, but they may be dismissed from consideration with the statement that they have no important bearing on the large problem of transportation in the Territory.

Ocean Service.

A number of good harbors along the Pacific seaboard of Alaska are now connected with nearby inland points by railroads and trails, or by wagon roads and trails only. All these harbors as far west as Cook Inlet are open throughout the year, and are from 1,000 to 1,400 statute miles from Puget Sound ports.[1] At present a summer steamboat service of about six trips a month is maintained with the more important of these ports, and in addition some freighters carry coal and other supplies north and bring back cargoes of fish and ore. The ports of southeastern Alaska have more frequent service. During the winter the service is continued, but is less frequent. During the summer, of about three and a half months, ocean steamers make the trip between Puget Sound and St. Michaels and Nome. There is also an occasional steamer to the mouth of the Kuskokwim and other points in Bering Sea.

[1] All ocean distances in this report will be given in statute miles.

Railroads.

The following table gives in concise form the data as to mileage, terminals, and gauge of existing railroads in Alaska:

Southeastern Alaska:	
White Pass and Yukon route, Skagway to White Pass (narrow gauge). Terminal at White Horse, Yukon Territory—total mileage, 102 miles	20.4
Yakutat Southern Railway, Yakutat to Situk River (narrow gauge)	9.0
Copper River: Copper River & Northwestern Railway, Cordova to Kennicott (standard gauge)	195.0
(The same company has built a few miles of track at Katalla, where the Alaska Pacific Railway & Terminal Co. has also done some work. At Valdez a few miles of track of the Alaska Home Railway were laid in 1907, and some work was previously done on the Copper River & Northwestern Railway and on the Valdez & Yukon Railway.)	
Kenai Peninsula: Alaska Northern Railway, Seward to a point near head of Turnagain Arm (standard gauge)	71.6
Yukon Basin: Tanana Valley Railway, Fairbanks and Chena to Chatanika (narrow gauge)	46.0
Seward Peninsula:	
Seward Peninsula Railway, Nome to Shelton (narrow gauge)	80.0
Paystreak Branch, Seward Peninsula Railway (narrow gauge)	6.5
Council City & Solomon River Railway, Council to Penelope Creek (standard gauge)	32.5
Wild Goose Railway, Council to Ophir Creek (narrow gauge)	5.0
	466.0

Main Routes of Travel.

At the present time the interior of Alaska is most conveniently accessible during the three or four summer months, June to September, inclusive. Fairbanks, the center of the Yukon-Tanana basin, may be reached by two routes. The first involves a 1,000-mile steamer trip, through the inland passage, to Skagway, then 110 miles of rail over the White Pass to White Horse, the head of Yukon navigation. A transfer is here made to a Canadian river steamer which reaches Dawson, 460 miles downstream. From Dawson an American steamer is used to Fairbanks, a further distance of 1,000 miles. At the best this journey consumes two weeks going in, but ordinarily connections can not be made promptly and more time is required. The outward trip by this route would require much longer. This route is used chiefly for high-class freight and passengers.

Most of the freight, however, for Fairbanks is shipped to St. Michaels by ocean vessels. Here it is transshipped to river steamers which are exposed to the open sea before entering the mouth of the river. These steamers carry the freight up the Yukon and Tanana Rivers. The mileage of this route is about 2,700 miles of ocean travel and about 1,100 miles of river travel, and usually occupies about a month. This route is open for a shorter summer season than the other. All rates are high, which is accounted for by the short season, expensive fuel, and cost of transshipping on both routes. In addition to having to bear the high rates, all goods have their sale price increased by the necessity of financing the nine months' storage.

The valley of the Kuskokwim is not so well served. Small steamers reach Bethel, and a few river steamers distribute freight to river points nearest the camps, whence they are hauled, usually, during the winter season.

Wagon Roads.

In 1905 the Government created a board of road commissioners for Alaska, and during its life it has been composed of officers in the military service, and presided over by Lieut. Col. Wilds P. Richardson, United States Infantry. The board has developed a system of roads and trails partially for military purposes, but more for the use of the people in many sections of this vast territory, in the development of the mining industry and in the solution of the transportation problems connected therewith. This board has constructed, since its organization and prior to July 1, 1912, 829 miles of wagon roads for use winter and summer, 599 miles of winter sled roads, 1,552 miles of trails, and in addition have annually staked many miles of trails for winter travel only. With one or two notable exceptions, these roads are not comparable with the best highway construction in the States, but for the money expended in their creation and maintenance they have shown a remarkable return, and have greatly assisted in development. The immediate commercial value of the expenditures of the board can be shown in the reduction in summer and winter freight costs wherever they have been built. The Alaska Railroad Commission desires to record itself as greatly impressed with the work accomplished by the board of road commissioners, and to express its belief that, regardless of future railroad construction in Alaska, work along the lines developed by that board should be continued and enlarged upon.

Probably the most important road constructed by the board of road commissioners is the one over which the Alaska Railroad Commission traveled. This road connects Fairbanks with Valdez on the coast and with Chitina on the Copper River Railroad, and forms the present winter route between Fairbanks and the outside world. On this route, throughout the winter months, a regular stage company operates a line carrying freight, passengers, and mail. In the early winter and in the spring wheel stages are used, but through most of the winter season horse sleds carry the traffic. As the service is expensive, the freight and passenger rates are high.

The Kuskokwim valley and the Iditarod section, immediately adjacent thereto, are much more poorly provided with transportation than the Yukon and Tanana valleys. A winter sled road has been built from the end of the Alaska Northern Railroad at Kern Creek, on Turnagain Arm, up the Susitna valley, and across the divide into the Iditarod region.

To sum up, all Alaska has less than 500 miles of railway in nine disconnected systems, less than 1,000 miles of wagon road, 600 miles of winter sled roads, and less than 2,000 miles of trails, with 5,000 miles of important navigable waterways which are closed by ice for about three-quarters of the year, and this in a country comparable in size, resources, and climate to Norway and Sweden.

From this brief statement it may be seen that transportation is difficult and expensive. The great interior can only be reached in the winter at an expense almost prohibitive except for high-class freight, and even in the short summer season transportation is sufficiently difficult to justify rates which might be considered excessive elsewhere.

The Alaska Railroad Commission believes that the industrial development of Alaska requires that the two great inland navigable water systems, the Yukon and Kuskokwim, be brought into railroad communication with one or more ocean ports, ice free the year round, and that the development of the two great valleys can not be effected until this is done.

While the Commission has taken under consideration the needs of the entire Territory of Alaska, it feels justified, in view of the short time at its disposal, in limiting the investigation in large measure to the region stretching westward from the international boundary to the Kuskokwim and northward from the Gulf of Alaska to the Yukon, which for the purpose of this discussion will be referred to as central Alaska.

CLIMATE.

Though Alaska is often loosely referred to as an Arctic province, yet nearly three-quarters of its area lies within the North Temperate Zone. Geographic position and extent relative to oceanic bodies, together with relief, have brought about physical conditions producing strong contrasts in climate between different parts of the Territory. Three general climatic provinces, each of which in turn includes a number of subordinate provinces, are recognized.

The first is the maritime province lying adjacent to the Pacific Ocean. This has a heavy precipitation (50 to 190 inches), comparatively high mean annual temperature (40° to 48° F.), cool summers (mean temperatures 50° to 55° F.), and mild winters (mean temperatures 20° to 35° F.). It has small variations of annual temperatures compared with the interior provinces, the records showing from −12° to 84°. The second is the inland province lying beyond the coastal mountains, with a continental climate characterized by semiaridity (precipitation 9 to 15 inches), comparatively warm summers (mean temperatures 50° to 58° F.), and cold winters (mean temperatures 0° to −15° F.). Its most striking feature is the extreme annual variation in temperatures, which are from −76° to 90° F. The mean annual temperature varies from 15° to 27° F. The third province includes the region tributary to the Arctic Ocean, which, according to a few records, has a precipitation of only about 6 to 8 inches, an average summer temperature of from 40° to 45° F., a winter temperature of about −10° to −16° F., and an extreme variation, according to a few records, of −54° to 60° F.

The climate of the coastal province is comparable with that of Scotland and the Scandanavian Peninsula, in Europe, but is somewhat warmer. That of the inland region is not unlike the climate of Alberta, Saskatchewan, and Manitoba, in Canada. The northerly province bordering the Polar Sea, is the only one in which Arctic conditions prevail.

Central Alaska, or the region here specially under consideration, lies in part in the Pacific maritime, in part in the inland climatic province. It includes Cook Inlet and the Susitna Valley and the Copper River Basin, whose climate, however, resembles that of the inland region lying north of the Pacific mountain system. Climatic records in central Alaska are, at best, but fragmentary, and hence all statements in regard to temperatures and precipitation, etc., must be regarded as only approximately accurate.

The precipitation of southeastern Alaska varies from about 147 inches at Ketchikan to less than 30 inches at Skagway. While there is but little snow near sea level, there is a very heavy fall in the mountains. At White Pass the winter snow fall is about 25 to 30 feet, but is probably less than 4 feet on the Chilkat summit. Records show that the mean annual number of days on which precipitation occurs in southeastern Alaska varies from 85 at Skagway to 235 at Ketchikan. The mean temperatures of the three summer months in this province vary from about 50° to about 55° F.; of the

three winter months from 20° to 30° F., while the mean annual temperature is between 40° and 48° F. The highest recorded summer temperature in southeastern Alaska is 92° F.; the lowest winter temperature −4° F.

In the coastal region, stretching from Katalla to Seward, the average temperature for the three summer months is about 51° F.; of the three winter months from 20° to 30° F. The lowest temperatures recorded in this region are −14° F.; the highest 82° F. Incomplete records show an average annual precipitation varying according to locality from 54 inches to 135 inches. The precipitation is about 127 inches at Katalla, 132 inches at Cordova, 135 inches at Childs Glacier, Copper River, 74 inches at Valdez, and 54 inches at Seward. The records indicate an average at different localities of from 90 to 240 days in which some precipitation occurs. The total snowfall is about 5–8 feet at Seward, 12 feet at Valdez, about 6 feet on the Trail Creek along the Alaska Northern Railroad, about 30 feet at Childs Glacier on the Copper River Railroad, and about 15 feet at Thompson Pass, crossed by the Military Road from Valdez.

Cook Inlet has quite a different climate from that of the outer coast line. Here the precipitation is only 25 to 40 inches, with a snowfall of 4–5 feet. Some precipitation occurs on about 100 days in the year. The mean annual temperature varies greatly in different parts of this region, being from 33° to 42° F., while the average temperature of the three summer months is about 53° F.; of the three winter months about 10° to 25° F. The highest recorded summer temperature is 87° F.; the lowest winter temperature, −40° F.

The climate of the lower Susitna and of the Matanuska valleys differs again, both from that of Cook Inlet and of the outer coast line. Here there are a very few records, but the summers are known to be warmer than on Cook Inlet and the winters are probably milder. The precipitation is small, one year's records at Chickaloon, in the Matanuska Valley, indicate a total of only 10 inches, but this was probably an unusually dry year. The lowest temperature recorded at this locality during the same period was −12° F.; the highest 84° F.

The lower Copper River Valley has much the same climate as that of the coast, but ascending the river above Tiekhel a gradual transition to inland conditions is noticed. There are no records at Chitina, but the precipitation is known to be small, the summers warm, and the winters cold. At Kennicott, the inland terminal of the Copper River & Northwestern Railroad, the snowfall is about 4 feet, and the extremes of temperatures recorded are −31° and 76° F. This station is 2,000 feet above sea level and close to a glacier. At Copper Center the total precipitation is about 10 inches, and the snowfall about 3 feet. Extremes of temperature of −50° and 85° F. have been recorded. The average temperatures of the three summer months are about 55° F., and of the three winter months about 10° F. It is estimated that the snowfall at Paxons, near Isabel Pass, is between 3 and 4 feet, and the total precipitation somewhat greater than at Copper Center.

The total annual precipitation in the upper Yukon Basin varies locally from 10 to 16 inches. At Fairbanks it is about 11.5 inches, at Eagle 12 inches, at Dawson 13 inches, at Fort Gibbon, the mouth of the Tanana, about 14 inches. The snowfall in this district is from

3 to 5 feet. It is reported that the snowfall in the upper White River basin is only 2 feet. Some precipitation occurs for about 80 days in the year. The mean temperature for the three summer months at Fairbanks is about 56° F.; the mean temperature for the three winter months about −12° F.; the mean annual temperature about 25° F. A minimum temperature of −70° F. is recorded, and a maximum of 90° F. The precipitation on the lower Yukon and Kuskokwim is about 17 to 20 inches. The average summer temperatures are a little lower than that at Fairbanks, and the winter temperature about the same.

The subject of prevailing winds along the coast, though important, can only be touched upon in this writing. In general it may be said that the severest storms along the central part of the Pacific seaboard of Alaska are from the south and southeast. These are more frequent from October to March than during the balance of the year. One of the most important climatic features of the coast of Alaska to shipping are the severe winds which blow in and out of the valleys, that traverse the coast ranges, and their connecting fiords. These blow toward the land in summer and toward the sea in winter. The severest are the outward winds, which are most common during January, February, and March, when velocities of 60 and 70 miles an hour are said to be not infrequent. Where a harbor or roadstead lies in the tracks of such winds they will seriously interfere with shipping. Examples of these winds are found at Lynn Canal, Bering River, Copper River, Lowe River, and Valdez Glazier, Resurrection River near Seward, and at Iliamna Bay. The fogs in summer and the snowstorms in winter also at times delay vessels navigating the Alaska coast.

The experience of those long resident in Alaska has shown the climate to be very healthful. No extremes of cold or heat occur along the Pacific seaboard. The excessive rains characteristic of many parts of this district are, to be sure, disagreeable, but experience demonstrates the fact that they have no adverse effect on health. It must be remembered, too, that the excessive precipitation is by no means universal in this maritime belt. It has been shown that at Skagway, for example, that the total precipitation is less than 30 inches, and at Seward about 54 inches. Probably the most trying feature of the coastal climate is the strong winds which blow in the winter from the valleys traversing the coastal barrier.

The Cook Inlet and Susitna regions have a climate similar to that of the interior, and warmer summers than those on the coast, with less precipitation. The same holds true of the Copper River Basin. Of the Yukon it may be said that the summers are cool and that bright clear weather prevails most of the time. The aridity of the climate makes the extreme temperatures of winter easy to resist. All who have lived in this inland region are agreed that the winter climate is far more healthful than in many parts of the States where the temperature is higher, but where there is an excess of humidity. Residents of the interior have no fear of the extreme cold that often prevails during the winter months. The winter journey between Fairbanks and Valdez is made by men, women, and children and offers no serious hardships except when storms are encountered.

The heavy snowfall on the seaward slope of the coastal mountains is the only serious climatic obstacle to the operation of railways in

Alaska. There is, however, also a marked fluctuation in the run-off, which affects cost of construction and maintenance. With the opening of spring the winter snows melt rapidly, with a corresponding rise in the watercourses. The danger to bridges and trestles is increased by the presence of ice, which may not only act directly against structures, but may also cause floods by forming temporary dams which may break and precipitate a sudden flood with ice cakes down the valley below.

The glaciers of the Pacific mountain system also affect railway location and cost of construction and operation. Some of the mountain passes otherwise available for railways are covered with glacial ice and hence can not be utilized. Glacial streams are heavily charged with sediments and subject to great fluctuations, and their channels are constantly shifting. Moreover, lakes often form within the glaciers or in the tributary valleys behind the face of the glacier, and the breaking of the ice dams holding them precipitates vast volumes of water into the valley below that may cause serious, damage to railway structures.

Most of the Alaska glaciers are retreating, but some have advanced during the last few years (see p. 62). Therefore railways projected close to the front of glaciers always, to a certain extent, are in danger of damage by the advance of the ice. Moreover, if a railway be projected across a moraine, it may be found on excavation that ice occurs underneath what appears to be simply a mass of gravel and glacial detritus. If such conditions are encountered, the ice will thaw and will entail a continuous charge for maintenance of grade. In considering the effect of glaciers on railway location, construction, and maintenance, it should be remembered that they occur only in the Pacific mountain system and chiefly on the coastal slope.

Another effect of climate on railway construction and maintenance, is the frozen condition of the ground which prevails in much of the inland region. At Fairbanks the alluvium is in many places frozen to bedrock, ground frost having been met with to a depth of over 300 feet. It is to be noted that unless the cover of moss and vegetation is stripped, only about 18 to 24 inches of the surface thaws during the summer. The ground is, however, not everywhere frozen in the inland region. The beds of the larger watercourses are usually unfrozen, and this also holds true of the gravel benches along the valley walls and other deposits of alluvium which are drained. The talus-covered slopes of the valleys are generally frozen, and a cut made into them leads to thawing and this brings about landslides that may much increase the cost of construction and maintenance.

No permanent ground frost occurs along the Pacific littoral, and the same probably holds true of most of the Susitna and Matanuska basins. There is considerable permanently frozen ground in the Copper River Valley, especially along the foothills and slopes of the Alaska Range. In the Yukon basin permanently frozen ground is the rule, except under conditions described above.

RESOURCES.

The mineral wealth of Alaska is at present its most important resource, but the Territory also includes extensive tracts of farming and grazing lands and many water powers. Excellent timber occurs in southeastern Alaska, while the inland forests are valuable for local use. There are also valuable fisheries along the Pacific seaboard which, while they will not furnish tonnage for the railways, yet affect the transportation problem by furnishing additional business for the steamers connecting with proposed coastal terminals.

The developed mineral resources of Alaska include gold lodes and placers, copper, tin, and silver deposits, together with petroleum, marble, and gypsum. (See Pl. II, p. 34.) There are also extensive fields of bituminous and lignitic coal and some iron ores, which are practically undeveloped. In addition to these, silver-lead, zinc, antimony, quicksilver, and other ores, and peat, graphite, asbestos, and mica have been found.

Gold lode mining has been carried on in southeastern Alaska since 1882, and is a large and well-developed industry. The value of the total lode production is about $57,000,000, of which $4,600,000 should be credited to 1912. Copper mining began in 1900 and has made rapid strides during the past few years. The total copper production is about 90,000,000 pounds, valued at $13,145,000. Of this, 28,940,000 pounds, valued at about $4,630,000, represents the output of 1912.

Placer mining, begun at Juneau in 1880, was extended to the Yukon Basin in 1886. No very important discoveries of placer gold were, however, made in Alaska until after the Klondike rush of 1898. This brought a large number of people into the Territory and led to the finding of gold at Nome in 1898, at Fairbanks in 1901, and in the Innoko-Iditarod region in 1908. Meanwhile the other smaller districts were developed, notably those of the Yukon, the Copper, and the Susitna Basins. The total gold output of all the placer mines has a value of $145,000,000, while the placer-mine output of 1912 has an estimated value of $12,000,000. Silver has been recovered, incidental to gold and copper mining, to the total value of about $1,800,000. The value of the output of tin, marble, gypsum, petroleum, lead, etc., to the close of 1912 is about $1,000,000. (See Appendix B, p. 144.)

The exploitation of coal deposits on Cook Inlet in 1854 by the Russians was the first attempt at any form of mining within the Territory. Though public attention has for several years been focused on the coal deposits of Alaska, no coal mining has been carried on except that of exploiting lignitic deposits for local use, which was begun 13 years ago. Large sums have been spent on surveys, development work, etc., in the Bering River and Matanuska fields. In spite of all this activity the total output of coal in the Territory up to the close of 1912 is insignificant, being less than 40,000 tons. During this period upwards of 1,500,000 tons of coal have been imported into the Territory.

To sum up, Alaska has produced to date mineral wealth having an aggregate value of $229,000,000, of which about $22,000,000 is to be credited to the year 1912. This output is remarkable, considering that large mining operations are practically confined to the coastal region, easily accessible to ocean transportation, and that the vast mineral wealth of the interior, except the richest of the gold placers, is almost untouched.

The resources of the entire Territory having been briefly considered, it remains to deal more specifically with those of central Alaska, comprising that part of the Territory here under consideration. An outline of these resources will here be presented, but for a more detailed statement the reader is referred to a later section of this report, which treats of the different railway routes. (See pp. 39 to 93.)

Gold placers, copper, and gold lode mines have been operated in central Alaska, and silver has been recovered incidentally to gold mining. There has also been a small output of coal and petroleum. Of the kinds of mineral deposits which are practically undeveloped, there are extensive coal fields, silver-lead ores, tin and antimony deposits, etc. In addition to these, some iron ore deposits have been found, but their commercial value remains to be proven.

Auriferous gravels are very widely distributed in central Alaska, and their exploitation has yielded gold to the value of nearly $90,000,000. Most of this has been taken from deposits which were very rich, for the high cost of operating here prevented the exploitation of the more extensive deposits of lesser gold tenor.

The high cost of mining in the interior has in a large measure deterred the prospector from searching for auriferous lodes, as only the richest and most favorably situated of such deposits could be profitably exploited under present conditions. Gold lodes have, however, been found in many parts of the province and have been successfully mined in the Kenai Peninsula, in Willow Creek district of the Susitna Basin, and in the Fairbanks district.

The copper deposits of central Alaska are among its most important resources. The only developed copper district is that of the Chitina Valley, from which one mine began shipments in 1911. Considerable development has also been done on copper deposits which lie in a belt stretching from Nabesna River to White River. This field gives promise of becoming an important producer when rendered accessible by a railway. Copper deposits have also been found in other parts of the province, but about these less is known.

The coal fields of central Alaska are extensive and include some of the best coal of the Territory. High-grade steaming and coking bituminous coals as well as some anthracite are found in the Bering River and Matanuska coal fields. Much of this coal is crushed and will furnish a large percentage of slack, and in many instances the coal beds have been so deformed as to prevent their profitable mining. While the percentage of the coal beds that can be profitably mined can only be determined by actual exploitation, yet the fact remains that these two fields contain much workable coal of a higher grade than any now known in that part of the North American Continent tributary to the Pacific Ocean. Though the high-grade coals, so far as known, are limited to these two fields, lignitic coal is widely distributed. The Nenana field, lying about 60 miles southwest of

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Fairbanks, is the largest of the lignitic coal fields, but a similar grade of fuel has also been found in the Susitna Basin and reported in the upper Kuskokwim Basin.

There are large tracts of arable and grazing lands in central Alaska for the most part unutilized, because of the lack of transportation. The census of 1910 shows that there were 2,660 acres of improved farm lands in Alaska, most of which is in the province here under discussion. Up to the present time hay and potatoes, with a variety of garden vegetables, have been the chief crops. In 1910 nearly $100,000 worth of potatoes and $100,000 worth of hay were produced. Oats, barley, and rye can be ripened in many parts of the Territory. Up to the present time only a small amount of wheat has been ripened, but it seems certain that this grain can be successfully raised, at least in the Tanana and Susitna Valleys.

The largest areas of agricultural lands are located in the Susitna, Tanana, and upper Kuskokwim Valleys, and there are smaller tracts in the Copper River Valley and in other parts of the province. Considerable profitable farming has been carried on near Fairbanks, where a local market is reached by wagon roads. A number of homesteads have been taken up near Knik, in the Susitna region, and more would be entered if there were any means of getting products to market. Agricultural land in Alaska is not likely to yield any crops for export for a long time to come, but with the increase of local markets following the mining development after railway construction, farming communities will spring up at many localities.

In addition to the farming lands there are much larger areas of good grass land, and cattle raising is likely to become an important industry in parts of this field. With the decrease of the western ranges in the States, Alaska may before long be drawn upon for beef and mutton. The reindeer is another source of food supply in Alaska. Domesticated reindeer have been successfully raised in Alaska for upward of 30 years, the herds now aggregate about 40,000 head. The coastal barren grounds of Bering Sea and the Arctic Ocean furnish the most extensive reindeer pastures of the Territory. Reindeer moss also grows abundantly on the uplands above the line of good timber and grass in many parts of central Alaska. It is conservative to state that Alaska has pasturage for several million reindeer.

The water powers of central Alaska are chiefly limited to the high ranges and the adjacent foothills. Their distribution is in a large measure controlled by the distribution of rainfall. Water powers are most abundant on the seaward slope of the coastal ranges, but are also found on both slopes of the high ranges lying further inland.

MAP OF ALASKA

SHOWING DISTRIBUTION OF

MINERAL DEPOSITS

Compiled under the direction of
Alfred H. Brooks, Geologist in charge
Division of Alaskan Mineral Resources

Base compiled chiefly from maps of the U. S. Geological Survey. Coast line from U. S. Coast and Geodetic Survey charts

Scale 1/5000000
Approximately 80 miles to 1 inch

50 0 50 100 150 200 Miles

50 0 50 100 150 200 Kilometers

1912

LEGEND

- Area known to contain anthracite and high-grade bituminous coal
- Area which may contain anthracite and high-grade bituminous coal
- Area known to contain low-grade bituminous coal
- Areas which may contain low-grade bituminous coal
- Area known to contain lignite
- Area which may contain lignite
- Gold and silver lode
- Gold placers
- Copper lode
- Tin deposit
- Petroleum seepage
- Gypsum mine
- Marble quarry

ENGRAVED AND PRINTED BY THE U.S.GEOLOGICAL SURVEY

House Doc. 1346; 62d Cong., 3d Sess.

POPULATION.

According to the census of 1910 the total population of Alaska is 63,700, of which about 36,000 are whites. The census was taken in winter, when only permanent residents could be enumerated, and these figures should, therefore, be augmented by many thousands, representing the annual summer migration to Alaska of miners, cannery employees, and others, but of course not including tourists.

Central Alaska, the region here specially under discussion, contains about 32,500 people. Of these at least 20,000 are whites. Though exact figures are not now available, it is probably safe to estimate that over half the white population of Alaska resides in the area which is tributary to the various railway projects here to be discussed.

Skagway has a population of 872 (1910). It is not known what the population of the region tributary to the White Pass Railroad is, but it probably includes several thousand people. It is also estimated that there are 2,000 or 3,000 more in the Klondike and other Canadian mining districts of the Yukon which are connected with the White Pass route by river navigation and winter roads.

The town of Haines, on Lynn Canal, has a population of 445 (1910), and the total of the tributary district is about a thousand. These include about 100 miners and prospectors in the Chilkat Basin. It is also estimated that there may be 100 or more whites along the Canadian part of the Haines-Fairbanks route.

The coastal towns of Prince William Sound and adjacent regions had populations in 1910 as follows: Katalla, 188; Cordova, 1,152; Seward, 534. The incorporated town of Valdez had 810, to which should be added some 600 or 700 more, representing the population of a settlement immediately adjacent, not included within the city limits. There are no facts available regarding the population of the Copper River Valley, as the census was taken before the influx of people, due to the completion of the railroad. It is probably safe to place this at several thousand, including those resident on or near the military road stretching from Valdez northward.

The population of the Kenai Peninsula, including Seward, is about 1,700, and there are between 600 and 700 in the Cook Inlet region, including the Susitna Valley. The population of the Iliamna region is reported to be 271, but of this probably not more than 100 are whites.

In 1910 there were nearly 17,000 residents in the Alaska part of the Yukon and in the Kuskokwim Basins. Of these nearly 8,000 were in Fairbanks and the adjacent region. The population of Fairbanks was 3,541 (1910); Chena, 138; Tanana, at the mouth of the river of the same name, 398; Rampart, 83; Hotsprings, 101. It is estimated that the entire population of the Iditarod-Innoko and adjacent districts is between 3,000 and 4,000, but there has been such an influx since the census was taken that these figures may be in error.

Though it will be evident from the above statement that the population of central Alaska is scant, it must be remembered that up to the present time the industrial conditions have been such as to attract only the placer miner. Even placer mining has been limited entirely to the exploitation of bonanzas. It is true, of course, that lode mining has been started at Fairbanks and one copper mine opened in the Kotsina-Chitina district, but outside of this there has been little industrial advancement in the inland region. In the absence of means of communication only the arable lands that lie close to the settlements have been taken up, so that the farming population is very small.

COMMERCE.

The Territory of Alaska was purchased from Russia in 1867 for $7,200,000. Up to the close of 1912 it has produced minerals, fishery products, and furs to a value of about $460,000,000. Alaska's commerce includes northward shipments of food products, merchandise, machinery, lumber, coal, etc., and return shipments of gold, silver, copper, salmon, halibut, etc. The average annual value of this growing commerce during the five years ending with 1912 is nearly $50,000,000. In addition to this the territory produces annually some lumber, farm products, etc., which are consumed locally and as to the value of which no accurate figures are available, but is probably about half a million dollars.

The average value of the merchandise shipped annually from the United States to Alaska, during the five years ending with 1911, is $16,740,256. The highest value during this period for any one year (1909) was $17,705,330, the lowest (1911), $15,170,109. It should be noted that the value of the shipments to Alaska for the year 1912 was much larger than any of the preceding six years. Complete statistics are still lacking, but the value of the shipments to Alaska for the first 11 months of 1912 was $21,585,587. The total for the year will, therefore, exceed $22,000,000, an amount several millions of dollars greater than the maximum for any one year, as above indicated. An average of about 22 per cent of the above annual value is made up of the shipments made to St. Michael and Yukon Basin. This includes some shipments to Canadian Yukon. There is also a considerable amount of commerce with inland points reached along the valleys of the Copper and Susitna Rivers, but, unfortunately, there are no statistics of the value of this trade.

It is estimated that during this five-year period an average of some 42,000 tons of merchandise were shipped into the Yukon region. This includes the traffic into the Iditarod-Innoko region, into the Tanana region, and into the Canadian Yukon. The greatest average for any one year was 50,000 (1909), and the lowest 40,500 (1910). It has been estimated that of this freight an average of 24,000 tons is shipped into the Fairbanks-Rampart region, the highest being 33,000 tons for 1909 and the lowest 15,000 tons for 1911. The information at hand indicates that about 8,500 tons have been annually shipped into the Innoko-Iditarod region during the years 1910 and 1911. A small amount of freight is also carried into Fairbanks over the military road during the winter months, and some also reaches the Kuskokwim Valley by direct shipments to the mouth of that stream.

The in and out bound passenger traffic to and from Alaska, not including tourists or cannery employees bound to remote places, amounted to 50,916 in 1910, and 43,293 in 1911. A part of this represents the travel into the Klondike and other districts of the Canadian Yukon. Most of this travel was to and from coastal points. The average annual passenger travel to the Fairbanks

region by steamboat route for 1910–11 is estimated to be about 2,000 and 1,000 to the Iditarod-Innoko region. About 800, in addition, travel in and out of Fairbanks by a stage during the winter months, and probably 1,000 go in and out on foot. In addition to these there are also several hundred who travel in and out of the Iditarod-Innoko region by the Kuskokwim River or by the winter trail to Seward.

The average value of the outbound shipments from Alaska for the five years ending in 1911, and including mineral products, fish, furs, etc., is $32,200,392. The highest value for any one year was $35,910,701 (1911), and the lowest, $29,151,404 (1910). The only outbound shipments from the Yukon and Kuskokwim Basins are gold and silver. The same is true of the Susitna Basin and a large part of the Copper River Basin, where there is, however, one mine which has been shipping copper ore for two years. While much of the value of the outbound shipments is represented by gold, silver, and copper, the greater part of the actual tonnage is made up of the fishery products which are not dependent on inland transportation.

This commerce is carried on by vessels which ply between Alaska and west coast ports. Its importance is indicated by the records of clearances and entrances of vessels. In 1910 a total of 451 domestic vessels, with a total tonnage of 396,740, entered, and 419, aggregating 384,967 tons, cleared Alaska ports. In 1911 the entrances were 514 vessels, with an aggregate tonnage of 426, 986, and clearances, 495 vessels, with an aggregate tonnage of 421,905. Trade in foreign bottoms was as follows: In 1910, 393 vessels, with an aggregate of 244,694 tons, entered, and 366 vessels, with an aggregate of 183,284 tons, cleared. In 1911, 367 vessels, with an aggregate of 187,849 tons, entered, and 331 vessels, with an aggregate of 156,647 tons, cleared. These figures for foreign bottoms include the clearances of the Canadian steamers on the Yukon.

The traffic on the Yukon and its tributaries is carried on by 58 river steamers varying in capacity from 6 to 588 net tons, and with an aggregate net tonnage of 14,081. There are also 12 steamers on the Kuskokwim with a net tonnage of 1,568. To arrive at the total tonnage it will be necessary to add that of the scows and barges used on the Yukon, of which there are 56, aggregating 25,393 net tons. About 60 vessels clearing from Puget Sound are regularly engaged in Alaska traffic. This does not include the whaling ships, cannery tenders, or small gasoline boats.

The commission employed Mr. Harry L. Muchemore as statistician, and he spent some two months in collecting data from which the above figures were taken. A fuller report on commerce is presented in the Appendix B (p. 144).

RAILWAY ROUTES.

(See Pl. I, p. 22.)

Outline.

The Pacific Mountain system which fringes the coast line of British Columbia and stretches northward into Alaska, presents a formidable barrier to inland travel. It is a single range 50 to 80 miles wide along the boundary of British Columbia and Alaska, but broadens out as it enters the Territory, and reaches an extreme width of 200 miles, made up of a number of parallel ranges. The great interior valleys lie north of these mountains, and all the ice-free ports lie south of them. It is through the passes in these mountains that a railway route must be sought.

Proceeding westward the first pass which would develop other than wholly Canadian territory is now reached and traversed by the White Pass & Yukon Railway. Chilkoot Pass, almost adjacent, is higher and not feasible for railway development.

The next pass to the westward is the one which would be used by a railroad route based upon either Pyramid Harbor, an arm of Lynn Canal, or Haines, a bay on the west side of Lynn Canal. The road would ascend the Chilkat River, whose headwaters are separated from streams flowing into the Alsek by passes about 3,200 feet high. Once over these passes, the route would follow a series of natural depressions parallel to the inland front of the St. Elias range, traverse the broad flat divide between the White and Tanana Basins, and follow the Tanana Valley to Fairbanks. The principal things that militate against it are that it is the longest of all proposed routes and that it lies in foreign territory for nearly half its distance to Fairbanks. (See p. 44.)

The next available pass would be that used by a route based on Yakutat Bay as its terminus. This road would run southeastwardly for about 50 miles, to the mouth of the Alsek River, and ascend the Alsek valley, reaching the Pyramid Harbor-Tanana route about 200 miles from the coast. Consideration of this route may be passed over with the statement that its harbor is indifferent; that the resources along its route are, so far as known, inferior to those known to exist along the route from Pyramid; the topography is extremely rugged; and it also passes through Canadian territory. The Pyramid Harbor route possesses many known advantages over this route.

Passing westward, the next route of access into the interior is afforded by the great Copper River valley. Three general routes up the valley of this river have been proposed: First, from either Cordova or Katalla directly up the river; second, from Valdez across Marshall Pass and down the Tasnuna to the Copper River valley; and third, from Valdez over Thompson Pass and a lesser summit at Ernestine, and thence to the Copper River at a point near Copper Center.

Along the first of these routes the Copper River & Northwestern Railway has already been constructed to Chitina, 132 miles from Cordova. It is the longest of the three routes, but has no grades to surmount until the divide between the Copper River and the Yukon Basins is reached. The other two routes, while shorter, have to surmount either an elevation of 1,860 feet [1] at Marshall Pass, or one of 2,750 feet at the Thompson Pass, before the Copper River Valley itself is reached. All three routes follow practically the same line from Copper Center up Gulkana River and one of its tributaries, across the divide to the headwaters of Delta River, and down that stream and Tanana River to Fairbanks. (See p. 64.)

The headwaters of the Copper are separated by the Alaska Range from the valleys of the White and Tanana rivers, and there are possibilities that may be considered for connecting these valleys with a railroad system lying in the valley of the Copper River, by lines across the Alaska Range through Mentasta and Skolai Passes.

The next available port is Seward, in Resurrection Bay. From this town the Alaska Northern Railroad has started the construction of a railroad which crosses the Kenai Mountains and reaches tidewater at its present terminus on Turnagain Arm, a branch of Cook Inlet. An extension of this railroad could reach the Copper River plateau by following up Knik Arm and Matanuska Valley over Tahneta Pass at an elevation of about 3,000 feet, and so reach the Copper River at a point near Copper Center. The Tanana Valley could be reached either by extension of this line as previously outlined or by Susitna River, from whose upper waters the headwaters of the Nenana River may be most easily reached by Broad Pass, about 2,700 feet high. This road gives promise of allowing for a connection with the great Kuskokwim Basin through one of the passes leading from the headwaters of the Yentna, a tributary of the Susitna. Rainy Pass, about 2,950 feet high, seems to be most promising. (See p. 84.)

Upper Cook Inlet is closed by ice during the winter season. Were it not for this fact, a railroad based on some harbor in this inlet might be considered. As it is, it seems necessary that any route reaching Cook Inlet from the valleys of Susitna or Matanuska must be carried across the Kenai Mountains to Seward along the line of the Alaska Northern route, or by other passes to the westward of that line.

West of Cook Inlet high and rugged mountains seem to bar any direct access to the Kuskokwim from the west side of this inlet, but toward the southerly end of the inlet these mountains are less difficult and the passes are low. The Iliamna Lake region offers a possible route from some such terminal point as Iliamna Bay into the Kuskokwim, and from that great valley possibly on into the lower Yukon from which it is separated by only a low watershed. (See p. 90.)

The commission will consider all these routes in detail in this report.

[1] These and other elevations given in this report are as accurate as can be obtained from information at hand. They are in part based on aneroid observations.

The White Pass & Yukon Railway.

DESCRIPTION OF LINE.

The White Pass & Yukon Railway, the first railway in Alaska, was built to give access to the Klondike gold fields, which were discovered in 1896. By midsummer of 1897 the value of this find was generally recognized and a northward movement of gold seekers began. The shortest route to the Klondike lay over the Coast Range of southeastern Alaska, where, at the Chilkoot Pass (3,100 feet), only 20 miles intervened between tidewaters, and streams tributary to the Yukon navigable for small boats. The route over the White Pass (2,880 feet), a few miles to the south, was not much longer. Therefore much the larger part of the travel into the Klondike was concentrated over these two passes, in spite of the difficulties they offered to transportation of freight. Horses could be used on the White Pass, but at the Chilkoot the grade was so steep that men had to be the beasts of burden. It is estimated that in 1898 about 28,000 people used these routes into the interior and that upward of 35,000 tons of freight were transported over these arduous trails.

It was these conditions which led to the construction of the White Pass & Yukon Railway, which now furnishes transportation between tidewater at Skagway and the navigable waters of the Yukon Basin at White Horse, on the Lewes River. Construction on the railway was begun in the summer of 1898 and freight was hauled as soon as a track was laid. By the next spring the track, in spite of the difficulties of construction, had reached the summit of the White Pass, 20 miles from the coast. A wagon road connected the end of the track with Lake Bennett, thence small steamers carried freight and passengers to Miles Canyon, where a horse tram furnished transportation to White Horse and the Yukon River boats. By this means a through system of transportation was established connecting tidewater with the Klondike, and this was of immense benefit to the new placer camp. Construction work on the railway was continued, and by 1901 the line had been completed to White Horse, 110 miles from Skagway, and, with its river service, has since been the established route into the Klondike. It is also used for passenger and fast freight service to the Alaska-Yukon.

The White Pass & Yukon Railway, a narrow-gauge road (3 feet), has its coastal terminal at Skagway, which is at the head of Lynn Canal, about a thousand miles by inside passage from Seattle. The track is laid with 56-pound rail for 40 miles and 45-pound rail for the remainder of the distance; for the service demanded the alignment is good and the property well maintained. Skagway is a well-laid-out and well-built town of some 800 inhabitants, and has a daily newspaper, banks, hotels, and telephones. It is connected by cable with Seattle and with other Alaskan ports, and by telegraph line with inland points and, through Canada, with the United States. The terminal facilities include ample wharves and coal and ore bunkers. (See p. 94.)

Leaving Skagway the line follows the Skagway River and 5 miles out begins climbing on a 3.9 per cent grade. This grade rules for a distance of 16 miles, with a general maximum curvature of 16°.

From the foot of the grade the line follows the east fork of the Skagway River, with a loop 2 miles long, crossing the river on a frame trestle. From Rocky Point, at mile 7, the line follows the canyon with much sidehill rock work to mile 12, where the big loop of the Skagway River, about 4 miles long, begins, involving some of the heaviest construction encountered, including concrete retaining walls, heavy bridges, snowsheds, and tunnel work. At mile 19 the old switchback crossing of the East Fork has been replaced by a cantilever steel structure some 215 feet above the bed of the river. About 1½ miles beyond, or 20 miles from Skagway, the summit of White Pass (2,880 feet) is reached and the international boundary is passed.

The line in American territory is built principally with sidehill construction in granite rock on steep mountain sides, and was constructed by the Pacific & Arctic Railway & Navigation Co. From White Pass the track alignment follows along the chain of lakes in the pass for 4 miles, with light construction and grades not higher than 1 per cent.

From mile 25½ to 26½ the grade drops sharply, with maximum of 3.8 per cent and 12° curves, and the line skirts a chain of lakes to mile 31½ with maximum grades of about 2 per cent and maximum curvature of 16°. At mile 31½ a heavy climb begins and continues to Log Cabin summit, with maximum grade of 2.6 per cent and curves of 8°; character of work continues light. From Log Cabin summit the line drops to Lake Bennett, maximum grades 3.3 per cent, maximum curvature, 16°. The line follows through swampy land to mile 36, and from there on sidehill to Bennett. The commission traveled only to Bennett.

Between Bennett and White Horse, 70 miles, the line passes through three general types of country. From Bennett for the first 14 miles the line skirts the bold shores of a lake, and construction was heavy; the ruling grades in both directions are about 1 per cent, and the maximum curvature 16°. From there on to Caribou Station, a distance of 12 miles, the sidehills recede and the line crosses spurs in a generally flat country, on grade maximums of 1 per cent in both directions, and curvature up to 16°. At Caribou, the end of Lake Bennett, there is a steel and wood drawbridge; here connection is made by steamers with the Atlin mining district.

From Caribou to White Horse the road follows broad flat valleys on grades not to exceed 2 per cent in both directions, except at White Horse, where the line drops from the plateau into the valley. Here the north bound descending grade is 3.9 per cent for a short distance only, with a ruling curve of 10°. At White Horse there are terminal wharves for connection with the river steamers to Dawson.

At mile 103½ a branch of 11 miles in length was built in 1908 to the White Horse copper district. This has a maximum grade of about 2¼ per cent and maximum curvature of 16°.

According to the report of the railway company the cost of this line was about $62,000 per mile. The physical valuation made by the Canadian Railway Commission places the cost at $48,738 per mile.

All but about 20 miles of this railway lies in Canadian territory. The chief reason for here describing it is that plans have been suggested for an extension to the copper district of the White River valley and to other parts of the Yukon Basin. Moreover, it would, in a

certain degree, compete with any railway built to Fairbanks, to which point, in connection with river steamers, it now handles freight and passengers. (See p. 25.)

The White Pass Railway could be extended to Lake Kluane by building about 120 miles. This road could be constructed with comparatively easy grades. At Lake Kluane it would intersect the route to be described from Haines to Fairbanks. (See p. 44.) The distance from Lake Kluane to the White River copper deposits is about 120 miles and construction with favorable grades would not be difficult.

The White Pass Railway now operates one through mixed train each day during the summer and three trains a week each way in the winter. In winter it connects with the stage for Dawson. This stage carries passengers, mail, and express. A little urgent freight is also handled over this line in winter. Coal-burning engines are used and train dispatching is by telephone. Rotary snow plows are required from November until the latter part of April.

RESOURCES.

The resources of the region tributary to the White Pass Railway practically all lie on the Canadian side of the boundary and need only brief mention here. A few auriferous lode prospects have been found near the railway, on the Alaska side of the boundary, but have not yet been proven of value. There is also a small amount of arable land and a small amount of good timber in the Skagway Valley on the Alaska side of the boundary.

This railway was built to furnish transportation to the Klondike placer fields, which had their maximum production in 1900, when the gold output had a value of $22,275,000. The value of the output gradually declined, so that in 1907 it was only $3,150,000. Since then the introduction of dredges and other mining machinery has led to an increase in the gold production, so that in 1911 it had a value of $4,634,000. The total gold output from this region, including 1912, is about $140,000,000.

The Atlin placer gold district is also tributary to the White Pass Railway. Its gold output has not been large and is included in the above totals. Placer gold has also been mined in several other districts of the upper Yukon, but the production has been small. There has been some prospecting for auriferous lodes in the Klondike and other districts of the Upper Yukon, but, so far as known, none of these have reached a productive stage. There has also been considerable work done in the Lake Bennett and adjacent regions of auriferous silver-lead deposits, but no productive mines have been developed. The geologic conditions in this general province, so far as known, are favorable for the occurrence of metalliferous lodes. Copper was found in the White Horse district some ten years ago, since which the deposits have been spasmodically developed. Lack of transportation prevented for many years the opening of mines. In 1908 some ore was shipped to British Columbia smelters by way of Skagway and larger shipments were begun in 1912.

Coal, chiefly lignite or sub-bituminous, occurs at a number of places in this province. The Tantalus coal mine has been operated for a number of years, the coal being shipped to Dawson by river steamers.

The timber of this region is scant and has value only for local use. There is considerable arable and grazing land in the upper Yukon Basin. Near Dawson and other settlements there are many ranchers which supply the local market with potatoes and other vegetables, as well as hay.

The Haines-Fairbanks Route.

DESCRIPTION OF LINE.

(See Pls. 2, 3, 4, Pt. II.)

The projected route from Haines to Fairbanks or some other point on the Yukon River system trends in a northeasterly direction, approximately parallel to the general mountain system and in the valleys between the St. Elias and Coast ranges. This line appears to possess certain topographic advantages over routes which run transversely to the mountain ranges, together with greater possibilities for economical construction. Generally the line follows the valleys of the Chilkat, Alsek, and Tanana River systems to Fairbanks, or some objective point on the Yukon River.

The terminus would be at Haines, in Portage Cove, or on the opposite side of the peninsula in the northern end of Chilkat Inlet. Portage Cove is now used as the harbor for the military post of Fort William H. Seward, as well as for the town of Haines, which has a population of about 450. There are two wharves at Portage Cove, one used by the post and one by the town. In both Portage Cove and the end of Chilkat Inlet good anchorage exists, fairly well protected against trouble from winds. The town of Haines is small, but is now important as the terminus of the military road leading up the Chilkat Valley to the adjacent mining districts.

A railway route to the interior has been explored, and a reconnoissance line has been run as far as the Alaska-Yukon boundary. This survey was made by the Alaska Midland Railroad Co., which is interested in the promotion of the project. The map of this reconnaissance was placed in the hands of the commission, and it was also furnished with estimated costs of construction, as well as general information concerning the character of the country traversed.

The line, as shown on the reconnoissance map, starts from the town of Haines and follows up the Chilkat River along its eastern bank. From the terminal to mile 23 construction is light and comparatively inexpensive. The river bottom is broad, and the line is supported on side hill, involving occasional light rock cuts with numerous trestle crossings. From mile 13 to mile 20 the line is supported on a chain of islands. The roadbed would require a very light fill, since the maximum fluctuation of the river level in this stretch is negligible. There are no maintenance troubles to be anticipated. From mile 20 to mile 33 the line traverses the river flats on a fill of sufficient height to keep the track above the water. At mile 26 snow sheds will be required. At mile 33 the Chilkat River is crossed to the western bank, necessitating one 150 foot steel span with pile approaches. From mile 33 to 37 the line is again supported on the gravel floor of the river bottom with light fill. From Haines to mile 37 there is a slight rising grade which, at mile 37, increases to 1.7 per cent on the climb to the summit. Construction work here will involve side hill

cuts, half earth and half rock. Mile 43 marks the international boundary between British Columbia and the Territory of Alaska.

Without having in its possession data on which to base an accurate estimate, the commission is of the opinion that construction work over the 43 miles, as herein described to the international boundary, would be comparatively inexpensive. In the opinion of the engineer who made the reconnoissance the first 25 miles could be built at a cost of $20,000 per mile, grading and track only, while the remaining distance to the boundary would cost in the neighborhood of $30,000 per mile. His estimates excluded all items outside of those entering into actual construction costs. The commission, from its knowledge of similar country, believes that these figures are somewhat low, and has made allowances for this difference of opinion in its estimates.

From the international boundary at mile 43 the line continues in the same general direction for 287 miles, where it crosses the Alaska-Yukon boundary near the headwaters of the Tanana River. The part of the line which is in Canadian territory, as described by the engineer who made the reconnoissance, can be built with practical gradients and at comparatively small construction costs. From the lower boundary the line ascends on a 2.2 per cent ruling grade to Isabel Pass, at mile 61. The elevation of this pass is approximately 3,150 feet. This 18 miles would involve rather expensive work with side hill rock cuts, and the reconnoissance engineer estimates the cost at $50,000 per mile, exclusive of equipment. From Isabel Pass to mile 69 the line continues to climb on a maximum grade of 1.5 per cent to a divide at an elevation of about 3,250 feet. Construction here would be very light, as the country is flat and unbroken by streams. From the divide the drainage flows northward into the river valleys tributary to the Alsek River. From mile 70 the railroad location descends the Tatshenshini Valley along its eastern margin. Construction would be very light, with the exception of a half a mile of canyon work. The reconnoissance engineer estimates the cost from mile 61 to mile 92 at $25,000 per mile, less equipment.

From mile 92 to mile 107 the line follows Klukshu Creek, again descending to cross a minor summit, elevation about 3,020 feet, which is reached on a uniformly ascending valley approach 1 mile in width, with gravel floor. There are no stream troubles to be overcome, and very few crossings, such as are necessary being possible to effect on pile trestles. The engineer estimates the cost of this stretch of the line at $30,000 per mile.

From mile 107 to 115 the line descends to Lake Dezadeash. This lake is at an elevation of 2,850 feet, and the line skirts its western margin 60 feet above its level. The ground is swampy and construction is estimated by the reconnoissance engineer at $35,000 per mile. Another summit, elevation approximately 3,390 feet, is crossed at mile 113. This summit is broad and level, requiring very little grading. Construction is estimated by the engineer at about $20,000 per mile. From mile 122 to 139 the line descends the valley of Kathleen Creek, in country offering little difficulty to railroad construction. This stretch is also estimated at $30,000 per mile. At mile 139 the the Keskewulsh River crossing will require two 150-foot steel spans. From mile 139 to Bear Creek Summit the line is uniformly supported on rising ground, involving very light construction work. This summit is at an elevation of about 3,550 feet and is probably the highest

point on the entire line. Construction work is estimated at $25,000 per mile. At about mile 143 a possible connecting line to the White Pass & Yukon Railroad would leave the Haines-Fairbanks line. From mile 160 to mile 193 the character of country is much the same as that just described, but the necessity for two steel bridges and numerous small crossings brings the engineer's estimate for this part of the road to $35,000 per mile. From mile 193 to 196 very heavy rock work on steep side-hill slopes is necessary. This the engineer estimates at $50,000 per mile, exclusive of one 400-foot tunnel at $90 per foot. From mile 196 to 213 there is no rock work and the cost is estimated at $35,000 per mile. From mile 213 to mile 295 the line traverses a series of broad river valleys on practically level grades. Comparatively light construction work, but numerous stream crossings will be required. The estimated cost, exclusive of crossings, is $35,000 per mile. There will be five bridges aggregating 1,800 feet of pile trestle, one 275-foot steel span and five 80-foot steel girders. The engineer estimates this bridge work at $275,000 a figure which the Commission believes to be low. From mile 295 to mile 330, the Alaska-Yukon boundary, no actual reconnoissance has as yet been made. From exploration work the possibility of a road with light gradients is established, and the engineer of the Alaska Midland believes that such a road would approximate in cost that part between miles 196 and 213 described immediately above; in other words, about $30,000 per mile less equipment and bridges.

No railway surveys have as yet been made from the boundary into the Tanana Valley but from a description of the country furnished by a member of the Commission who has actually traveled over it and from topographic maps it is believed that no great difficulty in the way of projecting a railway line down the valley of the Tanana River to the town of Fairbanks, or on to the Yukon River will be experienced.

From the boundary the line would take a northwesterly course traversing a broad swampy flat which here constitutes the watershed between the White and Tanana Rivers. Crossing the watershed the best route would probably be down the valley of Mirror Creek to its junction with the Tanana. There is a choice of two routes from the headwaters of the Tanana to Fairbanks. If the northern bank of the river is selected construction cost would be moderate, due to occasional stream crossings and some rock cuttings where the cliffs jut out to the river's bed. If the south side of the river is chosen the line will run, for the greater part of the distance, on the broad river flats, involving light grading but numerous crossings of tributary streams. The Tanana River would be crossed at the mouth of either the Delta or Little Delta Rivers, probably the only points on its whole length where the Tanana is confined to one minor channel between good bluff approaches. If the Little Delta crossing were adopted the remainder of the line would be identical with that part of the Cordova-Fairbanks route between miles 260 and 313, described on page 65. Throughout the Tanana Valley there is to be found occasional patches of excellent timber, sufficient in quantity and quality for ties and bridge stock.

The Commission has prepared as careful an estimate of the cost of this line as the nature of the information in its possession permits, and this estimate, together with some of the general characteristics of the line are as follows: Length of line, Haines-Fairbanks, 638 miles;

maximum curvature, 16°; maximum grade, 2.2 per cent; cost of entire line, $28,186,000; average cost per mile, $44,300.

RESOURCES.

Mineral.—The mineral resources along this proposed line consists of the gold placers of the Porcupine district in Alaska and of the Lake Kluane district in Yukon territory, the copper deposits of the Rainy Hollow district in British Columbia, and the copper deposits of the upper White River Valley, which are chiefly on the Alaska side of the boundary. The copper and gold deposits of the Nabesna Valley could also be made tributary by building a branch some 30 to 40 miles in length, and the gold placers of the Forty-mile district by a branch 100 miles in length. An inland terminal at Fairbanks would reach the most important gold placer district of Alaska, where some auriferous lodes have also been developed. (See Pl. II, p. 34.)

Of the undeveloped or little developed mineral resources there are some iron ores near Haines, some auriferous lodes in the Chilkat Valley, and coal, probably chiefly lignite, in British Columbia and the Yukon territory. The discovery of copper deposits in the Lake Kluane region has been reported. There are also some undeveloped placers in the Yukon-Tanana region lying adjacent to and north of the proposed line.

Placer gold was first found in the Porcupine district in 1899, since which time gold to the value of about $800,000 has been produced. The gold-bearing district includes Porcupine Creek and other streams of the Chilkat Basin, and the developed placer mines lie about 12 to 15 miles from the main line of the proposed railway and could be reached by a branch on water grade. In 1912 one large hydraulic plant was operated in the district, and preparations were being made to install two others. Some auriferous quartz veins have also been found in the district, but these are but little developed.

Some iron ore (magnetite) has been found close to the Government wagon road and about 2 miles from Haines. Here an adit-tunnel about 100 feet in length has been driven and a test shipment of a few tons made. It appears, however, that the ore, at most, carried only about 20 per cent of iron, and that no commercial ore bodies were found. It is possible that richer bodies of ore may occur in the belt of iron-bearing rock which skirts the east side of Pyramid Harbor and the Chilkat Valley for some distance.

The Rainy Hollow copper district lies in British Columbia not far from the boundary line. The principal claims are about 50 miles from tidewater and 30 miles from the Chilkat Valley, along which the proposed railway route runs. A branch to the copper field could be built at no great expense, following the Klehini Valley at water grade. Copper was found in the Rainy Hollow district in 1898, since which time considerable work has been done on several properties. In the absence of railway connection with tidewater no regular shipments could be made, but some 50 tons have been taken to the coast by wagons. The copper ores are chiefly sulphides and carry gold and silver values. While the district is best known for its copper deposits, lodes chiefly valuable for gold ore, silver, and lead have also been found, as well as some zinc ores. There are also reported occurrences of iron ores in this district. The information at hand indicates that

this district has promising metalliferous deposits which should be able to furnish tonnage for a railway.

The Kluane mining district includes an area adjacent to the Lake Kluane, in which placer gold was discovered in 1903. The auriferous gravels, as now known, are distributed over an area 75 miles in length, stretching along the inland front of the St. Elias Range, with a maximum width of about 30 miles. Placer mining has been carried on in a small way in this district, but the value of the total output probably does not exceed $100,000. Some copper and silver-lead ores have also been found in this region.

In considering the resources of the region traversed by the proposed railway it should be noted that while the discoveries of workable deposits under present cost of mining have not been many, yet the geologic conditions along a part of the route, so far as known, are favorable to the discovery of metalliferous deposits, especially gold. It seems quite likely that a northwesterly extension of the auriferous belt of southeastern Alaska may occur in this field.

Some coal has been found on the Canadian side of the boundary, about which little is known. It appears, however, that the coal is in part at least lignite and that it lies in Canadian territory on the Alsek side of the divide, and lignitic coal has also been found in the Kluane district. It is reported that bituminous coal occurs in the White River Basin, on the Canadian side of the boundary. There is little information about the extent or quality of any of these coals, and at present it is not safe to regard them as valuable for export and therefore as not an assured source of tonnage for a railway. There seems to be small basis of fact for the assertions which have been made that these coals are applicable to metallurgical processes or suitable for export.

The line to Fairbanks as projected traverses in the upper White River Basin, a district in which considerable copper ore has been found. To reach the copper deposits at the head of the White River a branch line 40 to 50 miles in length would have to be extended up that valley. On this, construction would be inexpensive, and it would ascend by water grade. Other deposits could be reached by spurs of lesser length. The copper deposits of this region include both sulphide and native ores. There are also some auriferous lodes in this district. While it appears that there has not been sufficient development on any of the many prospects located to assure a tonnage, yet the mineralization is widespread, and there is every reason to believe that the district would become a producer of copper if a tidewater connection were provided. It should be noted that while most of the prospects of this district are in Alaska, some of them are on the Canadian side of the boundary.

The productive mineral resources of the Tanana basin are chiefly gold placers and are largely confined to the area tributary to the lower river. There has been only a little placer mining in the Tanana Valley above the mouth of the Delta River. Auriferous gravels have been found at several localities in this remote region, but so far as prospected have not proved rich enough to mine under the present high cost of operations, due to the difficulties of transporting supplies and equipment. These would have to be hauled from the Yukon, a distance of over a hundred miles, and through a country where there are no roads.

Some auriferous lodes have been developed at Fairbanks and have been found in other districts of the Yukon-Tanana region. Lode gold and copper have been found in the headwater region of the Nabesna and Chisana Rivers, both tributary to the Tanana from the south. (See p. 73.)

The Fortymile placer district lies about 80 miles north of the route in the upper Tanana Valley. Gold was first found in this district in 1886, since which time the value of total output has been about $6,000,000. The value of annual output is now about $250,000. In 1912 three dredges were operated in the Fortymile district, besides a large number of smaller plants. The outlook for an expansion of the placer-mining industry, in case cheaper transportation be provided, is excellent, and some promising auriferous lodes have been found.

The Fairbanks gold district comprises an area stretching northeastward from the Tanana Valley for some 30 miles and from 10 to 15 miles in width. The district is tributary to the town of Fairbanks, with which it is connected by railway and by wagon road. Gold was first found in this district in 1902, and in the following year some small placer mining operations were carried on. Since that time the value of the total gold output aggregates some $53,000,000. The value of the gold output of 1912 was about $4,300,000, which was taken from between 130 and 140 different mines employing at different times in the year from 900 to 1,500 men.

The gold placers of the Fairbanks district are for the most part buried under a considerable thickness of gravel and muck, and therefore probably two-thirds of the mining had to be carried on by sinking shafts, drifting, and stoping. As the ground is frozen, thawing is necessary and this, together with the cost of hoisting, has made operations expensive as compared with other districts where open-cut mining is possible. The cost of deep mining in the Fairbanks district is between $3.75 and $4.50 a cubic yard, for the gravel passed through sluice box. If this cost were reduced by cheaper transportation, a large amount of gold-bearing gravel could be exploited not now available for profitable mining.

While the data for determining the gold resources in this district is very incomplete and any estimate can be regarded as little more than a guess, yet the best information available indicates that the placers of the Fairbanks district may still carry some $50,000,000 worth of gold. This does not take into account a large amount of auriferous gravels, the gold values in which are so low that they can not be profitably exploited by any methods now in use. This low grade gravel may ultimately yield much gold, but there are no quantitative data on hand permitting its amount to be estimated.

During the first four or five years of mining in the Fairbanks district attention was centered on the exploitation of the rich placers, though a few lode claims were staked. With the decrease of bonanza placer mining more and more interest was developed in the possibilities of auriferous lode mining. It should also be noted that this region is everywhere covered with moss and other vegetation, and that bedrock exposures are few. This condition much increased the labor of prospecting, for a large amount of stripping is required before the quartz veins can be uncovered. The first production from gold

lodes was made in 1908, since which time lode prospecting has been very active. Up to the close of 1912 upward of 2,000 lode claims have been staked and considerable development work has been done on quite a percentage of these. Meanwhile, many small shipments of ore were milled at custom mills erected at Fairbanks and Chena. The high cost of transporting the ore to Fairbanks made it imperative that mills should be installed near the properties, and this was undertaken in 1911 and 1912. As a result six mills were operated for a good part of the summer season of 1912, and five or six more were installed toward the close of the year. The total production from gold lodes in the district has a value something in excess of $300,000. In view of the heavy expense of installations and operations and the time lost in shipping to mills, the above record is creditable to the enterprise of the district.

The auriferous quartz veins of the district thus far developed are for the most part narrow, but with a high gold tenor. Many of the veins have proved to have remarkable persistency for considerable distances along the strikes, though up to the present time they have not been prospected to a depth of more than 200 or 300 feet. Some larger veins have been found, but their low gold content has not permitted of profitable exploitation under the present high cost of operations. Evidence of the high cost of mining is found in the fact that several of the mines are paying $15 to $18 a cord for wood, this being equivalent to $30 or $40 a ton for low-grade lignitic coal. If a railway were built, lignitic coal could be brought in from the Nenana field which should be delivered at the mines at not exceeding $10 a ton. Labor and equipment also cost very much more than in any of the lode-mining districts of the western states.

Taking all these factors into account, it appears that the results achieved by lode mining in the Fairbanks district are very encouraging. While there is no evidence that large ore bodies exist in the district, there is good reason to believe that there are many small veins which could be profitably exploited were the cost of operations reduced.

Placer gold has been found in many of the streams tributary to the Tanana from the north between the mouth of the Delta River and Fairbanks. Some of these have been developed in a small way, and the total output from this source is probably in excess of half a million dollars in value. Among the streams worthy of mention are Banner Creek, Tenderfoot, and several tributaries of the Chena River. These placers in part are so far from the transportation routes that the cost of exploitation has been almost prohibitive. They indicate, however, the possibilities of a mining industry if the region could be opened up by railways and wagon roads.

The Birch Creek placer district lies about 150 miles by trail north of Fairbanks. It is now reached by a wagon road some 40 miles in length, which starts at Circle, on the Yukon. Gold was first found in this district in 1894, since which time the value of the output has been about $5,000,000. The annual production now has a value of about $300,000. It is estimated that, in 1912, 27 placer mines were worked, employing a maximum of from 150 to 175 men. In spite of the high cost of transportation a dredge was installed in this district and successfully operated during the summer of 1912. There are also several hydraulic plants in this field. Auriferous lodes have also

been found in the Birch Creek district, but they are undeveloped. The Birch Creek district, while properly not tributary to the Tanana, yet would be benefited by any railway extended to Fairbanks. Eventually, no doubt, a branch line would be carried northward to tap this district, which has important potential gold resources.

If the proposed railway to Fairbanks were extended westward to the Yukon it would traverse an auriferous area including the Hot Springs and Rampart districts, which have produced gold to the value of about $4,000,000 since mining first began in 1894. The present annual gold output has a value of something exceeding half a million dollars. The possibilities of an extension of the placer-mining industry in this field under cheaper methods of operating are considerable. Some placer tin has been found in the Hot Springs district, and the discovery of lode tin is reported. A number of auriferous lodes have been staked, but are undeveloped.

Any railway built down the Tanana valley could be extended by branch lines into the Bonnifield placer district and into the Nenana coal field. The mineral resources of this district will be described in the account of the Seward-Fairbanks line (see pp. 86 and 88).

Water powers.—There are known to some undeveloped water powers in the vicinity of Haines and the Chilkat Valley. Some probably occur, near other parts of the route here described, but there is no data at hand in regard to them.

Timber.—The proposed railway will traverse a good timber belt in the lower Chilkat Valley, with spruce and hemlock 3 to 5 feet in diameter. There is also considerable timber in the adjacent region, including the flats near Haines and Pyramid Harbor, but the good stand is confined to valley bottoms. The timber line is about 3,000 feet. Above the Klehini River the timber becomes more stunted, and at the Chilkat Pass there is practically no timber except a little stunted spruce. In the Alsek basin the usual inland varieties of trees are found, including spruce, birch, and cottonwood. In favored localities the trees reach diameters of 2 feet, but most of the timber along the route measures not more than 6 to 8 inches. The same forest conditions prevail through to the upper Tanana, where the timber line is between 3,000 and 4,000 feet.

Some fine spruce timber is found in the flats adjacent to the lower Tanana, below Robertson River. Here some of the largest trees exceed 2 feet in diameter. The timber line is approximately 2,500 feet above sea level, and the best trees are confined to the valley bottoms. Much of the timber near Fairbanks has been cut, and the time is not far distant when some other source of fuel will have to be sought.

The Fairbanks district uses annually between 60,000 and 80,000 cords of wood, and the annual product of the three saw mills is probably between 6,000,000 and 8,000,000 board feet.

Agriculture.—There are excellent gardens and some small ranches near Haines and Pyramid Harbor. In these are raised vegetables, strawberries, some grain, hay, etc. The product has found an excellent market in the near-by settlements of Haines and Fort William H. Seward, competing with the vegetables which are brought in by water from Seattle. No attempt has been made to estimate the amount of arable land in this region, but it aggregates considerable, including the flats on the two sides of Pyramid Harbor and the

bench lands near Haines. There is also some farming and grazing land in the Chilkat basin, but no very extensive tracts, due to the mountainous character of the country.

The valley floors and slopes of the Alsek basin include much grass land. Agricultural development is undoubtedly possible in this field, though little has been done except some gardening at a few places. Grass grows especially luxuriantly in the flats at the eastern end of Lake Kluane and around the other lakes. The upper White River basin has long been known for its excellent pasturage. The gravel bottoms of the White River are covered with wild peas, which furnish excellent feed for stock. In this province the snowfall is so light that it is possible to winter stock without feeding. This experiment has been repeatedly tried and has been fairly successful.

Similar conditions prevail in the upper Tanana basin, which is also known for its extensive tracts of grazing land. These grass lands are found not only in the valley bottoms, but where the forest covering has been burned off extend up the slopes of the mountains to timber line. It may be said that these conditions prevail throughout much of the Yukon-Tanana region, where grass lands are found up to an altitude of some 3,000 feet.

The lower Tanana valley from the Delta to the Yukon is one of the most fertile tracts known in Alaska. Long before any farming was attempted in this region it was known for its fine grass and heavy stand of timber. Since the establishment of Fairbanks as a mining camp, thus giving a market for farm products, many ranches have been taken up, and several hundred acres are under cultivation in the vicinity. Experience has demonstrated that farming is not an experiment, but an industry, which can be profitably carried on, provided the product can be marketed. The work of the government experiment farms at Fairbanks and Rampart indicates the great variety of agricultural products which can be successfully raised. Farming has been carried on in the river bottoms and also on the hill slopes. Experience has shown that the slopes covered with birch forests are specially favorable for raising crops. This land can be easily cleared, and the soil is found to be much richer than that of the valley bottoms, and is apparently less susceptible to early frosts.

It is conservative to estimate the areas of agricultural lands in the Tanana Valley at between 2,000,000 and 2,500,000 acres. In addition to this there are extensive tracts of agricultural lands in the adjacent portions of the Yukon Basin. The government records show that the growing season in this general field varies from 90 to 120 days. It should be noted that plant growth is much more rapid in this latitude than it is farther south, because of the large amount of daylight. Oats, rye, and barley have been successfully ripened at the government stations, as well as on private ranches. The government records show that certain varieties of wheat can be ripened. At the government station at Rampart winter wheat was successfully ripened during five successive years. Shorter periods of experimentation at the Fairbanks farm have yielded similar results.

While the question of raising wheat is of importance to the future, present interest is centered on the farm products, which are in local demand. These include, above all, potatoes and other vegetables and hay. Some of the local grasses make good hay, but the best

success has been obtained with grain hay. Among the chief vegetables now produced besides potatoes are cabbage, kale, lettuce, radishes, carrots, beets, turnips, and cauliflower, though this by no means includes all the varieties which have been raised.

Of the agricultural importance of the Tanana Valley there can be no question. The district can not be expected to raise products which will be valuable for export, at least under conditions which can now be foreseen. It should, however, become in part self-supporting by raising a large amount of the food material now imported from outside. Though cattle raising has not been carried on to any extent, yet it is probable that this can be successfully done in competition with meat brought in from the States. The snowfall is, however, heavier than in the upper White River Valley and some winter feeding would be necessary. Whatever experience may show in regard to raising cattle, there should be no question that a local dairy industry could be developed.

Katalla and Controller Bay Coal Routes.

DESCRIPTION OF LINE.

(See Pl. 5, Pt. II.)

KATALLA.

Katalla Bay is an indentation on the south coast of Alaska, about 16 miles east of the Copper River delta. To the eastward about 10 miles lies Controller Bay, and these two possible landing points are the only ones between Cordova, 70 miles westward, and Yakutat Bay, about 200 miles eastward. The Bering River coal fields lie directly in rear of them and about 30 miles inland over practically level land. The short and easy haul has attracted much attention to the question as to their possible development as seaports for this coal.

The possibilities of Katalla Bay as a harbor are elsewhere described in this report. (See p. 96.) It may, however, be stated here that in the unprotected bight and foreshore where Katalla now stands a harbor could be created by the construction of suitable breakwaters. Their cost would, however, be very large, the construction would consume at least three years, and after completion a heavy and constant maintenance charge would be required. The shore is suitable for the construction of a town and terminals, and there is sufficient and convenient dockage room.

About six years ago Katalla was selected by the Copper River & Northwestern Railway Co. as the coast terminal both for handling coal from the Bering River coal fields and ore from the mines of the Copper River Valley, together with other in and out bound freight. This company started construction of a breakwater based on Palm Point, but the attempt was abandoned at an early stage. At the same time the same company built some 8 miles of railroad toward the Bering fields and did some construction work on the line toward the Copper River. They finally abandoned all work at Katalla and constructed the line from the Kotsina-Chitina copper field to Cordova, as elsewhere described in this report. (See p. 59.) The railroad construction was abandoned when the delay in rendition of patents to the coal fields made it appear that their issue was doubtful. It is probable that except for the controversy over these

patents the railroad work contemplated would have been completed to the coal fields as a branch of the main line from Cordova. This branch line is described at another place in this report. (See p. 68.)

At about the same time a second railroad, the Alaska Pacific Railway & Terminal Co., started work on the creation of an artificial harbor by the construction of a breakwater on the west side of Martin Islands. Their work was also abandoned during the controversy over the coal patents.

The commission examined the remains of the work of both of these companies at Katalla, and their plans for extension.

Two plans for constructing an artificial harbor near Katalla have been considered. The plan favored by the Copper River & Northwestern Railway contemplated the construction, based on Palm Point, of a high-tide rubblestone jetty built from a pile trestle, advanced out into the open sea by use of a revolving pile driver at the head of the trestle, the enrockment being kept as close to the head of the work as possible, the construction being entirely similar to work of this nature done at various Pacific coast harbors of the United States, viz, Grays Harbor, Columbia River, Coos Bay, and Humboldt Bay.

The proposed jetty has a shore arm extending 4,000 feet into the sea in a general southeasterly direction, and from that point 2,000 feet farther in a direction bearing about 30° farther northward. Most of the construction is in depths exceeding 30 feet, and a considerable part of it in greater depths, up to 50 feet or more.

Without a survey it is difficult to accurately estimate its probable cost, particularly as this will, to a great extent, be dependent upon the location of the quarry from which the rock is to be obtained, and it is not known whether a suitable quarry can be opened at a point less distant than inside Prince William Sound. It is believed, however, by the Commission that the breakwater must of necessity have a strong section, and that its first cost, even should rock be proven to be accessible and require no considerable work for protection of its loading wharf, would reach $1,800,000. This figure is rather liable to be found in error by being too low than too high, should a survey and estimate of the probable cost be made. There would, in addition, be necessary the cost of the wharf extensions from the shore arm parallel to the outer arm of the breakwater, for the shipping berths, and a further addition if the inner face of the outer arm were to be so constructed as to be used as a quay wall.

An alternative plan is that suggested by the Alaska-Pacific Railway & Terminal Co. This company proposed to create a harbor by connecting the inner of the Martin Islands with the shore by a double-track trestle; to connect the two islands by a breakwater; and to base a breakwater on the outer island, this latter structure extending 2,150 feet in a northwesterly direction. The breakwater between the islands would be about 1,600 feet long and in water not exceeding depths of about 30 feet. The outer arm, however, would be in depths exceeding this throughout nearly its whole length, and would require a strong section. This construction could doubtless be built at a lower first cost than the one planned by the Copper River & Northwestern Railway Co., but would be a less satisfactory harbor.

Both of these artificial harbors would leave a considerable section unprotected against winds, and both would be subject to rapid filling

should there be any considerable movement of sand along the coast. There is not at present sufficient data at hand to justify a statement as to whether this would be a seiorus menace, but no construction here would be justified without assurance that this movement is not considerable.

Any railroad planned to reach the Bering River coal fields from Katalla would follow the same line from Katalla to the coal fields that is described elsewhere in this report as a portion of the Katalla branch of the Copper River & Northwestern Railway. (See p. 68.) It would follow the valley of Katalla River and a low divide would have to be surmounted before reaching Bering Lake. Construction would not be difficult. After completion the haul of coal from the mines to the harbor of Katalla would be easy, as grades and curves would be light.

CONTROLLER BAY.

Controller Bay, which is elsewhere described in this report (see p. 97), is a shallow body of water largely occupied by mud flats. Within the bay there is a deep channel reasonably permanent in position, extending from near the southeasterly extremity of the bay to the open sea, which it reaches between Kanak and Wingham Islands. This channel, called Okalee Channel, is about 3,000 feet wide from Kanak Island outward to the sea. From Kanak Island inward its width is not over 2,000 feet, and a short distance inside this island it takes a widely sweeping bend to the eastward and extends with good depths and gradually narrowing widths for about 3 miles. This inner portion of the channel is about 3 miles from the mainland, being separated therefrom by a wide flat, submerged at high tide and composed of soft mud brought into the bay by the many tributaries draining the glaciers to the north and west.

Controller Bay was first investigated as a possible tidewater outlet for Bering River coal some 10 years ago. Since that time, when little was known of it, it has been charted by the Coast and Geodetic Survey.

Plans have been made by different corporations for tidewater terminals at this point. Some of these planned the construction of a long approach across the 3 miles of tidal flats and shoal water to the north side of the estuarial channel, with a coal-loading plant at its terminus. From the shore the railways would traverse about 17 miles of gravel flats to reach the margin of the coal fields and about 8 more miles to reach the mines of Trout Creek. This route would be practically level until the mine approaches were reached. The Bering River is the only considerable stream to be crossed, and it offers no difficulties. Construction of the railroad would be easy and grades and curves light.

Other plans for reaching Controller Bay contemplated a construction on Kanak Island, the coal wharf extending from the eastern end of this island out to the arm of the main Okalee Channel, but not to the main channel. The mainland would be reached in one of two ways. The first involves construction across the mud flats to a point east of the mouth of Bering River, whence the railroad to the coal fields would be along a route differing in no particular from those reaching the field from the north side of Okalee Channel, previously described. The second would require a causeway to be built across the shallow

Strawberry Channel, and from the mainland the coals fields would be reached via Katalla, from which point the route would differ in no respect from the route previously described from Katalla.

The principal objections to Controller Bay as a terminal are gone into fully in the description of that bay elsewhere in this report (see p. 97).

It is a matter of difficulty to form an estimate of the cost of a structure in Controller Bay suitable for handling coal. Any structure built out from the shore to the northern bank of the estuarial channel would require design to withstand the ice action, and the commission is of opinion that for a considerable distance inland from the north bank of the channel nothing less substantial than a structure built on concrete piers would be able to withstand this action. The distance outward from the high-water mark that the ordinary pile-trestle approach could be extended with safety can not be now predicted from the data at hand. No information is available as to the depth of the very soft alluvial material over which this structure would have to be built. It is believed that a terminal coal wharf, with bunker capacity of 10,000 tons and shore connection capable of handling 1,500 tons daily, would probably cost $2,500,000, and that a similar plant based on Kanak Island, with a crossing over the same mud flats to the mouth of Bering River, would cost about the same, while one with a crossing over Strawberry Channel would cost somewhat less.

The structures proposed by the various companies that had planned to develop the coal fields by terminals at Controller Bay were designed to be of a much less permanent character than herein outlined, being merely pile approaches with a wharf based on piles. It is the opinion of the commission that any such structure would be greatly damaged nearly every winter, and the development of a market for coal to be shipped therefrom would be extremely doubtful, subject as it would be to the frequent and long continued interruptions.

Cost of construction.—Estimate of cost together with governing characteristics of the roads are as follows:

Katalla Bay.

Length of entire line Katalla-Bering River, 31 miles.	
Cost of construction of line	$1,702,000
Cost of terminal facilities	2,500,000
Total cost	4,202,000
Average cost of line exclusive of terminal	55,000
Maximum grade (northbound) per cent	1.3
Maximum grade (southbound) do	0.58
Maximum curvature degrees	16

Controller Bay.

Length of entire line Controller Bay-Bering River, 25 miles.	
Cost of construction of line	$1,430,000
Cost of terminal facilities	2,500,000
Total cost	3,930,000
Average cost of line exclusive of terminal	57,000
Maximum grade (northbound) per cent	1.3
Maximum grade (southbound) do	0.58
Maximum curvature degrees	16

Resources.—The only known resources in the Bering River coal field and adjacent region besides coal are petroleum, some timber, a little agricultural land, together with some undeveloped water power. (See Pl. II, p. 34.)

The Bering River field, which is one of the two Alaska fields containing the largest amount of high-grade coal, lies about 25 miles northeast of Controller Bay and is drained by Bering River, from which it received its name. It is sometimes called the Katalla and sometimes the Controller Bay field. The surveyed parts of the Bering River field embrace about 22 square miles underlain by anthracite and about 28 square miles underlain by semibituminous and semianthracite coal.

The coal beds in this field which may be workable are from 3 to 25 feet thick, but through local swellings a much higher maximum thickness is attained. They are included in a great series of sandstones and shale, which are intensely folded and much faulted. In quality the coals vary from an anthracite, with an average of 81 per cent of fixed carbon, to a semibituminous, with 72 per cent of fixed carbon. The ash varies from about 2 to 10 or 12 per cent, the average from a number of analyses being from about 7 to 9 per cent. The bituminous part of the field includes much coking coal. The chemical composition of the bituminous coals of this region is similar to that of the best coals of the Appalachian fields, while the composition of the anthracite is but little inferior to that of the Pennsylvania anthracite.

The physical character of many of the coal beds is much less favorable, for they have been crushed to such an extent that they will furnish a large percentage of slack, which does not detract from their value for coking, and to a less extent for steaming purposes. The coal beds have been much deformed, thus greatly increasing the cost of mining, and in case of some of the beds prohibiting altogether the economic recovery of the coal. This is notably true along the western margin of the field, where there has been much faulting, and of the northeastern and anthracite part of the field, where close folding and faulting have in many instances so crushed the beds as to probably make them worthless for mining. It seems possible that a large part of the anthracite is so crushed as to be available only for briquetting, and possibly all of it is in that condition, and the same is true of the semianthracite. The most promising part of the field from the standpoint of physical constitution lies between this faulted zone on the western margin and the closely folded and anthracitic part of the field. In any event, most of the beds will probably be found to carry a large percentage of slack.

The development of the Bering River coal field has been chiefly limited to pits and short tunnels. With but few exceptions no coal bed has been followed a sufficient distance underground to warrant a definite opinion as to its commercial importance. Coal beds have, however, been uncovered where not naturally exposed in every part of the region, and while their correlation from place to place has not been possible except in very limited areas, yet the data are sufficient to show that there are many different beds. As no amount of surface prospecting will establish the continuity of the beds underground, it is evident that a large amount of underground work will be necessary in different parts of the region before the possi-

bility of economic recovery of coal from any given part of the field or from any particular bed can be determined.

As regards conditions of mining, it may be said that the relief of the region is very strong. The condition is favorable for development by tunnel, where the dip of the beds permit, and a large quantity of coal lies above water level. The deformed and faulted conditions have caused great variability in the thickness of beds and will also increase the cost of mining by the dead work required, due to rolls and slips. Underground water will doubtless be encountered, and there is evidence that some of the beds are quite gaseous. The character of roof and floor will vary from place to place and in different beds, so that no general statement of its effect on mining is possible. There is no reason to suppose that this last condition will be any less favorable than in many other coal fields.

About 6,000 or 8,000 tons of coal were mined near the faulted southwestern margin of the field in 1906 and 1907. This coal was taken from claims lying adjacent to Bering Lake, was brought to the coast in barges, and used in the construction work near Katalla. No official test of this coal was made, nor are there any records of its value under the boiler. It sold readily, however, in competition with the imported British Columbia coal.

The coal-bearing rocks of the Bering River field trend to the northeast into the unsurveyed high ranges, where it is probable that there may be other extensive areas. There is also some fragmentary evidence that coal occurs along the seaward face of the mountains east of the Bering River field. Prospectors report the discovery of coal between Controller Bay and Yakataga. There is also said to be coal on the southwest slope of Mount St. Elias, about 100 miles east of Controller Bay. All these facts suggest at least that there may be other coal fields in this region besides that of Bering River. Therefore, the areas given above only have value in giving a minimum, for it may prove that the surveyed field is but a fraction of the total. At the same time it should be noted that on account of the expense of development any coal occurring in the high ranges is not likely to be made available for a long time to come.

The Katalla oil field is marked by a number of seepages which stretch eastward from Katalla to Bering Glacier along a line which is parallel to the coast. Some seepages have also been found west of Katalla along the eastern margin of the Copper River flats. The line marked by these seepages is some 25 miles in length. About 18 wells have been drilled in this field, of which about four or five showed some oil, and some production has been made from two, which are located about 4 miles east of Katalla. Here a small refinery has been built, and in 1911 and 1912 the gasoline produced found a ready market in some of the coastal towns of the adjacent region.

The rocks of the Katalla field are shale, sandstone, and conglomerate, and are intricately folded and faulted. These conditions increase the cost of drilling and the location of oil pools. The seepages are abundant and some are strong, and the area over which they are distributed sufficiently large to encourage the belief that an oil pool may be discovered. It should be noted that some seepages have also been found near Yakataga, 75 miles east of Katalla.

The Katalla petroleum is a refining oil with a paraffin base and similar to that of Pennsylvania. It differs, therefore, from the fuel oil of California, and should find a ready market on the west coast.

The forests of the Bering River field will furnish the timber necessary for mining and other local use for a long time to come. A good stand of spruce and hemlock occurs along the lower slopes of the mountains up to an altitude of 800 or 1,000 feet, and scattered trees of smaller size occur up to altitudes of 1,700 feet. The larger trees of the lower slopes measure up to 2 and 3 feet in diameter. The flats bordering the coast and the Bering Glacier are, as a rule, without timber, though a scant growth of cottonwood is found along some of the streams traversing these plains.

The agricultural possibilities of this region are small. Within the coal fields proper there are some bottom lands on which native grasses grow well and which are capable of tillage. These areas lie, however, so close to the glacier that the growing season would be short and probably only the hardier vegetables and grains could be matured. There are some small areas in the flats near Strawbery Cove which could be utilized for farming, but as a whole, the arable land in this region is of small extent and at best will probably only be utilized to furnish vegetables to the population which might be engaged in opening the coal and oil fields. The excessive rain and cloudy weather are, however, unfavorable to agriculture.

Cordova-Fairbanks Route.

DESCRIPTION OF LINE.

(See Pls. 5 to 10, inclusive, and Pl. 17, Pt. II.)

The railroad from Cordova to Fairbanks would run almost due north from Prince William Sound to the Tanana Valley. It would penetrate the coastal range on a water grade through the Copper River Valley, and would therefore have to surmount only the one major summit of the Alaska Range between its termini. The Copper River & Northwestern Railway Co. owns and operates a railroad from Cordova to the Kennicott-Bonanza copper mine, and the part of this road between Cordova and the town of Chitina, 132 miles, directly in the line of the proposed Fairbanks route, is assumed to be available as an operative part of the through line from Cordova, were such a road constructed. This description will therefore be treated under two heads, namely, the existing railroad from Cordova to Chitina, 132 miles, and the proposed new construction from Chitina to the town of Fairbanks and the Yukon River.

CORDOVA TO CHITINA.

The coast terminal of the Copper River & Northwestern Railway is at Cordova. The town is located on Orca Bay on the slate foothills of the rugged bluffs which bound the bay to the eastward and just north of the small embayment making in toward Eyak Lake. It is situated from 50 to 200 feet above low water and has 1,100 inhabitants. It has several good hotels, a daily newspaper, a salmon

cannery, a sawmill, and a number of prosperous stores. It is the distribution point for general merchandise and supplies bound into the interior, and is equipped with municipal improvements sufficient for a town of its size. There is very little room for expansion in the space occupied by the present town site, and its future growth must necessarily extend in the direction of the low foreshores and tidal mud flats to the southward.

Cordova harbor will be described in detail in another part of this report (p. 99), but in connection with the description of the proposed Cordova-Fairbanks railway route it should be here stated that there are several available sites for coaling depots, both commercial and military, as well as for commercial docking facilities of ample capacity for all reasonable demands.

Construction work on the railway began in 1906. In 1907 there had been completed 4½ miles; in 1908, 53 miles; and the entire road was completed in 1911. There are altogether 196 miles in operation between the port of Cordova and the Kennicott-Bonanza copper mine, which mine furnishes practically all of the tonnage now hauled. Three through trains a week are operated between Chitina and Cordova, in addition to a daily freight train from the Kennicott branch. Maintenance expenses are necessarily high, because of conditions which will be elsewhere described in more or less detail. Sections for maintenance purposes are 20 miles in length, and under normal conditions the labor force averages one-half man per mile during summer and from one-half to one-fourth man per mile during the winter. The depths of snow to be expected between Cordova and mile 101 is from 4 to 14 feet, necessitating the operation of a rotary plow ahead of all trains during the winter months over this section of the road.

The company's terminals include a substantial pile and timber wharf, 700 feet by 80 feet, located about a mile north of the present town center. Three service spurs run out on this wharf from the stub of the main track. The main track follows the bluff shore line to the southward on trestles and through light rock cuts, and crosses the head of Eyak Lake embayment to the south shore of Eyak Lake. The passenger depot is at mile 1½ from the wharf, and, beyond the depot building, sidings leaving the main track to the northward are developed into a yard system, with three drill tracks, stock and hospital spurs, wyes, etc.

The company owns enough ground to provide for an adequate make-up yard, with head and tail ladders and some 20 to 30 drills, whenever business warrants such a development. In the shop layout there are two office buildings, one hospital, two storehouses, one 11-stall roundhouse, one cinder pit barn, one galvanized-iron warehouse, and a general shop building, which includes machine shop, paint shop, car shops, power plant, etc. The shops are adequate for maintaining such equipment as is now on hand. Its outfit comprises pneumatic wheel press, breast drills, rolls, planers, shears, punches, and a 17,000-pound steam hammer, besides compressed-air and bench tools. Adjoining the shop is a roomy wharf, from which deliveries are made directly from barge to rail. The entire plant presents an orderly and businesslike appearance.

Leaving Cordova, the main line as constructed runs in an easterly direction for 26 miles before turning north with the Copper River.

During the first 5 miles it is supported on hill side, and construction involved a small amount of rock and gravel work. The greater part of this 5 miles is along the south edge of Eyak Lake. At about 5 miles out from Cordova the line enters the Sheridan Glacier flats, which it crosses in a distance of approximately 15 miles. This stretch contains a tangent of 11 miles, was exceedingly simple, and easy of construction. The Sheridan Glacier flats are almost level, and therefore do not invite overflows. As far as mile 19 the flats are ordinarily beyond the reach of tides. East of mile 20 the line enters the tidal flats. The bottom in general is glacial overwash gravel, and the track is laid on a gravel fill 3 to 5 feet above surface of the ground. There are about 40 bents of trestle to the mile on this stretch, but the commission was informed that it is the ultimate plan to fill a large proportion of these structures. On certain parts of the line the roadbed has never been brought up to the located grade. This makes the road ride a little roughly at present, but the quantity of such work remaining to be done is not large.

From mile 19 to 23 the line hugs the foothills of the mountains lying to the south of Sheridan Glacier before making its turn into the Copper River flats. This stretch is not expensive, and it is possible that the alignment could be somewhat improved

From mile 23 to 49 the railroad traverses the Copper River flats in a general northerly direction. This is the flood plain of the Copper River delta, which stretches in a broad gravel and silt floor ranging in width from 10 miles at its southern to 2 miles at its northern end and extending about as far north as Childs Glacier. The lower portion of the Copper River flats is subject to flooding from two causes, namely, the failure of glacial reservoirs and the heavy rains to which this district is subject. There is no definite information as to the depth attained by such overflows, beyond the report of railroad employees that in one instance at least the water has risen to within a few feet of the coping of the Miles Glacier bridge piers, indicating a volume of water which if confined to one channel might cause serious damage to the roadbed in the lower part of the flats. Light overflows have been known to cause trouble in these bottoms by freezing and the consequent piling of ice on the track embankment. This has only occurred between miles 34 and 39, and could in all probability be entirely avoided by track elevation. When the commission made its inspection of the Copper River Railroad it had just been reopened to traffic after a suspension of operation of over six weeks, owing to earth slides and washouts resulting from the excessive rains of this season. A number of trestle washouts were noted. At Flag Point Bridge (mile 27½) over 300 feet of approach had just been renewed; it is not known, however, whether this washout was due to glacial floods or rains. From mile 35 to 39 from one to three bents at the ends of 80 per cent of all the trestles have been recently renewed. This trouble was due to the washing out of the gravel approach fills.

The crossing of the Copper River flats involved the construction of a number of expensive bridges. At mile 27 is a crossing known as Flag Point Bridge, consisting of one 300-foot, one 250-foot, and four 175-foot spans; at mile 28 is a bridge consisting of one 300-foot and one 260-foot span. Hot Cake Bridge (mile 34) consists of three 175-foot spans, and Miles Glacier Bridge (mile 49) consists

of one 450-foot, two 400-foot, and one 300-foot span. All of these bridges were designed for the heaviest traffic, and were in first-class condition when inspected by the commission. The substructure of the Miles Glacier Bridge is concrete piers carried down to bowlder foundation with pneumatic caissons. The substructures of other bridges are of concrete on pile foundation. The concrete work is apparently in good condition, though the ice guards show the effect of abrasion.

The Copper River flats are subject to high winds. These winds sweep down from Abercrombie Canyon and the northward, and have been known to reach a velocity of 80 miles per hour. The effect of such winds is to increase the expense both of operation and maintenance.

At Miles Glacier Bridge the line as located lies between the Childs Glacier on the west and Miles Glacier on the east. Both constitute a menace to continuous operation. The northerly lobe of Childs Glacier is now not over 1,500 feet from the track at the north end of the bridge, and it is reported that this glacier has been known to advance as much as 1,600 feet in a single season (for references see p. 171). The railroad at this point, however, is not in line with the movement of the center of the glacier, and could only be affected by an unusual advance of the north lobe. It is entirely possible that this finger of ice may sometime advance at such a rate as to endanger the Miles Glacier Bridge, but it is believed that this is a rather remote menace, and should not be considered as imminent. If such a condition should ever occur it is at least possible that the line could be so shifted as to avoid the ice from either the Childs Glacier or from the southwest moraine of Miles Glacier, the face of which is less than 2 miles distant.

Miles Glacier is liable to internal breaks during the melting season, suddenly freeing enormous volumes of water impounded as lakes in or near its mass. When this flood is first freed it inundates the entire river bottom in its vicinity, and has been known to leave a high-water mark on piers of Miles Glacier Bridge 22 feet above normal water stage.

From miles 49 to 56, the line follows the west side hill through Abercromble Canyon to Baird Glacier.[1] Construction here involved heavy rockwork in the sides of the cliffs, heavy snowshed work and a tortuous alignment. The maximum curvature of the road is on this part of the line, there being one 22°, one 20°, and one 18° curve, with central angles of 34°, 61°, and 41°, respectively, in a single mile. There are also in this stretch six snowsheds, about 83 per cent of the total of 4,097 feet on the entire line. There are frequent and expensive earth and loose rock slides. The slides, however, should not be considered as a permanent maintenance expense inasmuch as the slopes will undoubtedly come to rest in time, and thus, to a great extent, eliminate the trouble.

Between miles 56 and 63 the line curves around the foot of Baird Glacier and crosses it on the toe of the dead moraine. The moraine is over ancient ice, and is said to have shown no movement within recent years, but the glacier proper, some distance to the westward of the line, is understood to have advanced in a northerly direction

[1] Baird Glacier has been recently named Allen Glacier.

as much as a fourth of a mile in the past year. Such a movement would parallel the track, and should, therefore, cause no damage. The menace from this glazier and the summer thawing of the buried ice must be taken into consideration in any estimate of maintenance cost on this part of the line.

From the end of Baird Glacier moraine to the north end of Tasnuna River Valley, miles 63 to 86, the line again traverses the river flats, continuing on the west side of Copper River. The alignment is good and the grade light. The construction is similar to river bottom work hereinbefore described. From miles 62 to 68 some trouble with floods has been encountered. This has been improved by lifting the track and providing adequate water openings. At mile 75 the track lies over some morainic material from Heney Glacier, the foot of which glacier is over 2 miles to the westward of the line.

Between miles 86 and 101 construction involved rock cliff work of expensive character and one 400-foot tunnel, with considerable curvature. This district is also subject to strong winds and heavy snowslides, besides which it is probably the worst part of the line for loose rock and earth slides. It was partially due to the slides on this section that operations were suspended during September and October of the present year. The rock hillside is very steep, and the muskeg covering of the sloping benches above is loosened by hard rains, while the frost serves to start the rock in the cuts which have been fractured by over-shooting during construction. The slides cause very expensive maintenance work in the present operation of the road, but this trouble is sure to grow less in time, and the maintenance cost in 10 years should be no more than upon any ordinary mountain railroad section.

For the entire distance from the mouth of the Tiekel River to Chitina, miles 101 to 131, the road is supported on the west side hill, involving heavy rock work, and, during the first 10 years at least, high maintenance costs. The rock of the cuttings is of slaty character, and has been badly shattered by over-shooting during the construction period. The frequent draws are spanned by frame trestles, some of which are high and on sharp curves. In Woods Canyon the road clings to cliffs where the rock bed slopes toward the track at about 1½ to 1, thereby dumping its frost talus directly on the roadbed. At miles 103 to 112 and 114, there are short rock tunnels. The location fits the hill trace very closely.

To summarize, the Copper River & Northwestern Railway is a well-built, standard-gauge railroad, with 70-pound rail and substantial track structures designed for the heaviest class of traffic. In general, the curvature does not exceed 14°, and the maximum gradients do not exceed eight-tenths per cent and nine-tenths per cent against north and south bound traffic, respectively. The road is economically located and suitable for the traffic contemplated. With the elimination of one or two sharp curves, a net train load of 700 tons could be carried either way with suitable equipment.

The country traversed may be divided into three distinct districts as regards operating conditions. The Copper River delta section will always be expensive to maintain on account of its floods and the shifting channels of the river. The district in the neighborhood of Childs, Miles, and Baird Glaciers must be considered as constituting a more or less remote menace to the continued operation of the road.

While it is believed that no future movement of the glaciers in this district will ever render it entirely impossible to operate, such a contingency is at least within the possibility and should be taken into consideration. Should it occur, it would involve expensive changes of alignment. The district from mile 60 to Chitina, with its earth and rock slides, although involving the heaviest maintenance costs at present, should ultimately become settled and result in a comparatively low and uniform upkeep expense.

Chitina to Fairbanks and the Yukon River.—The proposed line from Chitina northward follows the left or western bank of the Copper River. The location is held at a considerable distance above the water in order to avoid the treacherous clay and gravel banks in the lower river bottom, and construction involves considerable heavy rock work up to the mouth of the Tonsina River at mile 11 from Chitina. Beyond the mouth of the Tonsina River the line leaves the Copper River and follows the left or south bank of the Tonsina on the same character of steep side hills as far as mile 20 from Chitina, where it crosses to the right bank on two 150-foot steel bridge spans with concrete abutments and pier on rock foundation. From mile 20 the line trends in a northwesterly direction, following the upper benches of the Tonsina and Copper River Basins to the village of Copper Center at mile 48. From mile 30 to 48 the line traverses the gravel second bench of the river at an elevation of some 500 feet above the bottoms. This district is dotted by small lakes, and presents a rather desolate appearance, with its sparse forest of scrub spruce, although at Willow Creek, mile 35, there is one of the most prosperous homesteads on the entire line. There are one or two homesteads betwen Willow Creek and Copper Center, while at the latter place there is quite a settlement and one rather successful attempt at farming.

The Klutina River is crossed at mile 47 on one 200-foot deck span with concrete abutments on piles. The line lies on the upper valley bench in order to avoid the clay-gravel slides of the Copper River. It crosses the Klutina at an elevation of 1,025 feet and requires a 3-mile development to drop down to this crossing on a 1.5 per cent grade. From this point the line proceeds in a northwesterly direction to the crossing of the Tazlina River at mile 59. The Tazlina at this point makes a wide loop, and it is proposed to eliminate the loop by cutting a new channel and thereby effect the crossing by one bridge, composed of two 300-foot through steel trusses, with concrete abutments and pier-on-pile foundations. From mile 60 to 107 the line is practically straight, running approximately 30° west through a fairly smooth country sparcely covered by scrub spruce and little other vegetation. The soil is frozen gravel and earth under the usual muskeg covering. Where the small streams are crossed patches of good timber are encountered suitable for ties and other railroad structures. The west fork of the Gulkana River is crossed at mile 107 on one 150-foot through steel truss and concrete and pile abutments 25 feet high. The climb to the summit begins at mile 108. The maximum grade of this climb is 1.13 per cent, and this grade is not exceeded at any part of the line against northbound traffic. From the summit at mile 130 to mile 140 there is little difference in elevation. At mile 135 the line follows a chain of lakes known as the Tangle Lakes, which form the source of the Delta River, and,

following this river from the summit, the line runs through the Delta Canyon and on the steep hillsides, involving considerable rockwork.

The location reaches the junction of Delta River and Phelan Creek at mile 168. From the mouth of Phelan Creek the line hugs the left or west side of the river, supported on the foothills of the mountains to mile 210, and from this point proceeds over the gravel bench of the Tanana River to the mouth of the Little Delta at mile 260. There is a good opportunity for crossing the Tanana River at this point, inasmuch as the stream is confined in a comparatively narrow channel with a rock bluff approach on the one side and high sand approach on the other. The crossing can be effected by two 200-foot steel spans with about 1,200 feet of timber trestle approach. From the Tanana crossing at mile 260 the line follows the north bank of the Tanana River and is supported on the sidehill as far as mile 335. From here on to Fairbanks the line runs upon the first valley bench through occasional patches of good timber, and involves little difficulties in the way of railroad construction beyond the crossing of an occasional slough of the Tanana River.

For operation purposes the entire main line will be divided into four engine stages—one from Cordova to Chitina, mile 132; the second from Chitina to mile 59 of the new line; the third from mile 59 over the summit to mile 234; and the fourth from mile 234 to Fairbanks. Coaling stations, together with an engine house, ash pit, and turning loop, etc., will be provided at each engine stage. It is proposed to put good substantial station buildings, with passing sidings, at intervals of about 7 miles, such buildings to be used for housing for section gangs until colonization or normal development of business warrants their use as stations. Water stations will be installed at intervals of about 21 miles. At Fairbanks adequate shop facilities will be provided, together with a freight yard, about as now provided by the Copper River & Northwestern Railway at its Cordova terminal.

There is no data at hand from which a close estimate can be made of the cost of extending this line into the Yukon, nevertheless, it is the opinion of the commission that Fairbanks should not be the final terminus of the main line. It should ultimately, if not immediately, be extended through to some point on the Yukon River. The data at hand indicates that the best route for such an extension is by way of the valley of Goldstream, across the Tolovana flats, and thence over two low divides to the Rapids, which are located about 40 miles below the town of Rampart. This route leaves the Tanana at Cripple Creek and crosses a divide less than 100 feet in height to the Goldstream. It then descends the broad, alluvial filled valley of Goldstream to the Tolovana flats. This part of the line is easy of construction and would probably require little or no rock work. The Tolovana flats are crossed in a northwesterly direction in a distance of about 20 miles. These flats are swampy in places, heavily timbered, and considerable trestle work will probably be necessary. At least one bridge will be needed to cross the Tolovana River. The width of the river is unknown, but probably does not exceed 100 feet. None of the streams in the flats are of glacial origin, and there would probably be very little difficulty from floods. Leaving the Tolovana flats, the line climbs over a low pass to an altitude

of about 300 feet in a distance of 3 or 4 miles. It then descends about 100 feet, and for the next 10 miles follows a low bench to the north fork of Baker Creek. It follows the valley of Baker Creek to a pass and climbs to an altitude of about 500 feet. This climb would probably be made in a distance of 3 or 4 miles. That part of the line traversing the bench would require almost no rock work, but a considerable number of trestle crossings. The ascent to the pass at the head of the north fork may require some rock work, but the expense of construction would not be heavy. Leaving this pass, the line follows down Stevens Creek, descending about 400 feet in a distance of 4 or 5 miles. It then climbs to an altitude of not over 200 feet and, descending the same distance, reaches the Yukon River. The construction work on Stevens Creek would be inexpensive, though the last 3 miles would involve heavy rock work.

Although not forming a part of the Cordova-Fairbanks main line, it is, nevertheless, necessary for the proper operation of this road to provide a branch line to tap the Nenana coal fields. This can be done by a line not over 50 miles in length, extending in a southwesterly direction from the Little Delta crossing of the Tanana River. This line could be very cheaply constructed, inasmuch as it lies throughout its length on the level plateau of the Tanana Valley; but before actually recommending such a branch line exploratory surveys should be made with a view to determining whether or not the Nenana coal measures underlie the valley of the Delta, or the valley of the Tanana, at Fairbanks. Geologists familiar with the district are of the opinion that this coal might be tapped on the main line as well as in the district where it now shows an outcrop. (See p. 73.)

The Kennicott Branch of the Copper River & Northwestern Railway.—While not a part of the proposed main line from Cordova to Fairbanks, as a freight tributary this branch will form a most important factor in the success of the through line, and therefore merits a brief description. The Kennicott Branch of the Copper River & Northwestern Railway produces virtually the only tonnage now hauled by that road. This branch extends from Chitina about 64 miles eastwardly to Kennicott, where is located the famous Bonanza mine.

From Chitina the road passes through a short tunnel coming out upon the west side hill of the Copper River, and crosses that river just above the mouth of the Chitina. This crossing, as built, is feasible for the traffic accommodated, but is of a temporary character and not as originally designed. It is about 70 feet below the location level and necessitates a climb on a 3 per cent grade to the north bank of the Chitina. With the exception of this 3 per cent grade there should be no extraordinary expenses in connection with the operation of the line. The road follows the high bench above the valley of the Chitina to the Kuskulana River, which is crossed on a heavy steel bridge in good condition. From the Kuskulana eastward it runs generally on the slopes of the high benches to mile 59 from Chitina, where it turns to the northeastward, supported on the steep hillside just west of and above Kennicott Glacier. It crosses all streams tributary to the Chitina on good timber struc-

tures. There are along this line a number of patches of first-class spruce timber, which will probably form the source of supply for native ties for the entire line for some years to come.

Skolai Pass— White River branch.—There is a possible extension of the Kennicott branch of the Copper River & Northwestern Railway which may, in the future, make it a most valuable feeder to the port of Cordova. It is at least possible to extend this line into the White River country, by way of Skolai Pass, and thus tap most valuable mineral districts, as well as afford a connection with southeastern Alaska.

This line was surveyed by an engineer employed by the Copper River & Northwestern Railway Co., and, while he did not in his report recommend immediate construction, he states that it is perfectly feasible to build such a line at a ruling grade not exceeding 3 per cent. The extension from Kennicott would follow the rim of the Nazina Canyon on frozen ground, covered by scrub spruce, for 10 miles, then, descending into the Nizina bottom at mile 13 from Kennicott, crosses that river several times in order to avoid expensive work. At mile 19 the Chitistone River is crossed on pile foundation. From thence to mile 24 the line follows the south side of the Nizina supported on the base of the mountain. Along this stretch the country is smooth, involving light construction and very little maintenance troubles from snow or slides. The Nizina is again crossed at mile 24 in order to avoid expensive rock cuttings, and from thence to mile 29 the line follows generally the west bank of the river, on smooth gravel flats rising with the river. It is necessary to cross it again to avoid glacial troubles, and then begin a 2 per cent climb supported on the mountain along the eastern edge and above the Nizina Glacier. There is no danger of snow slides but very little timber. From mile 37 to 42 the line follows the south side of Skolai Lake and Skolai Creek.

Near the foot of a glacier the line crosses to the north bank on steel trestles, and is at this point 100 feet above the bottom of the creek. At mile 42 to 43 there is a deep canyon with heavy rockwork and a short tunnel on a 2 per cent grade. From mile 42 to 46, the line is supported on the bench at the foot of the mountain slope, involving light construction work. There is a 3 per cent grade through a deep gorge between miles 46 and 48, involving very difficult construction; the rock is loose, with unstable slopes. Rockwork here may run as high as 75,000 cubic yards per mile. From mile 48 to 52 the line runs over smooth flat slopes of the mountain, involving very light construction on a 1 per cent grade. There is considerable trestle work in this stretch. The streams are at times torrential. From mile 52 to 55, the grade ascends at 2½ per cent, and the line follows the north side of Russell Glacier on steep bluffs with much rockwork and considerable loose rock slides. Mile 55 is the summit forming the divide between Skolai and White Rivers; the elevation of this summit is approximately 4,860 feet. From mile 55 to 57, the line descends on a 2½ per cent grade along the face of cliffs, with heavy rockwork and difficult to maintain after construction on account of the rock slides. The line here is about 100 feet above glacier.

From mile 57 to 61 the line circles the shores of Glacier Lake on very steep slopes involving sharp curvature and expensive work. This portion of the line would have to be held well above the high-

water line of the lake, which is a typical glacial reservoir of the kind that has caused so many of the washouts on the main line of the Copper River & Northwestern Railway. At the time of the reconnoissance of this extension, the high-water mark of the lake was 175 feet above the low-water mark, and it was not entirely empty and was filled with grounded icebergs. It may be possible to obviate the work between miles 58 and 61 by a tunnel one or two miles in length. From mile 61 to 64, the line descends on 2½ per cent grade between almost vertical rock walls. Construction work would be extremely expensive here and would be nearly equal in cost to tunnel work Beyond this point the character of the country changes entirely, and the valley of White River opens up to easy and economical construction. No reconnoissance was made for this extension beyoud mile 64. Were the line ever constructed this far, it would naturally extend through the valley of the White River and possibly as far as Haines or Pyramid Harbor, and thus form a very valuable link in the development of the country. The cost of this line has been roughly estimated at $8,000,000.

Branch lines to the Bering River coal field.—The Bering River coal field is located in the mountainous district about 12 miles north of Controller Bay, 50 miles east of Cordova, and directly south of Martin River Glacier. The best of the coal probably underlies the hills on the east and west of Kushtaka Lake. To reach this district from the Copper River Railroad there are two possible routes, both leaving the main line at mile 38 from Cordova. One, known as the Katalla route, follows the Copper River delta to the coast and thence to the coal fields, a distance of 55 miles, on a water grade. The other, known as the Lake Charlotte route, runs 38 miles direct from the junction point to the coal district, and involves considerable mountain work on steep grades.

Bering River coal field branch—Katalla route.—Leaving the main line at the junction, mile 38, on the west side of the Copper River delta, the branch line runs approximately south 30° east to Martins Point at mile 27. Rounding Martins Point it extends generally in a northeasterly direction to the coal fields. From the junction to mile 10 of the branch the line crosses the gravel floor of the great Copper River delta. The numerous channels cut in this delta will have to be spanned by steel or timber structures. The two branches of the Martin River are crossed at mile 5 and mile 9. This part of the road will involve approximately the same maintenance difficulties as that part of the main line which traverses the Copper River delta farther to the north. From mile 10 to mile 14 the line takes a side hill support on the mountains, forming the western boundary of the deltal plain. From mile 14 to mile 20 the line again crosses an arm of the mud flats and marshes, forming the lower part of the Martin River delta. From mile 20 the line follows the base of the mountains and rounds the coastal headland, entering the valley of the Katalla River. It leaves the side hill at about mile 28, and from this point to Bering Lake is located in a comparatively level river valley on a thick, peaty soil. Bering Lake is reached after climbing a low divide, and is crossed on a pile structure. From this lake to mile 51 the road follows the eastern bank of the Bering River on easy grades. The entire road to this point involves moderate construction expense, with the exception of the stretch crossing the delta of

the Copper River. From mile 52, however, to the end of the projected line at the Trout Creek district the line is located on the sides of the mountains, and construction will involve considerable expense.

In the valley of the Katalla River there is some good spruce and hemlock timber from which ties and some bridge stock may be obtained. There is apparently no good rock on the line for heavy masonry work, but gravel for ballast may be secured along the right of way.

With the exception of the stretches in the delta country and some little side hill work on other portions of the line, this branch should be constructed without great expense. Unfortunately, however, the commission has not in its possession detailed estimates of quantities from which a reliable approximation of construction costs can be determined. If constructed, the road could be cheaply operated on account of its low grades. In no case is there a grade exceeding 0.87 per cent, and the longest stretch of this grade is only 2 miles.

Bering River coal field branch—Lake Charlotte route.—The Lake Charlotte route leaves the main line at mile 38 and extends for 38 miles in an easterly direction. From the junction to mile 7 the line is on the upper slopes of the Copper River delta, involving more or less expensive crossings of the numerous channels which cut the gravel floor. From mile 7 the line begins a climb on the southern side of the mountains between Miles and Martin River Glaciers, involving heavy cuttings. At mile 15 the Martin River, a wide glacial stream with numerous wide channels, is crossed at an elevation of some 260 feet above the sea. From Martin crossing the line again climbs on the north slopes of the mountains lying just south of Martin River Glacier, reaching a summit with an approximate elevation of 380 feet at mile 18. From here the line turns southwardly, following the west shore of Lake Charlotte and the valley of Shepherds Creek, and descends at a sharp grade to the southern extremity of Kushtaka Ridge at mile 28. Almost the entire descent is accomplished between miles 18 and 25, involving a maximum grade of 1.7 per cent against the expected coal traffic. From mile 28 the line swings to the northeast, and follows the south and east shores of Kushtaka Lake to what is known as the Trout Creek district, assumed as the terminus.

The only unusually expensive construction involved in this branch is between miles 7 and 25, where it crosses over the divide, involving considerable rockwork.

Like the Katalla branch, there is no detailed estimate of quantities to be moved, and the commission's estimate can therefore be considered as approximate only. Before either branch is built it will be necessary to thoroughly explore the country with a view to securing the best location, and it is entirely possible that a line may be secured offering advantages over either of the ones described.

In comparing the two lines. it will be noted that the Lake Charlotte route is shorter than the Katalla route by some 17 miles. This advantage, however, is offset by the almost level grades of the Katalla line as compared with the 1.7 per cent grade against movement of traffic on the Lake Charlotte line. It should be borne in mind, however, that in time of war the coal supply from the Bering fields is liable to be intercepted by an active enemy if the Katalla branch is adopted. The line is susceptible to attack from the open sea, or

from landing parties put ashore at Controller Bay, Katalla, or the mouth of the Copper River. The Lake Charlotte route, on the other hand, lies behind the hills which skirt the coast, and is some 12 to 15 miles in the interior. It is too far distant inland for naval attack, and could be easily defended from landing parties.

Matanuska Coal Field Branch via Chitina.—This branch would leave the main line of the Cordova-Fairbanks route at mile 55 from Chitina. The line as contemplated extends in a general westerly direction for a distance of 108 miles to the Chickaloon district of the Matanuska coal fields. From the junction point to mile 27 of the branch the line ascends on a 1.64 per cent grade, and crosses a country comparable to that described on the main line between miles 20 and 55. It follows the bench bordering the south bank of the Tazlina River to mile 24, where it crosses this river and skirts the north shore of the lake of the same name to mile 30. It here leaves the shores of the lake, and again travels on the bench north of the Tazlina River to mile 55. From mile 27 to 33 the grade is zero, and from mile 33 to 57 the line ascends at a 0.58 per cent grade. The summit, known as Tahneta Pass, is reached at mile 57. It has an elevation of about 2,900 feet, and extends from mile 57 to mile 66. Leaving the summit, the line descends into the valley of the Matanuska River, and follows its north bank to the Chickaloon field at mile 108. The drop from the pass necessitates a 2.2 per cent ruling grade from mile 71 to mile 87, and 0.76 per cent grade from mile 87 to 108. The maximum of 2.2 per cent would be against the movement of coal from the Matanuska field to Cordova, and would therefore affect operating expenses adversely.

The commission has no estimate of quantities involved in the construction of this line, nor has it reliable information as to the character of the country traversed east of Tahneta Pass. From the reports of exploratory parties put into the field by the Copper River & Northwestern Railway, it would seem that the expense of construction will be quite high. About all that is definitely known of this line is that it is possible to construct it at adverse grades not exceeding 2.5 per cent.

Nabesna and Mentasta Pass branches.—The proposed Chitina-Fairbanks Railroad could be connected by branch lines with the upper Tanana Valley and with the upper Nabesna Basin. The latter certainly appears justified in view of the known deposits of copper and gold. This proposed branch would leave the main line near mile 85 and would there trend northeast for a distance of some 35 miles, crossing bench lands and involving comparatively simple construction. The Gulkana River would have to be bridged, but so far as known this would not be expensive. Near mile 35 the line would reach the valley floor of the upper Copper River and follow the same to about mile 60, near the mouth of the Slana River. This part of the line would also be of easy construction, so far as known. The junction of the proposed lines to the Nabesna and that through the Mentasta Pass to the Tanana would be near the mouth of Slana River, about 62 miles from the main line. The Nabesna branch would here trend southeasterly, probably following the Natat Creek and ascending to a pass some 3,400 feet in altitude, which separates the Nabesna from the Copper River. This pass would be reached at mile 90 from the main line. It is a broad depression and offers no difficulties of construction. It is possible that the ascent on the Copper River side

would require 3 per cent grade, but this can not be determined from the evidence at hand. The descent to the Nabesna would be along the valley of Jack Creek, and here it is believed that the grade would not exceed 2 per cent, but this, too, can only be determined after locations and surveys have been made. The Nabesna would be reached at the mouth of Jack Creek, about mile 110 from the main line of Fairbanks and Chitina. The evidence at hand indicates that this 110 miles of line could probably be built for between $3,500,000 and $4,000,000.

The Mentasta line leaves the Nabesna branch at the mouth of the Slana and ascends that stream to the pass, which has an altitude of about 2,800 feet. The ascent is a gradual one, and the grade will probably be less than 2 per cent. The pass is wide and affords no difficulties of construction. From the pass the line would descend to the Tanana at a grade which will probably be less than 2 per cent. The total length of this branch from the mouth of Slana River to the Tanana River is about 70 miles, and it probably could be built at a cost between $2,000,000 and $2,500,000.

Cost of construction.—The commission has, after careful consideration of all available data, supplemented by personal knowledge of the general character of the country traversed, prepared an estimate of the cost of the necessary new construction from Chitina to Fairbanks. This estimate, together with governing characteristics of the road, are as follows:

Length of entire line, Cordova-Fairbanks, 445 miles; length of new construction, Chitina-Fairbanks, 313 miles; cost of new construction, Chitina-Fairbanks, $13,971,000; average cost of new construction per mile, $44,600; maximum grade (northbound), 1.13 per cent; maximum grade (southbound), 1.5 per cent.

The estimated cost and mileage of the various coal branches are as follows:

	Miles of new construction.	Cost.
Bering coal field, Katalla route	55	$2,700,000
Bering coal field, Lake Charlotte route	38	2,054,000
Matanuska coal field	163	8,434,000

RESOURCES.

Mineral.—The mineral resources tributary to the proposed railway from Cordova to Fairbanks include on the main line some undeveloped auriferous lodes in the region lying between Cordova and Chitina; some copper deposits and gold placers in Hanagita Valley and the Bremner River region; the gold placers of the Chistochina district; some undeveloped gold-lode deposits in the Alaska Range, and the gold placer and lode deposits of the lower Tanana Valley. (See Pl. II, p. 34.)

More important are the resources which will be developed by branch lines. The Bering River coal field could be made tributary to this proposed line by a branch. The resources which thus might be made accessible include the high-grade coals of the Bering River field, and also the petroleum of the Katalla oil field. These are described in the account of the routes from Katalla and Controller Bay. (See p. 57.)

Of these branches, most important is that of the Chitina Valley, already constructed, which renders accessible an important copper-bearing area. If this line were extended over the Skolai Pass it would tap another copper-bearing area of much importance. (See p. 48.) It has been proposed to extend a branch line westward to the Matanuska coal field. The mineral deposits which would be tributary to this line are described in the account of the Seward-Fairbanks route. (See pp. 87, 88.) Another proposed branch would give access to the gold and lode deposits of the upper Nabesna basin. The Nenana coal field and Bonnifield placer district could also be made tributary to this route by a branch line. The mineral resources of this region are described in the account of the Seward-Fairbanks route. (See pp. 88, 89.)

Some discoveries of gold-bearing quartz have been made in the McKinley Lake region which lies about 8 miles north of the Copper River Railway at the station Alaganik near mile 21. Considerable development work has been done in this field, but as yet no gold has been produced. A number of gold-bearing quartz claims have also been located along the Copper River near mile 109. Some development work has been done on these, but no productive mine has yet been established. The area bounded on the north by the Chitina and on the west by the Copper River, and on the south by the Bremner River, has also been found to be mineralized. In the southern part of this belt some gold placers have been developed, notably in the basin of Bremner River. Several copper prospects have been opened up and in the vicinity of Taral in the northern part of this belt. Some of these give promise of containing workable ore bodies.

The most important mining developments in the interior Copper River basin are those of the Kotsina-Chitina copper belt. This belt stretches eastward from the Kotsina River basin to the headwater region of the Nizina, a tributary of the Chitina. Many discoveries of copper ore have been made in this belt, which has a length of over 100 miles and ranges from 5 to 10 miles in width. Up to the time of the completion of the Copper River Railroad in 1911, transportation into this field was both difficult and very expensive. For this reason the amount of mining accomplished has been comparatively small, though copper has been known to be in this field for upward of 15 years. The ores are chiefly sulphides with some native copper.

The one productive mine in this field is the Kennicott-Bonanza, located near the eastern end of the belt and about 200 miles from Cordova, and is the terminal of the Copper River & Northwestern Railway. The geologic conditions at this mine repeat themselves at many other places in the copper-bearing belt, and therefore the outlook for the discovery of other workable ore bodies is very favorable. Several such discoveries have been made, but in only a few cases has the development gone far enough to permit of an actual estimate of ore tonnage. None of these properties have yet been reached by spurs of the railroad, so that no ore has been shipped from them. The outlook for a large copper production from this field is favorable.

The Nizina placer district, which lies in the upper Chitina Basin, was discovered in 1902. The known area of gold-bearing gravel is not large, but the fact that water is available for cheap mining has permitted the development of parts of this district on a considerable scale. In 1912 four hydraulic plants were operated in the Nizina

district. Some discoveries of auriferous quartz have been made in this same region, but these prospects are as yet undeveloped.

Fifteen miles north of Chitina the proposed railway to Fairbanks will enter a region deeply buried in gravel silt and clay. This stretches northward for about 100 miles to the foothills of the Alaska Range. There seems to be no promise that this part of the basin will yield any mineral resources, though it is possible that lignitic coal may occur in places under a heavy gravel cover. This is purely an inference from incomplete geologic data, and even if found the coal might be too deep to mine profitably. From the foothills northward through Isabel Pass and down Delta River, the proposed railroad route traverses a region of some mineral promise, though no discoveries of importance have been made in this part of the field. Where the railroad enters the southern foothills of the Alaska Range it passes about 20 miles west of the Chistochina placer district. This district has been under development for the past 10 years and has produced gold to the value of about $1,600,000. It is a field where the cost of mining has been very high, because of the expense of hauling in supplies and equipment from the coast, some 300 miles distant. With the reduction of cost of operation this field would probably develop on a much larger scale than at present. A few auriferous lode discoveries have been made in this district, but are undeveloped.

Similar conditions to the above prevail in the Valdez Creek mining district, which lies about 75 miles west of the proposed railway route. The gold-bearing area of this district is not large, and operations have not been very extensive. It appears that there are possibilities of reducing costs by the installation of larger mining plants, and this undoubtedly would be done if the cost of transportation were reduced. It has been reported that a copper deposit has been found in this same region, but details in regard to it are lacking.

The plan for a railroad through the Copper River Basin also contemplates a branch line to the headwater region of the Nabesna. The Nabesna district contains both gold and copper deposits. Several years ago a small gold quartz mine was opened up in this district, but the high cost of operation prevented economic development. Some promising copper-bearing deposits occur in this field, which would undoubtedly be exploited if cheap transportation could be obtained.

A plan has also been suggested for projecting a railroad from the Nabesna branch through Mentasta Pass to the Tanana River. Little is known about the mineral resources of the region that would be traversed by this line. Some silver-lead ores are known to occur, but the extent of the deposits has not been determined.

Beyond the Isabel Pass the route enters the lower Tanana Basin, and at Fairbanks reaches the most important placer camp in Alaska and also one of promise for lode mining. The mineral resources of the Tanana have been set forth in the description of the Haines-Fairbanks route (see pp. 47 to 51), and it need only be repeated here that the district has produced gold to the value of $53,000,000, of which $4,300,000 is to be credited to the year 1912.

The Nenana coal fields lying in the northern part of the Tanana Valley could be made tributary to the Cordova-Fairbanks route by branch lines on water grade. The nearest known coal is about 25 miles distant from the through route. It should be noted that there may

be an eastern extension of the Nenana coal field, lying much nearer the main line, which has not been discovered because of the heavy gravel cover which mantles much of the district. (See pp. 88, 89.)

Water power.—Water powers occur at a number of localities along the proposed route, but are practically undeveloped. They are particularly abundant in the lower and mountainous portion of the road comprising that part of the district lying between Cordova and Chitina and including the Kennicott branch. There are also some water powers on the two slopes of the Alaska Range. The rainfall in the interior is much less than near the coast, and it is also questionable whether any of these powers would be available for more than three or four months in the year.

Timber.—The lowlands stretching eastward from Cordova to the Copper River Delta are in part timbered. Timber is not very abundant and occurs in isolated tracts. The largest trees in this part of the district are not over 2 or 3 feet in diameter. The forests are chiefly of spruce and hemlock, and timber extends to an altitude of about 3,000 feet, but that useful for commercial purposes is chiefly in the lowland. There is no timber between the Copper River Delta and the mouth of the Tiekel. The only exception is some scrub spruce at a few localities and a growth of stunted cottonwood which occurs on some of the islands in the river and adjacent flats.

Above the Tiekel spruce timber occurs sparingly along the lower slopes of the valley, but there is none of it of any value until the mouth of the Chitina is approached. There is some excellent timber along the west side of the Copper River near Chitina, where trees up to 2 feet in diameter occur. A small growth is found at various places along the Copper River and its tributaries, but this heavy timber all occurs in the valley bottoms of the larger streams. The aggregate areas of good forest is small. The so-called Copper River plateau, which stretches northward from the coast range to the foot of the Alaska Range, is covered with stunted spruce, together with some white birch and cottonwood. On the slopes of the valleys which traverse this region some better spruce timber is found, but occurs only in small quantities. Fairly good timber occurs along the southern foothills of the Alaska Range, where trees from 12 to 18 inches in diameter are found. There is some good timber on the Tanana, which has already been described. (See p. 51.)

From Chitina eastward the Kennitcott extension of the railway traverses a gravel bench standing 300 to 500 feet above the river level, and this is covered with a similar type of vegetation to that of the Copper River plateau. The trees are mostly stunted and have no value except for fuel. There are some patches of good timber in the river bottoms along the Lakina and other streams.

Agricultural.—There are practically no agricultural lands along the Copper River route between Cordova and Chitina. That part of the Copper River basin which is above Chitina includes in the aggregate considerable land which has some value for agriculture. This land is, however, confined to the river bottoms and adjacent slopes of the larger rivers. Such lands are found on the Tonsina, at Copper Center, at Gulkana, and Gakona, also on tributaries of the Chitina, as well as in other valleys.

Some successful farming has been carried on on the bench lands lying above the river bottom. This is notably true at Copper Center and at Willow Creek. The information at hand, however, indicates that the high bench lands, such as those which are found along the northern side of the Chitina Valley and stretch westward from the Copper River, there comprising the so-called plateau region, are not of any agricultural importance. On these lands the timber is usually stunted, and there is comparatively little grass land. It should be noted, however, that where the moss and trees are burned off the ground thaws, and it is possible that in course of time such action will bring about conditions by which grass and other vegetation can be induced to grow. It is not impossible that some agricultural use may be found for these extensive tracts of land, which comprise many thousands of square miles; but for the purpose of the present discussion they will not be included in the agricultural lands of Alaska. There are some good grass lands in the headwaters of the Copper River, which would be opened up by branch lines already described.

While the total area of the arable land within the Copper River basin is not inconsiderable, yet this Province as a whole can not be considered an agricultural region comparable with that of the Susitna, Tanana, and parts of the Kuskokwim Basin. Beyond the Alaska Range the Cordova-Fairbanks route traverses the fertile Tanana Valley, whose agricultural resources have already been discussed in the description of the Haines-Fairbanks route. (See p. 52.)

Valdez-Fairbanks Route.

DESCRIPTION OF LINE.

(See Pls. 5, 6, and 18, Pt. II.)

The town of Valdez lies at the head of Valdez Arm, a branch of Prince William Sound, and is built on the delta of the Valdez Glacier, the glacier being about five miles to the northeast.

It has a population of 1,500, including those on the military reservation adjacent to the town, and is well laid out. It has substantial buildings, is provided with hotels, stores, a bank, a telephone system, two daily newspapers, and is connected by cable with outside points and by telegraph with the interior. It is well provided with municipal improvements for a town of its size, and is the headquarters of the Alaska Road Commission. The harbor is elsewhere described in this report. (See p. 101.)

As located, Valdez is subject to occasional disastrous floods by the change in the channels of the glacial delta. It is located here by reason of the fact that the trail to the interior in 1898 led over the Valdez Glacier, and in the earliest rush of prospectors the camp was at this place. Later, when the Fairbanks district became known, the present road, then a trail, was established, with this as its coast terminus. Expansion on this gravel flat will give increasing difficulty as the town grows. The shores of the bay are precipitous and very high and offer few places for development for commerical purposes. In addition to the present town and the space immediately adjacent, a town site, called Port Valdez, has been

laid out at the mouth of Mineral Creek, about four miles below Valdez on the north shore of the harbor. This town site has been patented, except a small area, and offers a favorable location for commerical development and town-site purposes.

Several railroad projects to the interior were based on Valdez as the coast terminal. The Copper River & Northwestern Railway Co. projected a road beginning at the town site called Port Valdez. Practically a third of the grading was completed between Port Valdez and Valdez, but no other work was done from Valdez north until reaching Keystone Canyon. Through Keystone Canyon about 25 per cent of the necessary grading was completed, including 100 feet of tunnel work, but no work was undertaken beyond this canyon.

The Valdez-Yukon Railroad had its terminal about one mile west of Valdez, and for a distance of several miles up Lowe River grading was completed, but nothing was done beyond the mouth of Keystone Canyon. The present military road generally follows the grade of this line.

A third railroad, called the Alaska Home Railroad, did some grading at various places as far as Keystone Canyon. In addition to these, two other companies made filings but did no work.

There are two practicable routes by which a railroad can be constructed into the interior from Valdez: One via Marshall Pass, and the other via Thompson Pass. These routes are identical for a distance of about 27 miles, extending up the Lowe River Valley as far as Heiden Canyon.

From here one route leads on through Marshall Pass, and down the Tasnuna River to its junction with the Copper River, connecting with the Copper River Railway about 54 miles from Valdez and 87 miles on that line from Cordova.

The other route crosses Thompson Pass, and a minor summit at Ernestine Pass, reaching the Copper River valley 100 miles from Valdez.

The projected route from Valdez crosses the delta plain above the town, which is covered with the usual gravel overwash. This crossing would require some trestle work which should be high enough to prevent the gravel deposits from reaching the track level. The route follows the valley of the Lowe River through Keystone Canyon; no construction difficulties present themselves, and the grade is about 1 per cent. A location has been suggested at a higher elevation along the mountain sides in order to avoid the construction through the canyon. It is believed, however, that this would be impracticable, as the crossings of the numerous deep ravines would present greater difficulties.

In Keystone Canyon two short tunnels and a bridge of 200-foot span would be required. From here to the summit of Marshall Pass a location is practicable with a ruling grade of 3 per cent.

The commission did not traverse the route over Marshall Pass, but obtained a good view from a high prominence; the pass seems to present no difficulties of construction. The commission had with them Mr. Henry Deyo, the engineer who originally located this line; he gives the elevation of the pass 1,756 feet, and states that the line is practicable, presenting no difficulties except two extensive trestles and one bridge. In the pass the construction of about 1,000 feet of tunnel might be desirable to effect a saving of about a half mile of

heavy work with sharp curvature. The descent to Copper River could be effected with a ruling grade of 2.5 per cent.

The estimated cost of construction from Valdez to junction with the Copper River Railroad via Marshall Pass is $3,121,000.

The Thompson Pass route leaves the Marshall Pass location about 3 miles west of the latter pass, turning westward with a loop 6 miles long and a ruling grade of 3 per cent to develop the elevation on which to cross this divide, which has an elevation of about 2,750 feet.

In crossing this pass two tunnel projects were considered, one 980 feet long, saving 150 feet in elevation, and the other 4,000 feet long, saving 350 feet in elevation. It is possible that a tunnel at a lower elevation would reduce the approach grades. The rock is graywacke interbedded with some slate.

The topography from Thompson Pass to Beaver Dam is rugged in character. The location contemplates sidehill support from the headwaters of Tsina River following the right bank of the river to a point about the middle of the Tsina Canyon, there crossing to the left bank on 250-foot steel bridge.

This river is a typical glacial-fed stream with wide gravel bottom and changing channels. The valley walls rise very abruptly and at this point converge in a tortuous canyon 2 miles in length, with vertical walls 100 feet high. From this canyon to Beaver Dam there is good support for a railroad, although the hills are steep.

About 5 miles beyond Beaver Dam the location crosses Stewart Creek, requiring heavy work in the canyon, and from this point starts a rising grade, 1.6 per cent, to a low pass at Ernestine. Where Stewart Creek joins the Tiekhel that river turns abruptly to the eastward, and suggests a possible route to the Copper River through the Tiekhel Valley. This valley has never been surveyed, but information indicates that the entire valley is extremely rugged. This was confirmed by a view the Commission obtained later of the valley from the Copper River, where it emerges from a steep walled canyon.

In the ascent to Ernestine Pass the route follows the left bank of the river with a ruling grade of 1.6 per cent. From Ernestine on the topography is very rugged, and the location follows Mosquito Creek with a ruling grade of 1 per cent.

From Trout Creek to the Copper River the route follows in general the location of the Government wagon road, and from Copper Center the same route to Fairbanks is followed that is elsewhere described in this report. (See p. 64.)

The maximum grade northbound and southbound is 3 per cent.

Cost of construction.—Estimate of cost, together with governing characteristics of the road, are as follows:

Length of entire line, Valdez-Fairbanks, ... miles..	380
Cost of construction of entire line	$18,545,000
Average cost of construction per mile of track	48,800
Maximum grade (northbound) ..... per cent..	3
Maximum grade (southbound) ..... per cent..	3
Maximum curvature	16°

RESOURCES.

Mineral.—The mineral resources of the Valdez-Fairbanks line include the gold and copper deposits of the region close to tidewater which would be little affected by railroad construction, some undeveloped auriferous deposits lying between Valdez and the Copper

River, the copper deposits of the Copper River Basin, and the gold deposits of the Chistochina district, as well as the gold deposits of the Tanana Basin. The copper and gold bearing lodes of the Nabesna region and the gold placers of the Valdez Creek district could also be made tributary by branch lines. (See Pl. II, p. 34.)

The Valdez mining district embraces an ill-defined area tributary to Port Valdez, and includes both gold and copper lode deposits. Much work has been done on a number of the claims in this district, and one gold mine has been on a productive basis for several years. Most of this district lies north of Port Valdez and it would not be affected by railroad construction. These resources, however, are important inasmuch as they would affect the prosperity of the proposed coastal terminal at Valdez.

There is some evidence that the auriferous zone in which the Valdez mines are located stretches eastward toward the Copper River. If this proves to be the case, there is strong probability that with the development incidental to railway construction over either Marshall or Thompson Pass, that mining would be undertaken.

Gold lode prospects are reported from the following localities: In the upper part of the Tasnuna Valley, which would be traversed by the Marshall Pass route, and near the Beaver Dam Road House, and in the Tiekhel region, both on the Thompson Pass route. None of these prospects have been sufficiently developed to prove their commercial importance. There has also been a little placer mining on streams tributary to the upper part of Tonsina River.

So far as known the above-described mineral deposits are the only ones lying on the Valdez-Fairbanks route between tidewater and Copper River. The mineral deposits of the Copper River region are described in the account of the Cordova-Fairbanks routes (see p. 71) and of the Tanana Valley in the account of the Haines-Fairbanks route. (See p. 48.)

Water powers.—There are many undeveloped water powers on the coastal side of the mountains along these proposed railway routes. The abundant rainfall and topography is favorable to power development. The same may be said of the Copper River side of the divide, though here the precipitation is less. There are no power developments in this region except a few small ones in the vicinity of Valdez.

Timber.—There is some fairly good timber in the Lowe River flat, but this probably is only of value for local use. The timber line in the Lowe River Valley and around Port Valdez is from 1,500 to 2,000 feet above tidewater.

The timber between Keystone Canyon and Marshall and Thompson Passes for the most part is a scrub spruce with some cottonwood. There is practically no timber in this region above the altitude of 2,000 feet. The Tasnuna Valley is fairly well timbered up to an altitude of 1,500 feet, and in favored localities trees reach a diameter of 18 inches. The timber between Thompson Pass and Copper River is scant, and trees exceeding 12 inches in diameter are found only in a few favored localities. Locally, however, there are small tracts having a fairly good stand of timber, with trees from 16 to 18 inches in diameter.

Agriculture.—The region tributary to Port Valdez seems to possess but little agricultural value. There are, however, some good gardens

in the vicinity of Valdez. The Lowe River Valley floor between Keystone Canyon and the flats where timber has been burned off is covered with a good growth of grass. The aggregate of agricultural lands in this region is small, and the climatic conditions are unfavorable to farming. The same general conditions hold in the region lying between the Keystone Canyon and Copper River, both via the Marshall and Thompson Pass routes. There is, however, some good grass land, and the regions covered with heavy timber, such as that near Tiekhel, could undoubtedly be used for farming. The agricultural resources of the Copper River region are described in the account of the Cordova-Fairbanks route (see pp. 74, 75), and of the Tanana Valley in the description of the Haines-Fairbanks route. (See p. 52.)

Seward-Fairbanks Route.

DESCRIPTION OF LINE.

(See Pls. 11 to 15 inclusive, and Pl. 19, Pt. II.)

The Alaska Northern Railway has its terminus in Resurrection Bay at the town of Seward. The bay is a large ice-free harbor having sufficient shore line in the vicinity of the present town to enable development in a terminal port, the most serious objection to which is the great depth of water, making anchorage difficult. (See p. 103.) The town is well laid out, well developed, and has been recently incorporated. It is well provided with municipal improvements for a town of its size. It has a bank, a telephone system, a daily newspaper, hotels, and good stores, and cable communication with the outside. There is enough space for the development of the necessary terminal structures and about half a square mile immediately adjacent for the accompanying town, with plenty of room for commercial growth to the northward.

The Alaska Northern Railway Company has provided only temporary structures for sheds, storehouse, and shops, but has a good office building. It also owns the only dock at Seward, which extends out to 25 feet of water at low tide. From this dock the railroad starts, and runs through the town near the shore, until the head of the bay is reached, where it enters a heavily timbered flat stretching northward.

The railroad is single track, standard gauge, and has been constructed for a distance of 71.6 miles northward from the town of Seward, where it reaches Kern Creek on the north shore of Turnagain Arm, a branch of Cook Inlet. There are two summits, the lower one at mile 11 and the higher at mile 45. The ruling grade against southbound traffic (2.2 per cent) is on the approach from the northeastward near mile 45; the maximum curvature is 14°.

Starting at Seward the line runs approximately at level grade for a distance of 7 miles through the bottom lands previously mentioned. Construction work in this stretch was light, there being one long trestle over salt sloughs and meadows. At about mile 7 the climb begins, and there is no difficult construction to the summit at mile 11. The grade, however, is heavy, the maximum being 2.2 per cent, and there are numerous curves of 10° with some 12°. The elevation at this summit is 700 feet. Near the summit is a four-story trestle on a sharp curve.

At mile 14, Snow River, a glacial stream, is crossed by a 900-foot trestle about 30 feet high, part of which is on a 10° curve. Trouble at this point occurs frequently; recently six bents were taken out by drift; a steel bridge will ultimately be required. From this crossing the road follows the valley bottom on a slightly falling grade for about 3 miles, and occasionally the track is inundated. From mile 18 to mile 23.5 the road skirts the east shore of Kenai Lake, which forms an important transportation route for several mining properties to the westward. The level of this lake is subject to a variation of several feet during seasonal changes. Construction in this section was easy, but there are numerous 10° and 12° curves. From mile 26 to mile 34 the road skirts the shores of Trail Lake, the crossing from the western to the eastern shore being effected at mile 29.5 by 300 feet of trestle.

At mile 34 the climb begins to the second summit, the road following Trail Creek. Troubles frequently occur from floods at points in this stretch, and it will be necessary to elevate the track from 2 to 4 feet throughout this bottom for a distance of several miles; at mile 40 particularly there have been several troublesome washouts during rains or prolonged hot spells. At about mile 40 there is a wye, and at this point begins the steep climb to the main Kenai summit, the ruling grade of this approach being about 2 per cent. The heavy rockwork begins at about mile 43 and at about this same point the section is entered where snows give the most trouble. The railroad has not been operating in the winter seasons, but it is stated that the snow here never exceeds about 5 feet, except in slides and drifts. Winds are high, however, in winter, but the snowfall is comparatively light and would not give serious trouble.

At mile 45 the main divide of the Kenai Mountains is reached at an elevation of 1,065 feet, and the descent begins with a grade of 2 per cent; at mile 48 the first tunnel is reached. At the southern end of this tunnel a snow shed of at least 200 feet in length would be required for winter operation.

After passing through this tunnel the descent into the valley of Placer River begins, and in this descent about 2 miles of track are constructed along two reverse horseshoe curves and one complete loop. One of these curves is on a four-deck trestle 1,350 feet long, and there are three other trestles containing Howe truss timber spans. The highest trestle is built on a 14-degree curve and at the steepest grade (2.2 per cent).

Just before reaching mile 52 the gorge of the Placer River is entered, and the road encounters the heaviest of its construction work. There are six tunnels of a total length of over 3,000 feet within a distance of 4,500 feet.

This reach of 4 miles is the stretch of the road that limits the southbound traffic. It contains the heaviest grades, the stiffest curves, and several structures which would be most difficult and expensive to replace in case of accident. This location seems to have been ill advised. It appears to the commission from what was seen during its brief inspection that the location should have been carried from some point near the tunnel at mile 48, along the west wall of the valley with sidehill support, instead of being thrown out into the valley and developed largely on trestles with heavy grades and excessive curvature. It would by this suggested location

have reached its present grade at about mile 57 or 58 without excessive curvature, on a grade possibly as low as 1.1 to 1.2 per cent; and probably would have entirely avoided the expensive tunneling work about 3 miles down the valley, as its support here would lie above the steep walls of the canyon. Some snowshed construction would doubtless have been required, and possibly some steel trestles to span the few draws crossed. It is thought that the total expense of construction would probably have been much less than along the line actually adopted, and the costs of operation and maintenance greatly less. It is believed that a survey would show an economy in abandoning the present location along this stretch in favor of the one suggested at some time in the future when traffic has assumed sufficient proportions to warrant it.

From mile 52 to the head of Turnagain Arm at mile 61 the road lies along the valley bottom of Placer River, a glacial stream, the crossing of the river being effected on a high trestle near mile 53. This valley bottom, from a half a mile to a mile wide in some places, is covered with the usual glacial overwash. The river breaks up into numerous small streams which change their beds continually, with resultant damage to the track. The principal troubles are concentrated in 3 miles, from 54 to 57, where this floor is crossed in front of two glaciers. It should be noted that considerable of this difficulty would also be removed by the relocation previously suggested.

From miles 61 to 71.6 (the present terminus, Kern Creek) the line skirts the northern shore of Turnagain Arm, with side hill support along the foot of the steep mountains which border this shore. The construction presented no unusual difficulties except the expense of steep side hill cuts in rock. In crossing the bottom of Twentymile River, at the end of Turnagain Arm, it was necessary to construct and maintain a system of spur dikes to protect the bank from damage by reason of the excessive tides which carry ice in winter. It is also probable that a steel span will be found advisable for this crossing. At Kern Creek, the present terminus, connections with the Susitna and Kern Creek are now made by launch.

The track is laid on native ties, which appear to be in very fair condition although in place over seven years, and the company has a great number of these ties at various points along its present track. For the first 16 miles out of Seward 56-pound rails are used. The remainder of the track has 60-pound rails, and there is a small amount of this latter rail not yet placed in the track. In general, the alignment of the road is fair, considering the character of the country and the business anticipated at the time of construction; much of it, however, could be improved at no considerable expense. Generally, with the exception of the 10 miles in Placer River Valley, the location is good for the character of traffic anticipated. Some of the side hill cuts have not sufficient width for good support, and some of the timber structures would doubtless require early and considerable repair if subjected to traffic with full equipment. The company now seldom operates except with a light gasoline car carrying passengers, high-class freight, and express business, and this only in summer. The heavy equipment is only used occasionally when required to carry in a heavy piece of machinery for some mine development.

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Kern Creek-Fairbanks extension.—Starting from Kern Creek in a gasoline launch, the Commission examined the north shore of Turnagain Arm to a point where the proposed extension of the Alaska Northern leaves this arm and turns to the northward. This shore is bold, and the road would be held at the foot of the hills on a practically level grade with a series of cuts and fills. Several small valleys are crossed. The right of way has been cleared for a considerable distance beyond Kern Creek, and possibly as much as 2 miles of grading has been almost completed; these 2 miles, however, not being in a continuous stretch, but extending along the arm as far as Rainbow Creek. Construction throughout this stretch of about 30 miles would present no difficulty except the preponderance of heavy rock excavation in the work of grading. Considerable protection in the way of snow sheds would also be required. Work on this section would be facilitated, as the location is parallel to and hugs closely a water transportation route open to the sea for half the year.

It has been suggested that Turnagain Arm might be crossed by a bridge between Sniper and Bird points, with a view to locating a line across the Kenai Mountains by Moose Pass, Johnson Creek, or Quartz Creek. At the point suggested for this bridge Turnagain Arm is about 2 miles wide and the water is shoal. This arm, however, has an enormous tide, and for half the year is filled with ice floes, which it is believed make this suggested crossing impracticable. If any of these alternate routes over the Kenai Mountains were selected Sunrise Creek would have to be reached by a circuit around the east end of the arm. The routes may present advantage as to southbound grades over the present location of the Alaska Northern, but the mileage would be greater, and the principal difficulty as to grades in the existing line it is believed can be removed at much less expense by the relocation suggested.

Another suggestion has been made to carry the road over the Kenai Mountains to Port Welles in Portage Bay, on the west side of Prince William Sound. This is a shorter route to tidewater, but the difficulties of construction through the pass occupied by the Portage Glacier probably remove it from consideration, and information at hand indicates that Port Welles is an inferior harbor.

The projected location leaves Turnagain Arm at about mile 30 (from Kern Creek), turns northwardly and proceeds along the east shore of Knik Arm on the gently rolling gravel bench at an elevation of between 200 feet and 300 feet above sea level to the head of the arm, which is reached at mile 77 (from Kern Creek). In this stretch the location crosses six or seven streams of considerable size, of which the Yukla is the largest. Construction throughout this stretch would be comparatively easy. It is possible that one or more steel spans would be required in crossing the delta of the Knik and Matanuska Rivers at about mile 73. Near the western end of this crossing would be located the junction between the Matanuska Branch and the main line up the Sustina Valley. At mile 45 the location would pass about 7 miles east of Knik Harbor (sometimes called Ship Creek), a bight on the east shore of Knik Arm, which offers a safe anchorage at all tides during the six months of summer season. The plans of the Alaska Northern contemplate developing this harbor into a terminal for use during the summer months, from about May 1 to October 31, in order to save the rail haul of 115 miles across the Kenai Mountains.
(See p. 104.)

The Commission had no opportunity to observe any more of the location of the Alaska Northern Railroad than has been described to this point. Horses and pack transportation were taken at Knik and the Commission proceeded inland about 40 miles over the Willow Creek Road which reaches the headwaters of one of the tributaries of the Little Susitna River. Good views were had of the lower portions of the Matanuska and Knik Valleys. Plans and profiles were obtained from the company, and considerable detailed information was obtained from the engineers of the company, one of whom had been over the Broad Pass extension and in the Matanuska field. The territory north of Broad Pass is also known to one member of the commission.

From the junction at the head of Knik Arm, the line to Fairbanks as located would proceed westwardly, crossing the Little Susitna River at about mile 94, and would ascend the broad valley of the Susitna. This part of the line traverses a broad gravel bench offering no difficulties of construction. The grade is held near the foot of the eastern slope of the valley and would be at elevation between 300 and 500 feet until the canyon section of the Susitna is reached at about mile 173. Several streams of considerable size are crossed. The largest of these is the Talkeetna, crossed at about mile 228. No data is at hand as to the discharge of this river, but the area drained by it would indicate the necessity of bridging it.

Reconnoissances were run by the Alaska Northern reaching Broad Pass by ascending the Chulitna River, which flows into the Susitna from the west at about mile 150, but the Chulitna Canyon was found more difficult than the Susitna, involving about 25 miles of very heavy construction. This route would save one summit (Chulitna Pass) and a location survey might justify its selection.

The adopted location ascends the Susitna, following the east wall of the canyon from mile 178 to Indian Creek at about mile 197. This stretch of 19 miles is supported on the sidehills whose slopes are not excessive, though at places construction cost would be heavy. A steel bridge would be required to cross the Susitna at mile 195. The location then ascends Indian Creek, reaches the Chulitna over a minor summit (Chulitna Pass), and ascends that stream to Broad Pass at about mile 248. Data on this section of the location are not precise, but the construction would probably not be heavy except in short stretches, and it is reported that a location can be obtained with 1.5 per cent as the maximum grade and without excessive curvature.

Broad Pass (elevation about 2,800 feet) is a mountain gap from 6 to 8 miles wide and through it the headwaters of the Nenana are reached. The river is descended on a grade reported not to exceed about 1.5 per cent and with no difficult construction excepting through a narrow rocky canyon above the mouth of Healy Creek. Below this canyon the valley broadens out until it finally merges into the broad flats of the Tanana lowlands at about mile 313. The Tanana River is reached at about mile 340 and might be crossed here and the north bank followed to Chena and Fairbanks. The location surveys, however, followed the south bank to Chena at mile 382 (454 miles from Seward). This construction offers no difficulties, excepting the bridge across the Tanana, the best location for which can not be determined without a survey.

The estimates for this line include the bridging of the Tanana and the extension to Fairbanks. (See p. 109.)

Matanuska branch.—The best known part of the Matanuska coal field is about 40 miles up that valley above the junction point (at about mile 77 of the location). Coal and other mineral resources are known, however, to lie beyond this point but within 25 miles. Construction of the 40 miles to Chickaloon would be comparatively easy. Grades would be practically all one way, and could be held at about 8 per cent maximum without excessive curvature.

It has been suggested that the Tanana Valley be reached by abandoning the Susitna route and extending the Matanuska branch through Tahneta Pass (about 2,950 feet high), traversing the Copper River Valley by descending the Tazlina and ascending the Gulkana, via the proposed Matanuska branch of the Cordova-Fairbanks route (see p. 70), following a route elsewhere described in this report.

Kuskokwim extension.—The Susitna Valley offers a solution of the problem of providing transportation for the Kuskokwim Valley, and the Innoko-Iditarod district. Leaving the location already made by the Alaska Northern in its proposed Fairbanks extension, at about the point where it crosses Willow Creek (187 miles from Seward), this projected line would cross the broad Susitna Valley to the confluence of the Skwentna and Yentna Rivers, which would be reached at about 42 miles from the junction. The construction of this stretch would not be attended with any difficulties, but a steel bridge would be required to cross the Susitna and probably another to cross the Yentna. This Susitna crossing would give a connection with the navigable waters of that river about 40 miles above its entrance with Cook Inlet.

The location would then follow the north bank of the Skwentna, and Happy River, a tributary to Rainy Pass (elevation about 2,900 feet), which would be reached at about mile 120 from the junction. This construction would be expensive, there being several canyons in the rivers, but it seems to be feasible to obtain a location with a maximum grade of 2.0 per cent to the summit. No location surveys have been made of this route, but it has been traversed by one member of the commission.

It is possible that a location survey would develop an easier route across this summit by using Portage Creek for the ascent from the Skwentna River, and by using Hartman River for the descent to the Kuskokwim. This seems improbable, as the mileage would be increased, and from the meager data at hand it would appear that a long tunnel would be required to avoid heavier grades at the summit. It is mentioned here, however, as a possibility.

Rainy Pass marks the divide between the Susitna and Kuskokwim basins, if ascent is made via Happy River, and from this pass the descent into the latter valley would be made via Dalzell Creek, and the south fork of the Kuskokwim, with some heavy construction and grades probably not exceeding about 2.0 per cent. The heavy descent would end at about mile 150 from the junction, where the broad gently rolling uplands are reached.

From here to McGrath (79 miles farther, and 416 miles from Seward), on the navigable waters of the Kuskokwim, construction would not be difficult and grades would be light, though some swampy land would be traversed.

McGrath is not far from Ophir, which lies across a low divide in the headwaters of the Innoko, a tributary of the Yukon, and a future

extension of this line to the Yukon Basin or even to Nome might take this route, reaching the Yukon at a point near Kaltag. It might on the other hand, be deemed advisable in the future to terminate an extension in the Iditarod and ultimately reach the Yukon by an extension in a southerly direction through the upper Kuskokwim Valley, reaching the Yukon at a point near Holy Cross. The topography of this section is not yet well known, and as the extension to the Yukon would be a matter for the future, a recommendation as to this route should properly be left until more data are at hand.

Cost of construction.—The Commission has, after careful consideration of all the available data, prepared an estimate of the cost of the necessary new construction from Kern Creek to Fairbanks and from Kern Creek to the Kuskokwim.

Seward-Fairbanks: Length of entire line Seward-Fairbanks....miles..	463
Length of new construction Kern Creek-Fairbanks.....miles..	391
Cost of new construction Kern Creek-Fairbanks.....	$17,708,000
Average cost of new construction per mile of track.....	$45,300
Maximum grade (northbound).....per cent..	2.3
Maximum grade (southbound).....per cent..	2.2
Seward-Kuskokwim: Length of entire line Seward-McGrath....miles..	416
Length of new construction Kern Creek-McGrath.....miles..	344
Cost of new construction Kern Creek to McGrath.....	$17,970,000
Average cost of new construction per mile of track.....	$52,300

RESOURCES.

Minerals.—The developed mineral resources of the region which would be opened up by the proposed railway from Seward to Fairbanks, together with the branch lines to the Kuskokwim, include the placers and gold lode deposits of the Fairbanks, Innoko, and Iditarod districts, as well as of some smaller districts. The value of the total placer output from the entire Province is upward of $60,000,000. Lode mining has only begun in this Province, and the value of the total output up to date is not over half a million dollars. Incidentally to the gold mining, some silver has also been produced. In 1912 there were about 15 lode mines in this field which were on a productive basis, of which 3 were in the Kenai Peninsula, 3 in the Willow Creek district, 1 in the Innoko region, and the rest in the Fairbanks district.

The undeveloped resources of this field are chiefly coal, which is found in a number of widely separated localities and includes both lignitic and high-grade bituminous and anthracite fuel. Some copper prospects have also been found, as has some tin, antimony, silver-lead, and other metalliferous deposits.

In 1854 a Russian engineer prospected for alluvial gold in the Kenai Peninsula, representing the first search for precious metals in Alaska. Though alluvial gold was found, the enterprise was soon abandoned and the discovery forgotten. In 1895 workable placers were found on streams in the northern part of the Kenai Peninsula, which are tributary to Turnagain Arm, and since this a placer mining industry has developed. These operations have been mostly on a small scale, but there have been several hydraulic plants in use, and recently a dredge has been built for operations on the Kenai River. The annual output from the placer mining operations does not now exceed $40,000 in value. The output could undoubtedly be increased very much by improvement in mining methods. The value of the total output for the 10 years ending with 1912 is about $1,500,000.

Several years ago some systematic prospecting of auriferous lodes was undertaken in this same district, since which time lode mining has gradually advanced, and in 1912 three different properties were on a productive basis. The lodes thus far discovered are comparatively small, and the operations have not been on an extensive scale. There is good reason to believe that future discoveries will be made which will ultimately result in a lode mining district of importance.

More rapid strides have been made in developing lode deposits in the Willow Creek district, lying about 170 miles from Seward by the proposed railway route. Here three mines are now operating, and what is known of this field makes it probable that further discoveries will be made. The geologic conditions found in this district repeat themselves in many other parts of the province, and there is good reason to believe that other lode discoveries will be made.

There are no mining developments along the main line between Willow Creek and the Tanana Valley. Here, however, gold prospects have been found, and had they not been so remote from means of communication, they might by this time have developed into productive properties. Noteworthy are the reported discoveries of silver-lead ores in the region of Broad Pass. North of the divide where the route traverses the Alaska Range gold placers have been found in the Bonnifield district, lying on the north flank of the mountains and near the route to Fairbanks. These have also been developed in only a small way, and the value of the output up to date does not exceed a few hundred thousand dollars. In this connection mention should be made of the Kantishna district, lying about 60 miles to the southwest of the Bonnifield district and on the inland front of the range. Here there has been a small placer production and some recent discoveries of auriferous and other metalliferous lodes. The gold deposits of the Kantishna and Bonnifield districts are of significance in indicating the wide distribution of auriferous mineralization.

The gold placers and auriferous lodes of the Fairbanks district which would be tributary to this proposed railway have produced in all about $53,000,000, of which $4,300,000 represents the value of the production of 1912. These districts have already been described in the account of the Haines-Fairbanks route. (See pp. 48–50.)

Copper has been reported from only two localities in this province, and neither of these has been subject to an official investigation. Several years ago copper was found on Sheep Creek, a tributary of the lower Talkeetna, while in 1912 prospectors report the occurrence of copper on Sheep Mountain in the Matanuska Basin. It is yet uncertain whether there is any copper in this field worthy of exploitation, but these discoveries at least indicate that some ores are present. Some iron carbonate ores occur in association with the coal-bearing rocks of the Matanuska field. While these deposits, so far as known, are not extensive, yet, in view of their proximity to coking coal, they might be locally utilized.

The proposed line through Rainy Pass to the Kuskokwim traverses the southern margin of the Yentna placer district which has been under development during the past eight years, with a total gold production valued at about $500,000, and a present annual production valued at $100,000. This district is remote from transportation routes and most of the operations have been only on a small scale. Auriferous lodes have been found in this field, but are undeveloped.

The Rainy Pass line would traverse the upper Kuskokwim Basin, where a little gold has been found, but about the mineral resources of which there is scant information. At McGrath, near the mouth of the Takotna, it would reach the eastern margin of the Innoko-Iditarod region.

The Innoko-Iditarod region, lying between the middle Kuskokwim and lower Yukon, was first known to carry placer gold about 1906, and since 1909 mining has been on an extensive scale. The total output has a value of about $7,000,000, and that of 1912 about $2,700,000. A gold dredge was successfully operated in this field in 1912. Placer gold is widely distributed in the Innoko-Iditarod region, but up to the present time rich placers have been found on only comparatively few creeks. The outlook for further discoveries of placer gold is favorable.

In 1912 a small stamp mill was installed on an auriferous lode in the Innoko district, and its successful operation is a hopeful indication of future lode mine development. A still more favorable indication lies in the fact that the geologic conditions favorable to the occurrence of metalliferous deposits are known to prevail over a considerable area. The facts at hand are therefore favorable to the finding of auriferous lodes, in spite of the fact that there are no deposits yet developed which can be counted on for an assured tonnage. Cinnabar, an ore of quicksilver, is of common occurrence with the placer gold in this province. At least one cinnabar-bearing lode deposit has been found, and others are reported. These facts indicate the possibility of the development of a quicksilver-mining industry. Mining has been much hampered in the Innoko-Iditarod region by the high cost of transportation. The reduction of this cost would undoubtedly give an impetus to the mining industry and lead both to the development of resources already known and to the more systematic search for new deposits.

The coal deposits of this province are very extensive. They include the lignitic coal of the western part of the Kenai Peninsula, of the Susitna Basin, and of the Nenana field sin the southern part of the Tanana Basin. Lignitic coals are also reported south of the forks of the Kuskokwim. Of far greater importance are the bituminous and anthracitic coal of the Matanuska Valley, which are of the same high grade as those of the Bering River field, and will here be first considered.

The Matanuska coal field, as already stated, shares with that of Bering River the preeminence in the present fuel situation in the Territory. These coals are included in folded and faulted shales, sandstones and conglomerates. The western end of this field lies about 25 miles from tidewater at Knik Arm, and the coal-bearing series has been traced for 50 to 60 miles along the Matanuska Valley, but much of it is buried under a heavy blanket of gravels. There is also evidence that the same coal measures may occur under a younger conglomerate series, which occupies considerable areas. This can only be determined by tunneling or drilling. Bearing in mind the limitation put on the field observation by the gravel cover, the area of the coal-bearing rocks in the surveyed part of the field is estimated to be 74 square miles. In addition to this are certain conglomerate covered areas embracing about 25 square miles which may be underlain by coal. There is also known to be coal in the upper Matanuska Valley beyond the area of detailed survey, con-

sidered in these estimates. It is quite possible, therefore, that the coal field may embrace 100 square miles or more, though it remains to be determined by actual excavation how much of this area is underlain by workable coal beds. The field is larger than the Bering River field, but it is not certain that it contains more coal, as the latter appears to include more different beds. The coal beds which may be workable range from 3 to 32 feet in thickness. There has been no such marked variation in thickness of individual beds noted in the Matanuska field as is known to exist in the Bering River field, but this may be due to lack of exposures which are not plentiful.

The coal varies in quality from a lignite to a bituminous and anthracite coal. The bituminous coal, which seems to form the main body, appears to pass into a lignite at the west end of the field, while there is some evidence that the same coal is represented by an anthracite near the east end of the belt. The lower grade coals from this field varies from 48 to 50 per cent of fixed carbon, with from 5 to 12 per cent of ash. The bituminous coal varies from 61 to 77 per cent fixed carbon with from 7 to 15 per cent ash. The average of 16 analyses of bituminous coals gave 65 per cent fixed carbon and 11.6 per cent ash. One analysis of the anthracite yielded 84 per cent fixed carbon and 6 per cent ash. The bituminous coal can, in part, be coked.

Much of the bituminous coal is crushed and will yield a large percentage of slack which does not detract from its value for coke and not greatly as a steaming coal. The lower grade of bituminous and the lignitic coals are less crushed than those described above and will yield a larger percentage of lump fuel.

Among the unfavorable mining conditions are the folded and faulted condition of the coal measures. The extent of these disturbances, and hence their effect on profitable exploitation, can only be determined by opening up the beds in underground workings. So far mining operations have been practically confined to two localities and only a few hundred feet of tunnel has been driven. Another deterrent to cheap mining is the presence of igneous rocks which cut the coal measures as dikes and large stocks. It should also be noted that there is not a large amount of coal above drainage level and the sinking of shafts and slopes will have to be resorted to early in the mining development. While underground water will have to be handled, this will probably not be great because of the low precipitation. The information at hand also indicates that gases will be met with.

To consider the lignitic coals: As the proposed railway line will not reach the area underlain by lignitic coal of the western half of the Kenai Peninsula, these deposits need no further mention here. Little is known about the lignitic coals of the Susitna Valley except the fact that this fuel is widely distributed along both margins of the basin. These coals are undeveloped and probably could not be profitably exploited in competition with the high-grade fuels of the Matanuska field, but might find a very local use.

The Nenana coal field is one of the largest known in Alaska. Its coals, so far as determined, are all of the lignitic character, but as they lie north of the Alaska Range they could be transported for local use to Fairbanks in competition with the better fuels from the

Matanuska field. The area within which the coal-bearing series outcrops measures about 165 square miles, and it is most probable that the coal also occurs under the heavy gravel sheet which mantles much of the bedrock of the southern Tanana Basin. Estimates which include only 122 square miles of the better-known coal field give a content of 9,950,000,000 tons, and it is possible that this figure might be multiplied several times and still be within the bound of probability if the total coal content of the region were included. The coal beds which have been subject to official examination vary from 3 to 30 feet in thickness. While locally somewhat broken, they are not sufficiently disturbed to seriously enhance the cost of mining. The field as outlined stretches from the Nenana River eastward to the upper waters of the Little Delta, and may extend still farther eastward to the Delta River. The proposed railway route traverses the western margin of the field, where the most important discoveries have been made. There being no means of transportation, no attempt has been made to mine any of this coal.

Water power.—A few small water powers have been developed in the Kenai Peninsula, and others are available. Water powers also occur in other parts of the province, notably on both slopes of the Alaska Range and along the eastern side of the Susitna Valley.

Timber.—The timber line in the Kenai Peninsula is between 1,200 and 2,000 feet. Heavy forests are, however, found only below altitudes of 1,000 feet, and the aggregate of good timber land is not great. Spruce is the dominating variety of trees, but hemlock also occurs in the flats at the head of Resurrection Bay and on some of the larger streams tributary to Turnagain Arm, besides which there are the deciduous trees, cottonwood, birch, etc. Most of the timber land contains but few trees that will square more than 4 or 6 inches, but in the Resurrection Bay flats and in some other lowlands hemlock and spruce up to 4 feet in diameter are found. There is also considerable timber, including scattered areas of spruce, with trees which will square 12 inches on the plateau which stretches westward from the base of the mountains to Cook Inlet.

In the Susitna and Matanuska Basins timber line varies from 2,000 to 2,200 feet, but the growth above 1,500 to 1,800 consists only of stunted trees. The best forests are in the lowlands and on the mountain slopes up to 1,000 feet. Here spruce, cottonwood, and birch are found, but the largest trees are usually not over a foot in diameter. In favored localities the trees run up to 15 and 18 inches in diameter.

The timber of the Tanana and Yukon Basins has already been described (see p. 51), and it has been shown that the best of it does not, as a rule, exceed 2 feet in diameter. It should here be again noted that the lower Tanana Valley includes the best timber of the Yukon Basin.

On the Kuskokwim slope of the Alaska Range timber is found up to altitudes of 2,400 to 2,800 feet. Here in the river bottoms spruce and cottonwood are found up to 12 to 18 inches in diameter. The same general forest conditions prevail on the lower Kuskokwim, but the timber becomes scanter as the sea is approached and finally gives way to barren grounds about 100 miles from tidewater. In the Innoko-Iditarod region timber is practically limited to the valley bottoms, and the supply is inadequate for local use. The flats of

the upper Kuskokwim, including the area around Lake Minchumina, are well timbered. Forest conditions on the lower Yukon are similar to those on the Kuskokwim described above. Take it all in all, the regions which would be opened up by a railway from Seward to the Innoko-Iditarod region have considerable timber which can be used locally, but hardly enough to furnish the fuel necessary for any large development.

Agriculture.—The agricultural areas of this province, including land suitable for tillage and grazing, are large. While estimates of the extent of these lands can be little more than guesses, it is conservative to say that the Susitna and Matanuska basins include 2,000 to 3,000, the Tanana 3,000 to 4,000, and the Kuskokwim 2,000 to 3,000 square miles of agricultural lands lying less than 1,500 or 2,000 feet above sea level. More complete data may show the agricultural lands of the province to exceed the above by many thousand square miles, but in any event the above figures will show that this is an important field for the pioneer farmer when railways have opened up the land, and thus transportation furnished to the local markets. It should be noted that there is also some agricultural land in the Kenai Peninsula, where there are many gardens and several ranches.

The above described lands, where not timbered, are in many places covered by the luxuriant growth of grass which gives evidence of their fertility. Their adaptability to growing of potatoes, as well as forage crops, has been proven in many places. It has been shown elsewhere in this report (see pp. 51–53) that in the Tanana and in parts of the Yukon Basin, barley, oats, and rye can be matured. Also that the experiments in growing of wheat at Fairbanks and at Rampart have been a success. Conditions for agriculture are certainly as good in the lower Susitna basin as in the Fairbanks district, for if anything, the growing season will be longer. Taking it all in all, the Susitna Valley offers an excellent field for agricultural development, and probably the best in Alaska. It is also fair to assume that the conditions in the upper Kuskokwim Basin are similar to those in the Tanana Valley. In addition to the tillable lands there are extensive tracts of grass lands, in the Susitna and other valleys tributary to this route. Large areas of reindeer pastures are found in this region above the limit of good grass. This is notably true along the inland front of the Alaska Range where there is plateau region furnishing 4,000 to 5,000 square miles of reindeer pasture. In conclusion, it may be said that the Susitna, lower Tanana, and upper Kuskokwim Basins contain farming and grazing lands unrivaled in extent and fertility in Alaska, and which in time to come may furnish a food supply for export.

Iliamna-Kuskokwim Route.

DESCRIPTION OF LINE.

(See Plate 16, Part II.)

Iliamna and Iniskin Bays are arms of Kamishak Bay, on the west shore of Cook Inlet and are fully described elsewhere in this report. (See p. 105.) Iliamna Bay is now unsettled, but has been selected as the terminal of the proposed Alaska Short Line Railway.

If such terminal were established, a railroad could be constructed from the flat near Diamond Point, around a point northward along

the west coast to the north arm of the bay, and up the valley across the divide toward Iliamna Lake. The distance from this flat near Diamond Point to the end of the north arm of the bay is about 4 miles. The construction of the first two or more miles on the shore of the bay would be along rocky slopes in places almost vertical, and would involve some very heavy work. A railroad based on a terminal on Iniskin Bay would reach the same point by heavy construction around the steep, rocky bluff between the two bays.

From the head of the north arm to Iliamna Lake the route of the Alaska Short Line passes over the divide and descends along Chinkelyes Creek to within 100 feet of sea level at Iliamna Lake. The Geological Survey map shows the elevation of this divide at between 800 and 900 feet and its distance about 3 miles from tidewater. About half of this elevation might possibly be saved by a tunnel some 2,000 feet long. The line skirts the shores of Iliamna Lake for 20 miles and then turns to the northwestward. Near Chekok River the line enters a gravel flat which is followed as far as the Newhalen River Valley, and then turns northward to Clark Lake, a distance of about 15 miles. It then crosses the outlet of the lake and skirts the northwest shore to the head of Portage Bay, and continues thence across the flat of the Chulitna River. The route follows up Chulitna Valley, and a northerly branch of the Chulitna, the Koksetno, to Black River; thence up this valley over the summit. Beyond the Chulitna River topographic data are lacking and the summit is of unknown height, but is probably about 2,000 feet. From here the line trends in a generally northeasterly direction to a crossing of the Mulchatna River near its head; thence in a northwesterly direction crossing a divide at the head of the Haliknuk River, following down a tributary of the Kuskokwim to that stream. From this point it might reach the Yukon near Holy Cross, traversing the southern part of the Iditarod district. The total length of this line is unknown, but is estimated at about 400 miles, of which 250 miles lie between Iliamna Bay and the Kuskokwim. It is estimated to cost $44,300 per mile.

RESOURCES.

Mineral.—The prospective mineral resources of the Iliamna region are copper, silver, lead, gold, and petroleum, but none of these have been developed on a commercial scale. The developed mineral resources of the inland region which would be served by the proposed railway from Iliamna Bay include the gold placers of the Iditarod-Innoko region and some smaller placer camps which are tributary to the lower Kuskokwim River. Auriferous lodes have also been found in this district, as well as some quicksilver deposits. Coal has been found on the lower Yukon and has been reported in the Kuskokwim basin. (See Pl. II, p. 34.)

Metalliferous lodes have been found in three general areas in the Iliamna region. The easternmost of these is along the two margins of the granite belt which separates Iliamna Bay from Iliamna Lake. In this district copper-bearing lodes and silver-lead deposits have been found, both of which carry some gold. A second zone is that lying north of Iliamna Lake and within a granite mass where a quartz vein is reported to have been found which carries copper, gold, and silver. The third zone is a belt of altered limestone lying near a gran-

ite area, within which some copper-bearing lodes have been found. The total underground work on the dozen or more developed prospects does not exceed a few hundred feet and is insufficient to permit of a definite statement as to their commercial importance. It may be said, however, that the geologic occurrences of these ores is similar to those which in other districts have yielded commercial ore bodies. Moreover, these same geologic conditions are believed to maintain over considerable areas not yet prospected. These facts augur well for the future of the district in spite of the fact that it contains as yet (1912) no single shipping mine.

Auriferous gravels have been found at several localities in the region, and have been mined in a small way on a tributary of Clark Lake and in the Mulchatna basin lying to the west. The region lying between Lake Clark and the Kuskokwim is practically unexplored, except by prospectors, who report the finding of some placer gold.

The mineral resources of the Innoko-Iditarod region, including the developed placer gold deposits and the prospective auriferous lodes and quicksilver deposits, have already been described in the account of the Seward route (see p. 87). Reference should also here be made to the fact that this gold-bearing belt seems to extend southwest, where it includes the gold placers of the Anniak River and of Goodnews Bay. This indicates the possibilities of future gold discoveries in this region.

Some petroleum seepages have long been known in the Inniskin and Oil Bay region, lying adjacent to and northeast of Iliamna Bay. Here three wells were drilled, in all of which some oil was obtained. Operations were suspended in 1904, and no production of oil has been made. The information at hand indicates that this is a refining oil with a paraffin base. The geologic structure, so far as known, is not unfavorable to the occurrence of oil pools.

There is no definite information of the presence of coal in the region which would be opened up by the proposed railway from Iliamna or Inniskin Bay. It seems unlikely that any coal will be found in the Iliamna region. There is some hope of finding lignitic coal in the eastern part of the Kuskokwim basin, but no definite evidence of its presence. A little lignitic coal has been found in the western part of the Innoko basin, but there is no assurance of its being of commercial importance. Some bituminous coal occurs on the lower Yukon near Nulato, but the evidence at hand from the small amount of development accomplished indicates that it may be too much disturbed to assure profitable exploitation.

Water power.—No water powers have been developed in the Iliamna region, but the possibilities of such development are considerable. The largest known power is on the Newhalen River, draining Lake Clark. This stream falls about 120 feet in a comparatively small stretch, where it traverses a rock canyon. Among other power possibilities which deserve mention are those on the Tazimina and Kontrashibuna Rivers. As both streams are fed by lakes, they give promise of a steady flow. The outlets of the lakes which lie between Cook Inlet and Iliamna Lake probably also include water powers. There is, therefore, good reason to believe that hydroelectric power could be obtained to operate a railway between Iliamna Bay and Lake Clark.

Timber and agriculture.—The Iliamna region is only scantily timbered. On the Cook Inlet side of the divide there is no timber, and in the lake region to the west the forests are limited to only a part of the bottom lands lying below 1,200 feet in altitude. Of the region tributary to the lakes probably only about 10 per cent is forested. Spruce and birch are the prevailing types of timber, but the stand is not heavy, and individual trees, even in favored localities, seldom exceed 12 inches in diameter.

There has been practically no farming in the Iliamna region, but undoubtedly potatoes and other vegetables, as well as the hardier grains, can be grown here as in other parts of Alaska. Grass lands are widely distributed but occur in no large areas. Parts of the region might furnish stock ranges, but these appear to be rather limited in extent.

In the absence of information to the contrary, it can be assumed that the region to the westward is probably of the same type as regards forests and grass and agricultural lands. The forest of the central Kuskokwim River is not heavy, but good timber is locally obtainable. There are also some good grass lands in scattered areas. Much of the Innoko-Iditarod region is untimbered, but there is considerable grass. While the agricultural possibilities are probably not great, yet potatoes and other vegetables have been successfully raised in the Iditarod region. Excellent gardens have long been in existence at several of the missions on the lower Yukon. With the population attracted by mining, the latent agricultural and grazing possibilities of this Province would undoubtedly be utilized.

There are extensive reindeer pastures in this region. The reindeer moss occurs not only in the untimbered part of the region, but also in the open areas included within the forested areas. A government reindeer herd has been established near Iliamna Lake. There are also very extensive reindeer pastures in the lower Kuskokwim Valley and in the adjacent portions of the Yukon Basin.

Fisheries.—The proposed Iliamna Railway would pass within about 100 miles of Bristol Bay, one of the most important centers of the salmon-canning industries in Alaska. A branch line to Bristol Bay could be constructed on water grade and at very low cost. As Iliamna Bay is about 1,530 miles from Seattle by direct ocean route, Bristol Bay about 2,800 miles, it is doubtful whether any traffic could be diverted from the ocean route to such a railway. There are no salmon canneries on the Kuskokwim, but there is reported to be plenty of fish. It is possible that direct railway connection might lead to a fishing industry on the Kuskokwim. These facts indicate that the hope of obtaining any tonnage for a railway from the fisheries is possible but rather remote.

HARBORS OF SOUTHERN ALASKA.

The commission has regarded it as desirable to gather together some brief notes on all harbors considered by it in making its examination and to present them in sequence for purposes of ready comparison.

SKAGWAY.

The harbor of Skagway, 1,000 miles from Seattle, is Taiya Inlet, the straight, narrow, and deep inlet which is the northern terminus of Lynn Canal. This arm of Lynn Canal is about 14 miles long and about a mile in width. The depths throughout are exceedingly great, from 50 to 240 fathoms, and these extreme depths lie close to the shore at all points, excepting where narrow beaches are formed opposite the mouths of the streams which flow into the inlet. Excepting at these points, which are few in number, the shores are high and steep, and afford protection from winds from all directions, except up and down the inlet. The winds, however, are frequent and strong. The entrance from the sea is by way of Chatham Strait and Lynn Canal and is easy, affording ample depths and safe to vessels following the usual courses.

One of the great objections to the inlet as a harbor is its excessive depth. The nearest anchorage is in Portage Cove in Chilkoot Inlet at the town of Haines, later to be described. The tidal range is great, the mean being about 14 feet, with extreme ranges of about 21 feet. The inlet is free of ice at all times, although during the summer season small bergs of glacial origin are frequently encountered between the mouth of Lynn Canal and the open sea.

The town of Skagway is built on the flats where Skagway River empties into the Taiya Inlet, but a short distance below the head of the inlet. It derives its importance by reason of its selection as the terminus of the White Pass & Yukon Railroad, which crosses the White Pass at the international boundary, 20 miles inland, and thence reaches the headwaters of the Yukon River at White Horse. The town has about 800 inhabitants, and in the few years immediately following the Klondike rush was the most important port in Alaska. It is well provided with municipal improvements for a town of its size, and there is sufficient space in the valley for increase to a considerable extent.

There are three wharves extending from the town over the flat mud beach which reach deep water. The westernmost of these, not now used, occupies a line directing it at the headland about one-half mile south; the other two lie close to it and to the eastward and the railroad company has recently constructed along the precipitous shore a terminal for shipment of ore. These wharves are so located to protect them as much as possible from the north and south winds. All commercial vessels are required to tie to one or another of these structures, as there is no safe anchorage space near the town.

The protection of Skagway from hostile naval attack would not be difficult so far as the location of gun and mortar-batteries is concerned, Lynn Canal being a long narrow entrance affording numerous points for their location. The depths are great (generally well over 100 fathoms) and tidal currents strong, so that the use of submarine mines as an accessory would be difficult. A railroad based on Skagway would lose its importance as a military asset by reason of its location largely in foreign territory.

Haines and Pyramid Harbor.

(See Pl. III, p. 96.)

The harbor of Haines (about 1,000 miles from Seattle) is in Portage Cove, a bight on the west side of Chilkoot Inlet, near the northern end of Lynn Canal, and contains wharves now supplying the town of Haines and the military post of Fort William H. Seward. These two settlements lie on the peninsula between Chilkoot and Chilkat Inlets at a point where the peninsula is low and less than a mile wide. The head of navigation in Chilkat Inlet is directly across the peninsula from Portage Cove. The peninsula extends southward about 10 miles, where the two inlets come together, forming Lynn Canal. The entrance from the sea is by way of Chatham Straits and Lynn Canal and has been described.

Portage Cove affords about 1 square mile of anchorage and is well protected from both sea and land gales. The frequent heavy seas caused by winds blowing up Lynn Canal are not only broken up by the comparatively shallow water caused by the submerged beach of the Katzehin River some 3 miles south, but the cove itself is sheltered behind the highlands to the southward. About 1 mile north of Portage Cove there is a similar bight with a lesser anchorage area. The land winds from Taiya Inlet only rarely cause much disturbance in either of these coves, both of which have been proposed for use for terminal structures. The tidal range is great, the mean being about 13 feet, with extremes of about 20. The harbor is ice free at all seasons.

Portage Cove and the small cove to the northward have been proposed as the terminal port for a railroad to the interior via the Chilkat River, which flows into Chilkat Inlet to the westward of the peninsula. The town of Haines, with a population of about 450, and the military reservation, on a portion of which Fort William H. Seward is located, occupy a large portion of the available space which would be necessary for the development of a city of any size, and a good wagon road now leads up the Chilkat Valley into the interior. There is ample space in Portage Cove for the development of a combined naval and commercial coaling station. Such a station would, however, have to be supplied by coal from the sea, there having been as yet no suitable coal deposits located along the line of the proposed railroad leading into the interior.

Chilkat Inlet, on the west side of which Pyramid Harbor is located, offers itself as a harbor for a terminal for this same railroad. The head of this inlet is occupied by a long mud flat, submerged at high tide, formed by the discharge of the Chilkat River, but between these flats and Pyramid Island and in the inlet for a short distance south of this island there exists an area of good anchorage of approximately 2

square miles, well protected from winds from all directions except the southerly gales from Lynn Canal and the land winds making down from Chilkat Valley. The swell from the winds from Lynn Canal is, however, broken up by the narrowness of the inlet at its mouth, and it is believed that this anchorage area offers a harbor which would never be dangerous to large ships, although possibly inconvenient when the winds from either of these two directions are high. The entrance from the ocean is the same as for Haines and Skagway. The tidal range is large, about 14 feet mean, with extreme ranges of about 21 feet. The inlet is free from ice at all times.

The shore on the east side of the inlet (the west shore of the peninsula) offers sufficient space for the development of the necessary terminal structures for the railroad into the interior via the Chilkat River. The same space could be utilized for the development of a large commercial settlement if Portage Cove were used as the harbor.

The protection of Haines or Pyramid Harbor from hostile naval attack would present the same problem as has been indicated in the description of Skagway, and, as in the case of the line from Skagway, the railroad based on Haines passes through foreign territory.

Katalla.

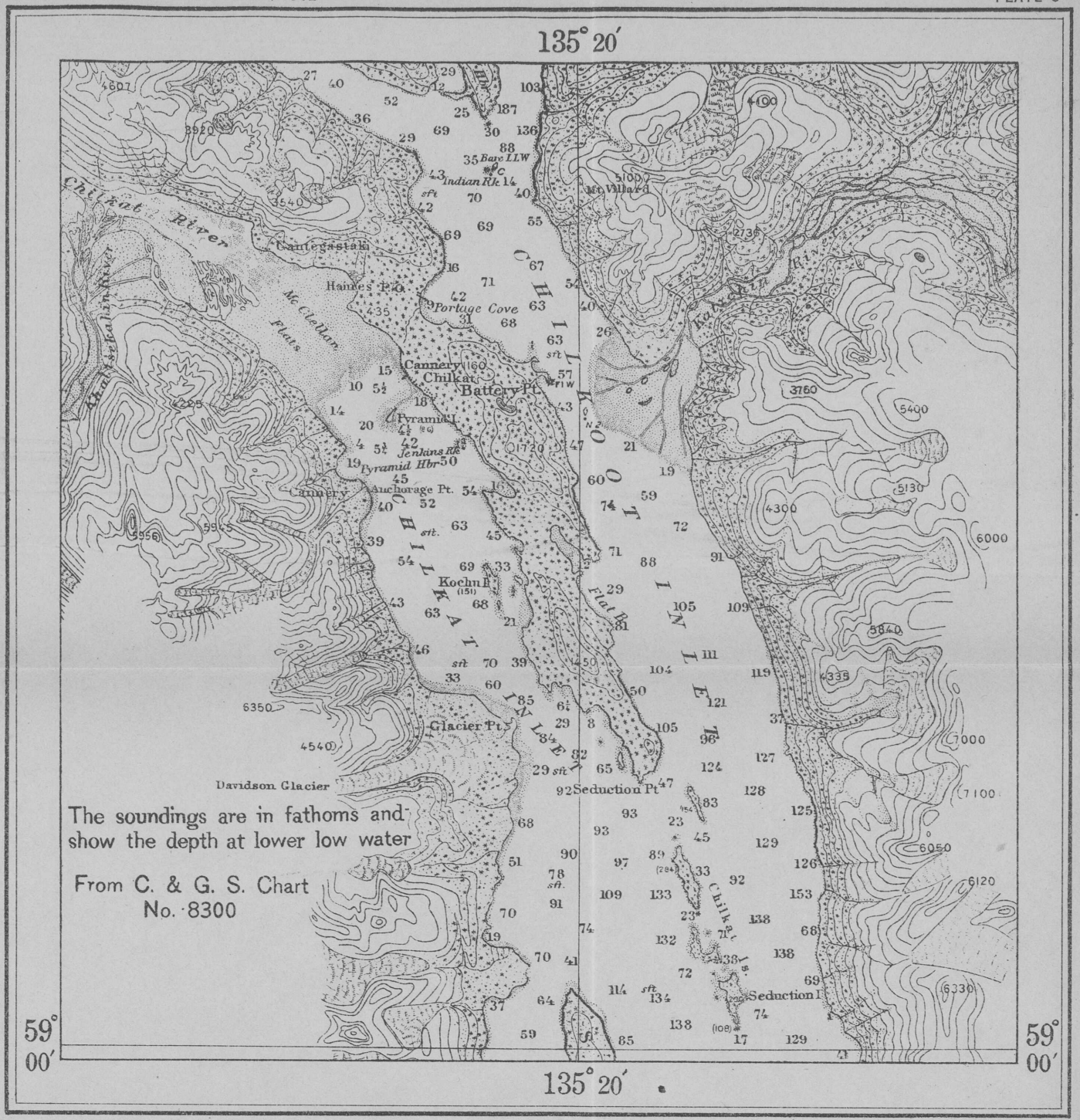
(See Pl. IV, p. 98.)

Katalla Bay (1,300 miles from Seattle) is an indentation on the south coast of Alaska a short distance west of Controller Bay and about 16 miles east of the mouth of the Copper River. It is merely a bight in an unprotected foreshore open to the ocean swell from southerly storms, and in its natural state is entirely unsuitable for the shipment of coal or ore. From October to January storms are frequent and severe, and during the remainder of the year, while they are less frequent, it is at times necessary for vessels to pass without attempting to discharge freight or passengers.

The bay has moderate but sufficient depths and good bottom. The mean range of tide is 10 to 12 feet with extremes of 15 to 17 feet. No ice is formed in the bay and there seems no reason to fear trouble from ice if a harbor were created, which could be done by the construction of suitable breakwaters. (See p. 54.)

The town of Katalla came into importance about six years ago, when this point was selected by the Copper River & Northwestern Railway Co. as the terminal for its proposed railway leading from the coast up the Copper River to the Kotsina-Chitina copper district, and also for the branch leading to the Bering River coal fields about 31 miles inland. Construction was started, shops were erected, and plans made for building a breakwater based on Palm Point, but the company finally abandoned all work, and decided to construct its terminal at Cordova and to reach the coal fields by a branch from the Cordova Copper River line. (See p. 68.) At about the same time the Alaska-Pacific Railway & Terminal Co. started work on the creation of an artificial harbor on the west side of Martin Island, but their work was also abandoned during the controversy over the coal patents. (See p. 54.)

As a result Katalla has been almost deserted, there being now but about 150 inhabitants, whereas six years ago the town was the scene



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CHART OF HAINES AND PYRAMID HARBOR AND APPROACHES

Statute Miles

5 4 3 2 1 0 5

Nautical Miles

5 4 3 2 1 0 5

House Doc. 1346; 62d Cong., 3d Sess.

of considerable activity. The shore is, however, suitable for the construction of a town and terminals and there is sufficient and convenient dockage room. Coaling berths could be provided by construction of one or more spurs from the shore arm of the breakwater or could be based on the shore behind Palm Point.

The construction of an artificial harbor at Katalla would be difficult and expensive both in construction and maintenance, and service to shipping would never be as satisfactory as could be had in several of the harbors that are open into the inland bodies of tide water. The commission has no data as to littoral sand movement, which if it occurs would be a serious menace, and no construction would be justified without assurance that such movement is not considerable.

Katalla lies directly on the coast without any advanced stations available for sites for batteries for protection against naval attack.

Controller Bay.

(See Pl. IV, p. 98.)

Controller Bay (1,300 miles from Seattle) is a shallow bay about 30 miles eastward from the mouth of the Copper River. It is protected from the sea by Kanak Island and Okalee Spit, both low sand spits, and by Kyak and Wingham Islands, with considerable relief. To the north lies the mainland, a treeless coastal swamp traversed by numerous winding streams and broken near the sea by tidal inlets. The bay is a large shallow body of water largely occupied by mud flats, and having a deep channel reasonably permanent in position extending from the easterly portion of the bay to the open sea, which it reaches between Kanak and Wingham Islands. This channel, called Okalee Channel, is about 3,000 feet wide (between 5 fathom contours at low tide) from Kanak Island outward to the sea. From Kanak Island inward its width is not over 2,000 feet, and a short distance inside this island it takes a widely sweeping bend to the eastward and extends with good depths and gradually narrowing widths for about 3 miles. This inner portion of the channel is about 3 miles from the mainland, and is believed to be sufficiently protected from ocean swells. Just north and east of Kanak Island there is a smaller channel of about 20 feet in depth, which brings into Okalee Channel a portion of the tidal discharge from the western end of the bay and of the flow of the Bering River, which enters the north end of the bay, contributing its discharge to reinforce the ebb. A portion of the discharge of this section of the bay, however, reaches the ocean through the shallow strait called Strawberry Channel, which lies between Kanak Island and the mainland to the north.

Okalee Channel is maintained mainly by the tidal discharge of the big bay, the material of the bottom being the fine glacial silt brought in by the streams draining the glaciers to the northward. If the channel were marked with buoys, as is usual in commercially developed ports, entrance could probably be made in any weather except the heaviest gales.

Outside of the bay and near the entrance to Okalee Channel from the sea, close to the shore of Wingham Island, is a narrow but deep annel offering shelter from westerly gales. The entrance to Con-

troller Bay is from the southwest, but smaller craft can enter at high tide by the channel between Kyak and Wingham Islands.

Controller Bay was first investigated some 10 years ago as a possible outlet for the Bering River coal, which lies directly behind the bay and about 25 miles distant. Since that time, when little was known of it, it has been charted by the Coast and Geodetic Survey.

Structures for utilizing Controller Bay as a terminal port would offer the choice of two general plans. One plan is to reach the north side of the estuarial channel by building across the 3 miles of tidal flats and shoal water between the north shore of the bay and this channel. The alternate plan would require the construction on the northeast side of Kanak Island of a wharf extending out to the arm of the main Okalee Channel, but not to that channel itself. The mainland from this structure could be reached either by a construction across the mud flats from the mainland east of the mouth of the Bering River to the north side of Kanak Island, or by a causeway to be built across the shallow Strawberry Channel toward Katalla. (For more detailed description of these works see p. 56.)

As previously mentioned, the commission was unable to visit Controller Bay on either of the two occasions when it was attempted, on account of the weather conditions. Such observations as were possible from a distance were made on September 25, when a strong northeasterly wind was blowing off shore. The headlands of Kanak and Wingham Islands were easily made out, as was the Okalee Channel entrance. A heavy surf was observed to be breaking over Strawberry Point, Kanak Island, and the shallow channel between.

The principal objections to Controller Bay as a terminal are four:

(*a*) The deep-water channel is from 3 to 4 miles from the mainland, approach being over soft mud flats of glacial silt with winding, shifting channels, the bank of the channel itself being quite steep. The depth of this soft mud is not known, and the cost of structures based on this long mud flat can not be safely predicted without more data.

(*b*) It is known that at times, though not every winter, heavy ice is formed on these flats from the fresh-water discharge of the tributary rivers, and this ice in breaking up under action of the tidal currents and the swells created by storms would doubtless seriously damage any such structures as pile wharves on the flats besides interfering with navigation. It is reported that this ice has at times attained a thickness of 6 feet.

(*c*) The harbor has absolutely no anchorage outside the limits of the channel.

(*d*) There is no suitable place for development of a town.

In addition to these grave defects, the construction of any permanent wharf structure across the mud flats to reach the channel or to reach Kanak Island would doubtless cause variations in tidal flow such as to seriously change channel conditions. The bay also has the disadvantage of being directly in the path of the heaviest winds blowing from a northerly direction off the glacial masses immediately adjacent. These winds are common during the winter and often attain excessive velocities. Shipping, if ever developed to any commercial importance, would suffer considerably during such weather. Observations made during the survey of the bay by the Coast and Geodetic Survey indicate that the tidal currents in the

CHART OF KATALLA AND CONTROLLER BAYS AND APPROACHES

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The soundings are in fathoms and show the depth at lower low water

From Coast and Geodetic Survey Chart No. 8513

channel are as high as 4 knots an hour, and this current with a following wind would doubtless give considerable difficulty to shipping at anchor. It should also be stated that none of the large fighting ships of the Navy would ever be brought into Controller Bay and that any arrangement for coaling war vessels would involve lightering into the open sea outside.

The defense of a harbor at this point against hostile naval attack would not be as simple as if the bay were not immediately on the coast. It could, however, be effected by location of gun and mortar batteries on Wingham and Kanak Islands with submarine mines as an accessory defense at the mouth of Okalee Channel.

CORDOVA.

(See Pl. V, p. 100.)

The harbor of Cordova (1,400 miles from Seattle) is formed by the deep indentation in the east shore of Prince William Sound known as Orca Bay, and is protected from the sea by the highlands of Hawkins Island and the low, shallow straits between this island and the mainland west of the mouth of the Copper River.

The harbor is completely landlocked and is said to be perfectly safe in all weather. Strong northeast winds blow at times from the opening in the mountains at the head of the bay and also from the opening in the hills at the foot of Eyak Lake. These winds are known to have reached a high velocity at times, but ships anchored close in to the shore of the inlet above Cordova are protected from them by the shore bluffs.

Prince William Sound is entered from the Pacific Ocean by the passage between Hinchinbrook and Montague Islands or from the southwestward by one of the passages west of Montague Island. The passage from the entrance to Orca Bay is a fine roadstead of ample depth, and when fully provided with aids to navigation will be safe for vessels following the usual courses. The harbor is ice free at all times.

The entrance to the harbor is by Orca Bay from the northward, through the narrows between Channel Island and Salmo Point, rounding North Island with a sharp turn about 5½ miles north of Cordova. In addition, there is a cut-off channel between Salmo and Knob Points of Hawkins Island and North and Observation islands. This channel is used by vessels of 2,500 tons and less, but is narrow and has only 3 or 4 fathoms of depth at low water at its eastern outlet. It could be improved, if necessary, by dredging, which would be inexpensive unless rock reefs were developed. All entrance channels are fairly well lighted and buoyed after Hinchinbrook is reached, there being on that cape an excellent second-order light and fog signal.

There is no good anchorage ground in the north arm of Orca Bay or in the broad bight at the head of this bay. There is, however, about three-fourths of a square mile of water from 5 to 8 fathoms in depth north and east of North Island; a stretch of good roadstead 4 miles long by one-half mile in Orca Inlet northward from Cordova, approximately 1 square mile of proper depth, but with hard sand bottom between Hawkins and Observation Islands; and for vessels of medium

draft 2 square miles of good anchorage on the Hawkins Island side of the inlet opposite Cordova. There are therefore nearly 4 square miles of anchorage area for large vessels. South of Cordova the entire inlet is occupied by shallow mud flats, a portion of which near the shore is suitable for easy reclamation for industrial development.

The mean range of tides is 13 feet with an extreme of 15 feet, although the inhabitants of the town state that the average exceeds these figures and the extreme may have gone as high as 27 feet. The tide reaches the bay both by way of the sound and through the shallow channels between the inlet and the ocean, and in times of flood there is a lag of about 15, minutes, the inlet flooding earlier. This gives rise to the heavy rip at flood tide which occurs off Salmo and Knob Points, but it is understood that this rip causes no inconvenience to any except the smallest craft unless aggravated by a strong northeast wind.

The town of Cordova lies on the foothills of the rugged mountain bluffs on the east side of the southern end of Orca Inlet and just north of a small shallow embayment making in toward Eyak Lake. The town site is rugged, ranging in elevation from 50 to 200 feet, and is restricted in area. There is slight room for expansion in the flats eastward of the town and west of Eyak Lake, none whatever to the northward. If it should be developed into an important terminal and grow into a large city, the flats in the embayment near the present town would doubtless be occupied by smelting plants and the commercial growth would probably occur by building out on the flats to the southwestward. A main channel could be dredged along or near the line of present deepest water near the Hawkins Island shore, and in the flats berths for shipping could be formed, with space between for commercial development. The space behind would be easy of reclamation for use as a business section. Across the inlet the rolling shore of Hawkins Island affords space for a large and economic development for growth into a city.

The town has reached its present importance by reason of its selection as the terminus of the Copper River & Northwestern Railway. It has about 1,100 inhabitants and has had more, and is well provided with improvements for a town of its size.

The business of the Copper River & Northwestern Railway is handled over a substantial pile and timber wharf 80 by 700 feet, located about a mile north of the town. The track between the town and the wharf follows the bluff shore line through light rock cuts supplemented by occasional trestles, and is developed on the wharf by three service spurs run out from the stub of the main track. The wharf is protected from the occasional northeast winds by the bluffs to the northward.

There are five practical locations for coaling stations designed for combined naval and commercial use:

(*a*) At the head of Orca Bay on the flats known as Nelson Townsite.

(*b*) In the bight between Salmo and Knob Points of Hawkins Island.

(*c*) On the east side of Hawkins Island opposite Cordova.

(*d*) On the sand spit on the east side, 1 mile north of turning buoy.

(*e*) In the small bight just adjacent and north of the present railroad wharf.

The first of these locations has no adjacent anchorage ground and is open to the objection of lying in the track of the northeast winds;

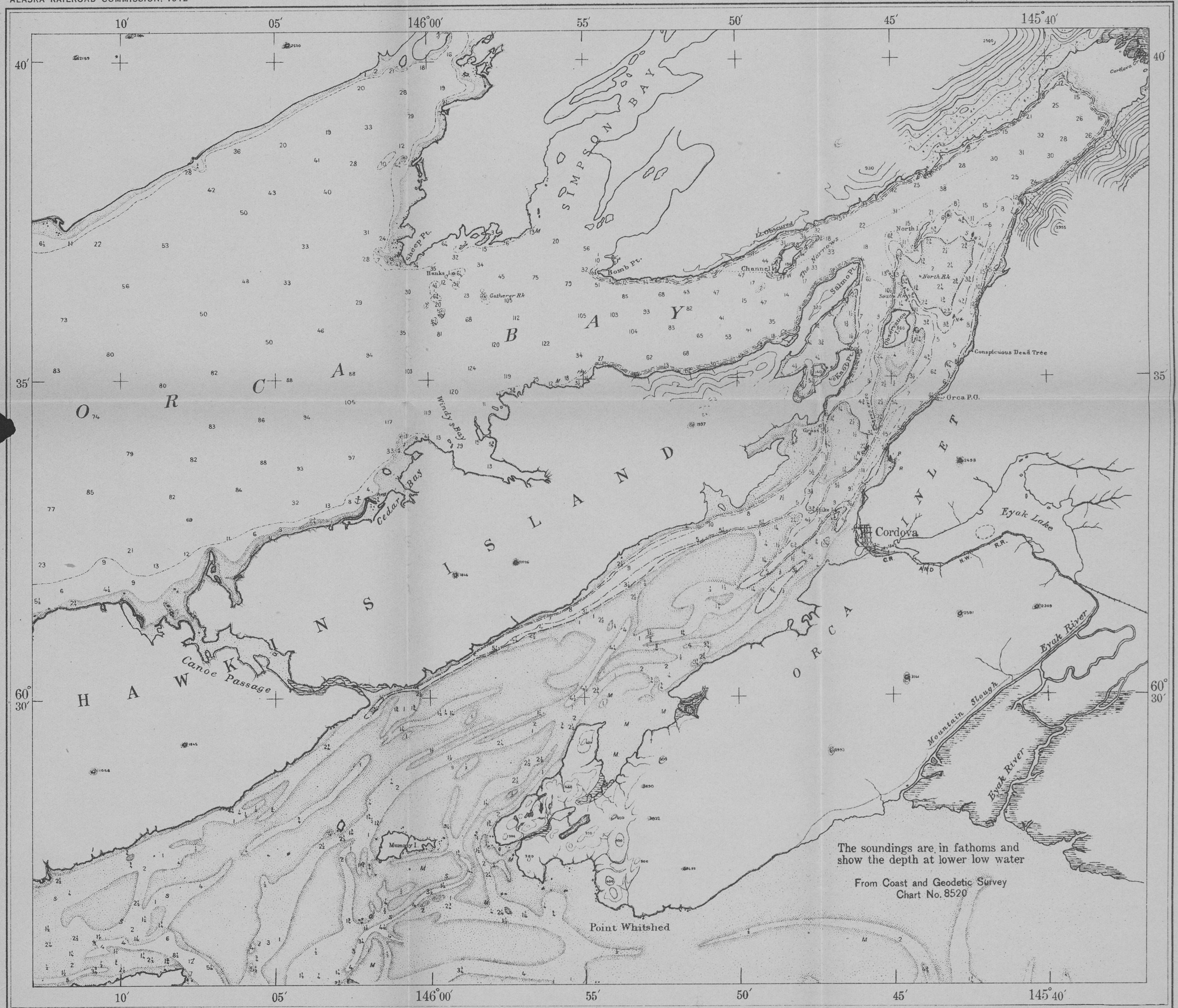


CHART OF THE HARBOR OF CORDOVA AND APPROACHES

Statute Miles

Nautical Miles

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its principal objection lies in the fact that it would involve the construction of 10 miles of railroad, 90 per cent of which would be heavy rock cliff work, costing probably as much as $75,000 per mile. Locations *c* and *d* would make ideal sites for naval purposes, but would necessitate a steel bridge, 1¼ miles in length, across Orca Inlet in order to provide railroad service. The north end of Hawkins Island is covered by rather high, rounded knobs with comparatively low shore bluffs. Location *b* is, in many respects, the best, but this site also involves heavy railroad construction in steep rock cliffs. It is estimated that railway connection with this site would cost in the neighborhood of $500,000. All things considered, site *e*, just north of the steamship wharf, appears to be best adapted to the requirements of the problem and to the limited first cost necessary to a new project. This bight or cove is about 3,000 feet in length by some 400 feet in width. The bottom is said to be soft sand and mud, and the water is shallow out to the chord limiting the bight, where the depths increase to from 5 to 11 fathoms with good anchorage bottom. The inclosed space when improved by filling would comprise about 20 acres of land and afford ample room for a 1,000-foot foreshore, 100,000-ton storage coaling plant, together with a limited number of shops for a small naval repair station. The railroad now reaches this site. There is an upper bench just back of the shore bluffs which would protect the site from snow slides, and the bluffs at the north of the bight would afford protection from the northeast winds.

The port could be easily fortified against naval attack. In case it should be considered desirable to defend the entire Sound from attack, advanced sites for batteries could be found to defend the channels east and west of Montague Island. Locations farther in, defending Orca Bay alone, can be found sufficing to keep warships beyond bombarding range of the military and commercial interests at Cordova. Depths in the channels in Orca Bay are, however, so great (from 100 to 150 fathoms) that the use of submarine mines as an accessory defense would be difficult.

It should be noted here that the railroad based on Cordova would be subject to a flank raid by an alert naval enemy, using Katalla or Controller Bay as a landing point. Such a raid would be much easier of execution should the coal extension into the Bering field be located via Katalla than if the Lake Charlotte route be followed. Should the offensive operation succeed in penetrating to the main line, the destruction of one of the large steel bridges would suffice to seriously hamper operations for a considerable length of time. If necessary, however, defensive measures could be devised to prevent such action.

VALDEZ.

(See Pl. VI, p. 102.)

In the harbor of Valdez (1,420 miles from Seattle) is Port Valdez, a deep indentation forming one of the northerly extensions of Prince William Sound. It is about 10 miles long by 1 to 3 miles wide, is completely landlocked and protected from all winds excepting the shore winds either off the Valdez Glacier or down the valley of the Lowe River. These winds are at times severe. The entrance to Prince William Sound has already been described. The passage

from the entrance to Valdez is clear until Valdez Narrows is reached, about 10 miles from the town of Valdez. Here a reef lies almost in the middle of the narrows; but it is now marked with a beacon, and its passage is not attended with any danger.

The upper end of Port Valdez is fringed by a wide mud flat, submerged at high tide, the beach of which is steep. The harbor has a very restricted anchorage area, there being about 3 square miles on the beach of this mud flat where anchorage is possible but the depths are excessive (up to 50 fathoms), the shore steep, swinging room restricted and the anchorage almost impracticable in the east winds. The mean range of tide is about 10 feet, with an extreme of about 15 feet. Although it has been reported that the harbor has been frozen over on the mud flats near the town, it is believed by the commission that it can be regarded as an ice-free port.

The town of Valdez lies at the head of the arm and is the most northerly ice-free port in Alaska. The town is situated on the delta of the Valdez Glacier, about 5 miles northeast. Valdez has about 1,500 inhabitants, including those on the old military reservation adjacent to the town. Built as it is on the glacial overwash, it has been subject to several more or less disastrous floods annually, by reason of changes in the channels of the glacial stream. Its location at this point is due to the fact that in the gold rush of 1898 one of the trails toward the interior led over Valdez Glacier, and one of the earliest rushes of prospectors was to this point. A few years later, when the Fairbanks district became known, the present military road, then a trail, was established with this as its coast terminus.

The shores of Valdez Arm are generally precipitous and very high. The entire large flat that could be used in the expansion of the town of Valdez is on the delta of glacial streams, so that growth at this point would be attended by increasing difficulties as the size of the town increased.

There are two other points available for use for town purposes. One of these is a small, low-lying plain on the south side of the arm about 3 miles southwest and is now occupied by the military post of Fort Liscum. Almost directly opposite, at the mouth of Mineral Creek, is a possible location for a town of considerable size. This town site, called Port Valdez, has been patented, with the exception of a small area at its eastern end. There is here a considerable area suitable for development for business or residence purposes. There are no improvements at the present time except a wharf, and this is exposed to the strong easterly winds.

The town of Valdez is well provided with all municipal improvements necessary for a town of its size, and there is in the hills closely adjacent ample water power for further development in case of growth. The town is provided with two long wharves extending across the mud flats to deep water. One is owned by local interests and the other by the town. In addition to this, a wharf reaching deep water from a point northward of the town was constructed by the Valdez-Yukon Railway Co., but is now in bad repair and not in use.

In case of the selection of Valdez as coastal terminal for a railroad system, it would appear that the best opportunity for development would be at the site of Port Valdez, which would be easily reached by an extension of the railroad across the flats on the north side of the end of the arm. This location could be utilized for the development

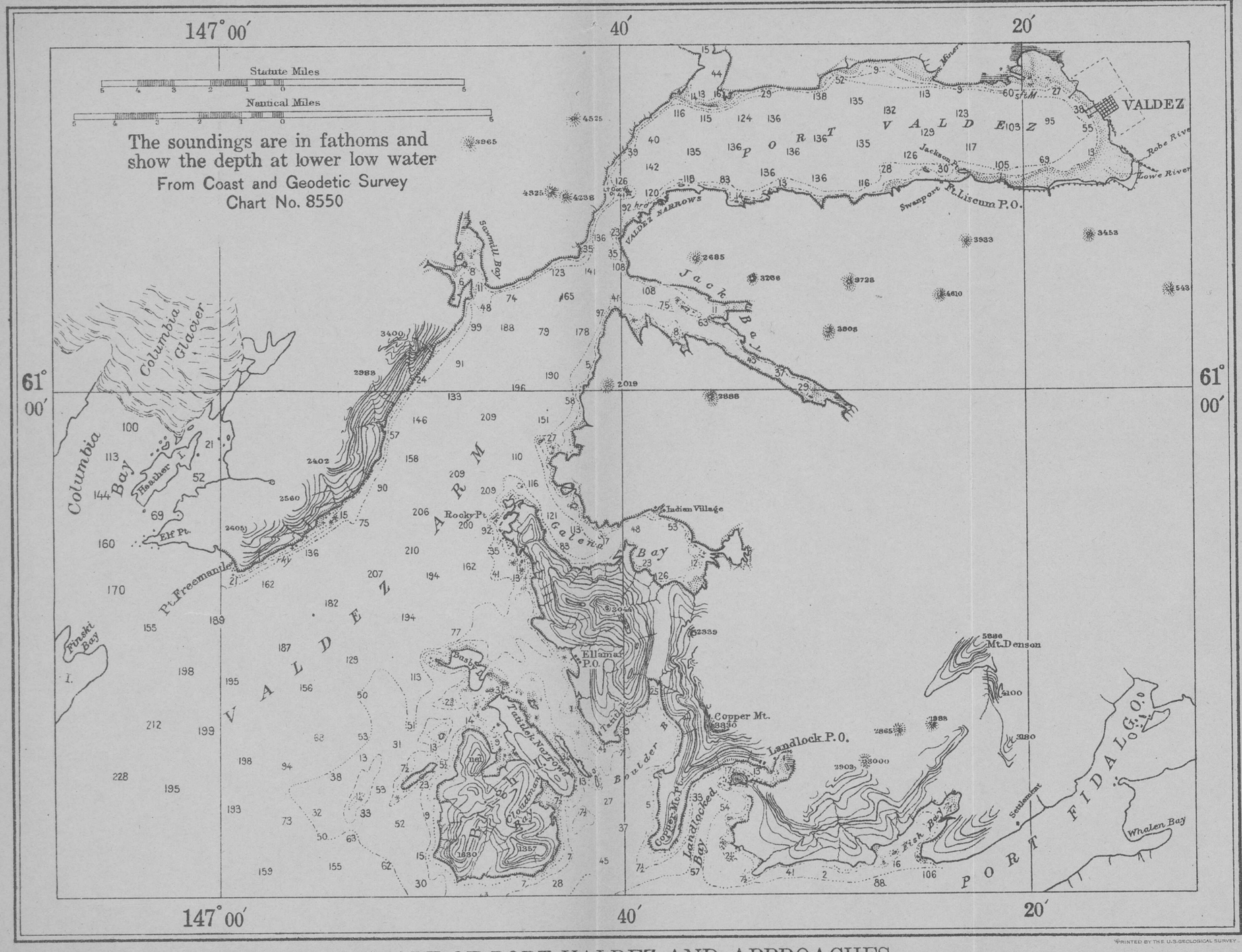


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of a combined commercial and naval coaling plant, in the rather remote contingency that the Matanuska fields should find an outlet with Valdez as a port.

The defense of this port against naval attack would not be difficult so far as construction of gun and mortar batteries is concerned, but the depths both at the outer entrances to the Sound or at any inner line in Valdez Arm for the defense of that port alone are so great (from 100 to 150 fathoms) as to make a defense by submarine mines difficult. It should, however, be observed that any railroad running to the interior from Valdez would be less vulnerable to a flank attack by a raiding party than a railroad based either on Cordova or Seward.

SEWARD.

(See Pl. VII, p. 104.)

The harbor of Seward (1,420 miles from Seattle) is Resurrection Bay, a large embayment in the Kenai Peninsula, about 170 miles westward from the entrance to Prince William Sound. The bay is about 16 miles long from Cape Resurrection, and entrance is easy. Depths are great throughout the bay, and without any dangers near the usual courses of vessels entering or leaving. Shores and islands are high and steep, affording protection from gales from all directions except southeast winds, and seas from this direction are broken by the islands at the entrance. These southeast winds and land winds from the north give trouble to shipping at times.

A flat one-half to three-fourths of a mlle in width, submerged at high tides, extends entirely across the northern shore, and the beach in front of it affords a small anchorage area in favorable weather. This anchorage affords scant swinging room and can not be used with safety either in southeast winds or winds off shore.

The main range of tide is about 8½ feet. The bay is always free of ice. The principal objection to the bay as a harbor results from the excessive depths of water (from 100 to 200 fathoms). The only really satisfactory anchorage is at Sunny Cove, a small bay in Renard Island, about 14 miles from the town of Seward, and only just inside the entrance to the bay. This cove furnishes an anchorage area of about a half square mile.

The town of Seward (population about 500) lies on the east shore at the northerly end of the bay, and is the terminus of the Alaska Northern Railroad, which runs north from the town through a low plain of considerable extent and well timbered. The town occupies the bench at the foot of the steep hills on the west side at the head of the bay. Practically all the water front has been granted for the use of the railroad. The town has been recently incorporated and is provided with all necessary conveniences, having a good water supply from a small stream in the nearby hills, and an electric plant whose hydraulic power is similarly derived. It is believed that there are other streams within reasonable distance that could be used to extend both these services. There is abundance of room in the timbered plain to the north to provide for expansion of the town, and the mud flats offer opportunity for easy reclamation for commercial purposes.

The railroad runs through the town close to the shore of the bay, and reaches the only wharf with 25 feet of water at its face at the south end of the town. The face of this wharf is normal to the action

of southeast winds and when these winds are strong vessels find difficulty in lying at the wharf. This wharf is owned by the Alaska Northern Railroad Co.

A reservation for naval purposes has been made in the valley at Lowell Point, about 1½ miles south of the town. To reach this an extension of the railroad would be required along the steep rocky bluffs just south of the town. If this were done this steep shore might be utilized for a commercial coaling development, or a combined naval and commercial coaling plant could be built either on the east front of the present town or at the foot of the hill directly opposite. At either of these last two sites an economical development could be made of a combined naval and commercial coal bunker affording a bin capacity of 10,000 tons, with a shore connection capable of handling about 1,500 tons daily. A combined plant of 1,000 foot foreshore affording a naval storage of 100,000 tons would, however, have to be developed either on the east front of the town or at the naval reservation at Lowell Point, neither of which is protected against heavy southeast winds.

The topography at the entrance to the bay seems to be entirely adaptable for the development of an adequate defense against naval attack so far as suitable location of batteries is concerned. Depths throughout are, however, in excess of 100 fathoms which would make submarine mine defense impossible.

It should here be noted that the railroad based on Seward would be subject to a flank raid by an active naval enemy using Cook Inlet as its line of operations. If necessary, however, defensive measures could be devised to prevent such action.

Knik Harbor (Ship Creek), Cook Inlet.

(See Pl. VIII, p. 106.)

Knik Harbor, sometimes called Ship Creek, in Cook Inlet (1,650 miles from Seattle) has been suggested as a possible summer terminal for the Matenuska coal, the location of the Alaska Northern being on the plain behind and about 7 miles from this point. The saving in haul would be about 115 miles, and it may be observed that the worst part of the haul, from the operation viewpoint, would be avoided by the use of this terminal.

Knik Harbor is a bight on Knik Arm of Cook Inlet, about 20 miles below Knik, and is now used by vessels of size up to 2,500 tons as the lighterage point for supplies for Knik and the Susitna River. It is a small bight, affording about 1 square mile of anchorage area, and is well protected from swells, but is somewhat exposed to southerly winds.

Entrance from the sea is by Cook Inlet, which affords a good channel of approach with ample depths in the channels, except across a wide bar a few miles below Knik Harbor, where vessels drawing 25 feet or more might ground at low tide. Tidal ranges are exceptionally large, and currents strong, especially above East and West forelands (about 60 miles below Knik Harbor). This extreme tidal range and the strong currents in the upper part of the inlet operate to keep the waters muddy from suspended glacial silt and to create swirls and eddies even in deep waters, thereby exaggerating the dangers to navigation.



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The mean range of tide is about 30 feet, with extremes of about 40, and with the larger floods the tide comes in as a bore. Currents are as high as 5 miles in places and navigation is difficult and to some extent dangerous. In the portion of the inlet opposite the mouth of Turnagain Arm, this great tidal movement, especially when the severe winds are blowing out of this arm, causes a bad tide rip and a heavy sea, making navigation difficult, especially for smaller vessels. For the same reasons at certain stages of the tide similar conditions exist at the entrance of Cook Inlet from the sea.

Knik Harbor is now used in the summer season by smaller ocean vessels and no serious trouble is encountered. It is believed that larger vessels could navigate the channels, but that a coaling station at this point would not be used by the larger ships or colliers of the Navy.

The upper portion of Cook Inlet is filled with floating ice throughout the winter months, from November till late April, and navigation during this season would be impossible. The tidal movement, strong currents, and winds, with this field of ice, would enforce the most substantial construction upon any wharf structure expected to withstand its action.

HARBORS IN COOK INLET.

The lower portions of Cook Inlet may be regarded as ice free the year around. The upper part of the inlet is generally closed to navigation by ice from November to the latter part of April. Ice does not generally interfere with navigation southward of Anchor Point, except on the western side of the inlet where large fields of it are sometimes carried by wind and tide as far as Augustine Island, closing the harbors here discussed for brief periods.

It has been suggested that a railroad be based on some harbor on this western shore, south of the winter ice line, and carried over the mountains to the Kuskokwim Valley via Iliamna Lake.

Three harbors need consideration and are here briefly described:

TUXEDNI HARBOR.

Tuxedni Harbor (sometimes called Snug Harbor, about 1,575 miles from Seattle) is a large and secure anchorage lying behind Chinik Island. The channel into the harbor is clear of obstructions and deep. The anchorage, of ample size with sticky bottom, has a depth of less than 20 fathoms, and is protected from all seas and from all winds except the land winds from the draws.

Unfortunately the topography immediately behind this harbor is so rugged as to prohibit a railroad across the mountains from this bay, and data would indicate that it is equally impracticable to reach the passes further south by construction along the coast.

ILIAMNA AND INISKIN BAYS.

The commission visited Iliamna Bay, using the revenue cutter *McCulloch,* and anchored there on the night of September 22, 1912, and on the following day made a reconnoissance of the bay in the ship's launch, and viewed Iniskin Bay from outside.

Iliamna Bay (1,530 miles from Seattle) is a funnel-shaped indentation in the mainland, with two minor arms. The shores are bold, high, and rocky with very little flat area. A reef makes out from the point at the southern entrance, and there is a low rocky island near the middle of the entrance and south of the channel. The bay, except at its entrance, is shoal, the 5-fathom line crossing the channel about three-quarters of a mile inside the entrance. Anchorage inside is very restricted except for vessels of light draft. The large body of water, Kamishak Bay, of which Iliamna Bay and Iniskin Bay are arms, does, however, furnish ample anchorage for vessels of any draft, and protection can be obtained from winds from any direction by using the highland of Augustine Island as a shelter.

Iniskin Bay, just north of Iliamna Bay, is a secure harbor in any weather. Its inner end has extensive flats bare at low water, and the northern half of the entrance is obstructed by a number of small islands, but there is ample channel width north of them.

A railroad leading into the Kuskokwim would have its terminus in one of these bays. At the head of Cottonwood Arm of Iliamna Bay there are two flat areas about half a mile wide, one extending back three-quarters of a mile and the other somewhat farther. Each of these areas fronts a mud flat, 1 to 2 miles wide from the shore to 1-fathom depths, and over 2 miles additional distance from 5-fathom depths. Just west of Diamond Point is a low, level tract about a quarter of a square mile in area and with about a half mile of frontage, but it also is nearly 3 miles from 5-fathom depths.

These are the only sites available for terminal structures, and dredging operations to reach across the flats might develop reefs. If not, the flats at the head of Cottonwood Arm offer possibilities of easy reclamation for extending the space available for commercial use.

Information at hand indicates that there is very restricted space for terminal structures in Iniskin Bay. If placed here, a railroad would have to be constructed along steep, rocky shores between the two bays in order to reach the head of Iliamna Bay, and the low divide across which the railroad route would be located.

The commission is of opinion that both Iliamna and Iniskin Bays are harbors more suitable for use of light-draft vessels engaged in local traffic than for deep-draft vessels engaged in large commerce.

Aids to Navigation.

In closing its discussion of harbors the commission desires to state that the snowstorms of winter and the fogs of summer make navigation of Alaskan waters hazardous. More liberal provision should be made for aids to navigation. Powerful installations are badly needed on some of the more prominent capes adjacent to the usual ocean routes.

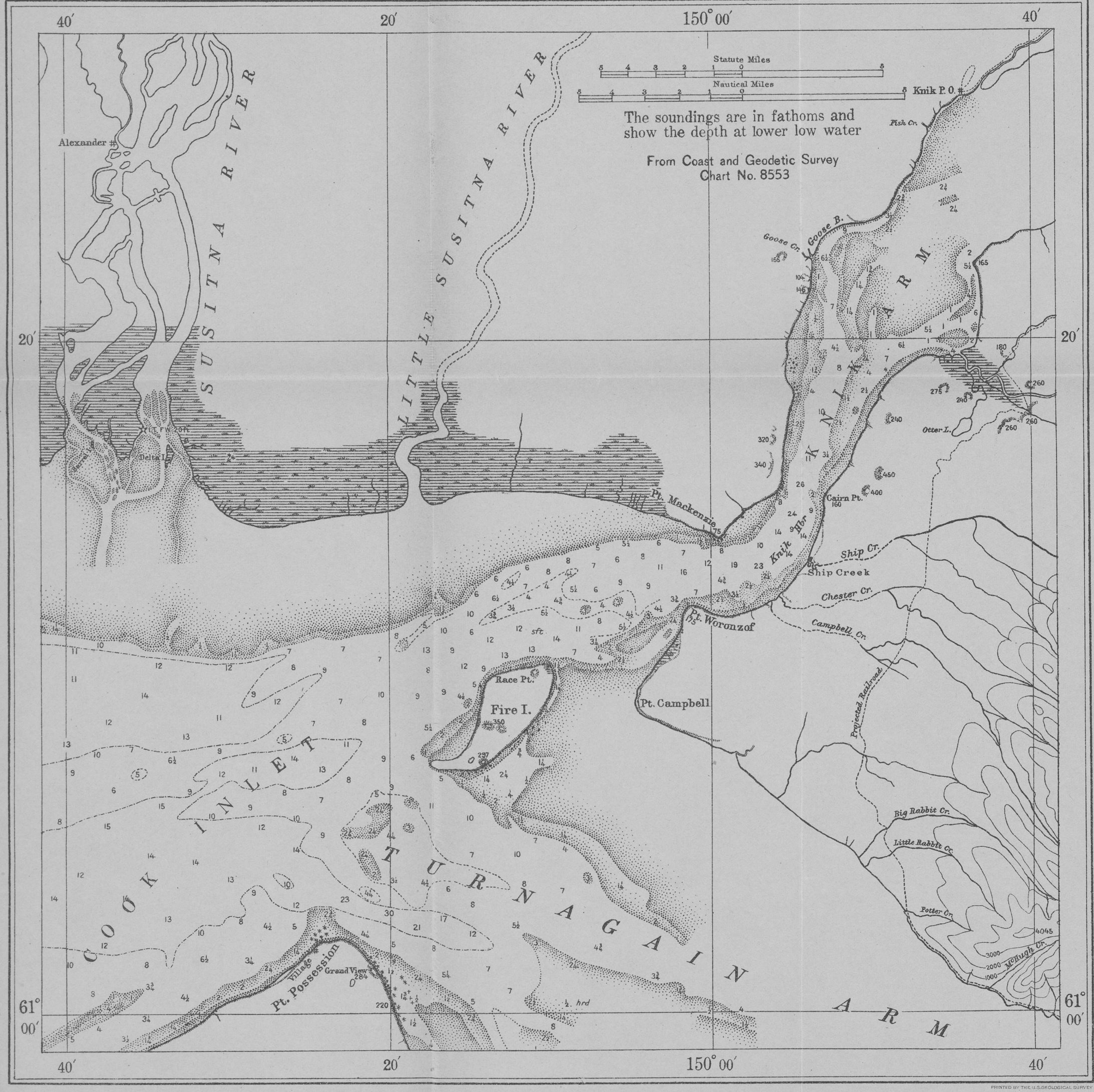


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CONSTRUCTION.

The commission has made a careful study of conditions in Alaska as regards wages, cost of materials, and freight rates. It had at its disposal the results of preliminary surveys of only a portion of the roads considered. Such surveys were lacking on many of the routes, though considerable data bearing on costs of construction were available.

The commission has prepared estimates of cost of construction of all roads under consideration. These estimates are submitted herewith in the order in which the various roads have been described. It will be observed that the cost of the line from Chitina to Fairbanks has been estimated in considerable detail. It is regretted that the other lines could not be treated in the same manner, but this was impossible on account of lack of data, and in these cases the commission was compelled to assume a cost of construction per mile comparable to that experienced in country of similar character traversed by existing lines or estimated for in the Chitina-Fairbanks line, over which the commission actually traveled.

The commission had opportunity to obtain construction results from a number of existing railroads and also to discuss costs with engineers who have had Alaskan or Canadian experience; and it was on information such as this that it based its unit prices for the various classes of excavation, clearing, grubbing, trestles and bridges, masonry work, etc. For equipment the commission assumed the number of locomotives and cars which it believed sufficient to care for the traffic immediately in sight. In all of the following estimates no allowance has been made for organization and promotion expenses.

Estimate No. 1—Haines-Fairbanks route.—This line involves the construction of 638 miles of line, starting at the town of Haines, running in a northwesterly direction through 287 miles of Canadian territory and terminating at Fairbanks.

Cost of construction of this line is estimated at	$21,284,700
Engineering and superintendence, 5 per cent	1,064,235
Terminal ground and land damages	20,000
Telephone	159,500
Contingencies, 10 per cent	2,252,844
Interest, 6 per cent on cost during one-half period of construction	2,230,315
Rolling stock plus overhead charges	1,173,920
Total	28,185,514
In round numbers	28,186,000
Average cost per mile of track	44,300

There was no profile of this line available, and the above estimate is based almost entirely upon information furnished by the engineer who conducted the exploratory reconnaissance. One member of the commission, having traveled over approximately the same route, was sufficiently familiar with the character of the country traversed to form a general idea of the cost of railroad construction.

Estimate No. 2.—Chitina-Fairbanks route.

	Quantity.	Unit price.	Total cost.
1. Right of way			
2. Clearing.....acres..	3,756	$100.00	$376,000.00
3. Earth.....cubic yards..	2,190,535	.40	876,214.00
4. Frozen earth or gravel.....do....	1,937,605	.75	1,453,205.00
5. Loose rock.....do....	89,100	1.00	89,100.00
6. Solid rock.....do....	398,925	1.60	638,280.00
7. Culverts.....miles..	313	500.00	156,500.00
8. Pile and framed trestles			977,260.00
9. Bridges (steel and masonry)			464,000.00
10. Tunnels.....feet..	945	75.00	70,880.00
11. Ties	901,440	.50	450,720.00
12. Rails (75-pound).....tons..	36,930	65.00	2,400,450.00
13. Rail sidings, laid.....feet..	110,180	2.84	312,900.00
14. Switch timbers and ties			20,000.00
15. Spikes.....lbs..	2,253,600	.05	112,680.00
16. Splice bars.....do....	4,031,440	.05	201,570.00
17. Track bolts.....do....	532,100	.07	37,240.00
18. Track laying.....miles..	313	600.00	187,800.00
19. Ballasting.....do....	300	1,000.00	303,450.00
20. Turnout and switch furnishings			30,000.00
21. Water stations	16	4,400.00	70,400.00
22. Depots	46	2,500.00	115,000.00
23. Snow fences.....feet..	93,200	.34	31,690.00
24. Snow sheds.....do....	15,845	50.00	792,000.00
25. Intermediate yards	3	40,000.00	120,000.00
26. Fairbanks yard, track, buildings, etc			260,000.00
Cost of construction			10,547,339.00
27. Engineering and superintendence, 5 per cent			527,367.00
28. Terminal ground and land damages			20,000.00
29. Telephone			78,250.00
30. Contingencies, 10 per cent			1,117,296.00
31. Interest, 6 per cent on cost during half period of construction			1,106,122.00
32. Rolling stock plus overhead charges			575,000.00
Grand total			13,971,374.00
In round numbers			13,971,000.00
Average cost per mile of track			44,600.00

Estimate No. 3—Valdez-Fairbanks route.—This line involves the construction of 101 miles of road from Valdez to the northward, where it joins the route already estimated for the Cordova-Fairbanks route, from which point to the terminus, 279 miles, the construction cost per mile is taken from estimate No. 2.

Cost of construction of 101 miles	$4,684,046
Engineering and superintendence, 5 per cent	234,202
Telephone	25,250
Contingencies, 10 per cent	494,350
Interest on cost, one-half period of construction	489,406
Rolling stock plus overhead charges	174,225
Grand total, 101 miles	6,101,479
279 miles at $44,600	12,443,400
Total, Valdez to Fairbanks	18,544,879
In round numbers	18,545,000
Average cost per mile of track	48,800

Estimate No. 4—Seward-Fairbanks route (from Kern Creek to Fairbanks).—This line involves the construction of 391 miles of line, extending from Kern Creek, the terminus of the Alaska Northern Railroad, in a northerly direction to Fairbanks. The use of the existing Alaskan Northern tracks, which run from Seward to Kern Creek, is contemplated.

Cost of construction of 391 miles	$13,382,054
Engineering and superintendence, 5 per cent	669,103
Terminal land damages	20,000
Telephone	97,750
Contingencies, 10 per cent	1,416,891
Interest on cost, one-half period of construction	1,402,722
Rolling stock plus overhead charges	719,440
Total	17,707,960
In round numbers	17,708,000
Average cost per mile of track	45,300

Estimate No. 5—Seward-Iditarod line.—This line involves 344 miles of new road, the first 115 miles from Kern Creek to Willow Creek is coincident with the Seward-Fairbanks route. From Willow Creek it runs in a northwesterly direction 229 miles to the village of McGrath on the Kuskokwim River.

Cost of the first 115 miles (estimate No. 4; this includes all overhead charges)	$5,209,500
Cost of construction of the remaining 229 miles	9,746,000
Engineering and superintendence, 5 per cent	487,300
Telephone	57,250
Contingencies, 10 per cent	1,029,055
Interest on cost, one-half period of construction	1,018,764
Rolling stock plus overhead charges	421,360
Total	17,969,229
In round numbers	17,970,000
Average cost per mile of track	52,300

Estimate No. 6—Iliamna-Kuskokwim route.—This line involves about 400 miles of road, starting at Iliamna Bay, running in a northwesterly direction and terminating at or near Piamute on the Yukon River.

Cost of construction of this road is estimated at	$17,440,000
Engineering and superintendence, 5 per cent	872,000
Telephone	100,000
Contingencies, 10 per cent	1,841,300
Interest 6 per cent on cost during one-half period of construction	1,209,198
Rolling stock plus overhead charges	736,000
Total	22,198,498
In round numbers	22,199,000
Average cost per mile of track	55,400

Estimate No. 7—Valdez-Marshall Pass—Copper River line.—This line involves 54 miles of new road. It starts at Valdez and from that town to Marshall Pass the line is coincident with the Valdez-Fairbanks route. At mile 27 this line runs through Marshall Pass, thence in an easterly direction, connecting with the Copper River & Northwestern Railroad at about mile 87 of that route.

Cost of construction of the first 27 miles	$1,507,190
Cost of construction of the remaining 27 miles	1,205,000
Total cost of construction	2,532,190
Engineering and superintendence, 5 per cent	126,610
Telephone	13,500
Contingencies, 10 per cent	267,230
Interest, 6 per cent on cost during one-half period of construction	88,186
Rolling stock, plus overhead charges	93,150
Total	3,120,866
In round numbers	3,121,000
Average cost per mile of track	57,800

Estimate No. 8—Branch from Bering River coal field to Cordova via Katalla.—This line is 93 miles long, 55 miles of which is a proposed extension. This new line connects with the Copper River & Northwestern Railroad at mile 38, and runs in a southerly direction to the town of Katalla, thence in a northeasterly direction to the Bering River coal fields.

Cost of construction of this new line is estimated at	$2,099,500
Engineering and superintendence, 5 per cent	104,975
Telephone	13,750
Contingencies, 10 per cent	221,823
Interest on cost, one-half period of construction	73,201
Rolling stock, plus overhead charges	187,000
Total	2,700,249
In round numbers	2,700,000
Average cost per mile of track	49,000

Estimate No. 9—Branch from Bering River coal field to Cordova via Lake Charlotte.—The total length of this line is 76 miles; 38 miles of which will be new road. This new line connects with the Copper River & Northwestern Railroad at mile 38, and runs in an easterly direction via Lake Charlotte to the Bering River coal fields.

Total cost of construction of this new line	$1,583,334
Engineering and superintendence, 5 per cent	79,167
Telephone	9,500
Contingencies, 10 per cent	167,200
Interest, 6 per cent on cost during one-half period of construction	55,176
Rolling stock, plus overhead charges	159,600
Total	2,053,977
In round numbers	2,054,000
Average cost per mile of track	54,000

Estimate No. 10—Katalla-Bering River coal field line.—This line involves 31 miles of road, starting at the town of Katalla and terminating in the Bering River coal fields.

Cost of construction of this line	$1,180,699
Engineering and superintendenc, 5 per cent	59,035
Telephone	7,750
Contingencies, 10 per cent	124,748

Interest, 6 per cent on cost during one-half period of construction	$41,168
Rolling stock, plus overhead charges	288,190
Total	1,701,590
In round numbers	1,702,000
Cost of terminal facilities	2,500,000
Grand total	4,202,000
Average cost per mile of track, exclusive of terminal	55,000

Estimate No. 11—Controller Bay-Bering River coal field line.—This line involves 25 miles of road, starting at Controller Bay and running in a northeasterly direction to the Bering River coal field.

Cost of construction of this line	$952,313
Engineering and superintendence, 5 per cent	47,616
Telephone	6,250
Contingencies, 10 per cent	100,618
Interest, 6 per cent, on cost during one-half period of construction	33,204
Rolling stock plus overhead charges	287,500
Total	1,427,501
In round numbers	1,430,000
Cost of terminal facilities	2,500,000
Grand total	3,930,000
Average cost per mile of track, exclusive of terminal	57,000

Estimate No. 12—Chitina-Matanuska coal field line.—This line leaves the Copper River & Northwestern Railroad at mile 132 at the town of Chitina; for 55 miles the proposed new line is coincident with the Chitina-Fairbanks route. Leaving that route the line runs in a northwesterly direction for 108 miles to the Matanuska coal fields.

Total cost of first 55 miles	$1,853,335
Cost of construction of remaining 108 miles	4,860,000
Engineering and superintendence, 5 per cent	335,667
Telephone	40,750
Contingencies, 10 per cent	708,975
Interest, 6 per cent, on cost during one-half period of construction	233,962
Rolling stock plus overhead charges	400,980
Total	8,433,669
In round numbers	8,434,000
Average cost per mile of track	51,700

Estimate No. 13—Kern Creek-Matanuska coal field line.—This line involves 187 miles of new road, starting at Kern Creek, the terminus of the existing tracks of the Alaska Northern Railroad, and terminating in the Matanuska coal fields. From Kern Creek to Matanuska Junction, 77 miles, the new line is coincident with the proposed Seward-Fairbanks route. The remaining distance of 38 miles runs in an easterly direction to the Matanuska coal fields.

Cost of construction of new work, extending from Kern Creek to the Matanuska Junction, of 77 miles, is	$2,640,353
Cost of construction of remaining portion of line, extending from Matanuska Junction to the coal fields, is	1,223,116
Engineering and superintendence, 5 per cent	193,174

Telephone	$28,750
Contingencies, 10 per cent	408,539
Interest, 6 per cent, on cost during one-half period of construction	134,818
Rolling stock plus overhead charges	316,250
Total	4,945,000
Average cost per mile of track	43,000

Estimate No. 14—Skolai Pass-White River Branch line.—This route involves the construction of 129 miles of new line starting from McCarty's, near Kennicott, on the Copper River and Northwestern Railroad, and running in an easterly direction through Skolai Pass, connecting with the Haines-Fairbanks route near the junction of the White and Donjek Rivers.

Cost of construction is estimated at	$6,750,000
Engineering and superintendence, 5 per cent	337,500
Telephone	32,250
Contingencies, 10 per cent	711,975
Interest, 6 per cent, on cost during one-half period of construction	234,952
Rolling stock plus overhead charges	222,525
Total	8,289,202
In round numbers	8,289,000
Average cost per mile of track	64,000

Estimate No. 15—Fairbanks-Yukon extension.—This route involves 115 miles of new line starting at the town of Fairbanks and runs in a northwesterly direction to the Yukon River.

Cost of construction	$3,775,000
Engineering and superintendence, 5 per cent	188,750
Telephone	28,750
Contingencies, 10 per cent	399,250
Interest, 6 per cent on cost during one-half period of construction	131,753
Rolling stock plus overhead charges	198,375
Total	4,721,878
In round numbers	4,722,000
Average cost per mile of track	41,000

Estimate No. 16—Valdez-Matanuska coal field line.—From Valdez to Mile 55 on the Chitina-Fairbanks route, this estimate is the same as the like portion of the Valdez-Fairbanks route. The remaining 108 miles to the Matanuska coal fields is the same as the like portions of the Matanuska-Chitina line.

Cost of construction	$10,255,204
Engineering and superintendence, 5 per cent	512,760
Telephone	57,500
Contingencies, 10 per cent	1,082,546
Interest, 6 per cent on cost during one-half period of construction	357,240
Rolling stock plus overhead charges	396,750
Total	12,662,000
Average cost per mile of track	55,000

No construction work should be begun until adequate preliminary surveys had been run. Topographic surveys should be made over a wide belt of the country traversed, in order that no opportunity may be lost to secure the best possible location. They could be completed in one year, and the commission is of the opinion that the railroads can be built and ready for the operation of trains within three years after the completion of the surveys and after decision as to definite location.

There have been presented to Congress measures for Government construction of railways in Alaska which contemplate the use of railroad and construction equipment of the Panama Canal Commission. It is possible that economy would attend the use of this material, but this would depend upon the amount which it would bring if offered for sale in the open market at Panama. The commission does not feel that it would be justified in considering the use of this equipment in its estimates of cost, but invites attention to a memorandum furnished by the Secretary of the Interior containing a list of such equipment as is now or will later become available. This memorandum is made a part of the appendix of the report. (See p. 142.)

In the above estimates, while the time of construction for the trunk roads was assumed at three years, it was considered that the shorter branches and the coal roads could be constructed in one year; interest items were computed accordingly.

Attention is invited to the fact that in each of the foregoing estimates it is assumed that money used in construction bears interest at the rate of 6 per cent; should it prove feasible to obtain these funds at a lower rate of interest an appreciable reduction in first cost would result.

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ANALYSIS OF OPERATION COSTS.

The commission feels that it is necessary here to make the following statement. Its instructions from Congress do not contemplate that any recommendation should be made as to how railroads in Alaska should be constructed, i. e., by private corporate ownership or by one of the many forms in use whereby Government assistance is rendered. The commission disavows any intention of making such recommendations, believing that Congress, in its wisdom, desired to reserve to itself the solution of that problem; but it has been impossible to form any estimates of costs of operation without some assumption as to the the interest rate on the capital required for construction. This interest rate would obviously differ in two cases; construction by Government or bond guarantee, and construction by private capital. Moreover, were construction carried on by private capital unassisted, the necessity of earning sufficient income to pay operating expenses and interest on bonded indebtedness might make it the duty of the directors of the corporation to impose rates on traffic that would seriously retard the development which the Territory so greatly needs.

The commission has therefore been forced to base its studies upon two hypotheses, viz: That the capital necessary for construction is obtained at 6 per cent interest, assumed as possible if construction is carried out by private corporate ownership unassisted; and that capital is obtained at 3 per cent interest, assumed as possible if the construction is done either by the Government itself or by private capital with bonded indebtedness guaranteed both as to principal and interest.

Estimates of results of operation of the various railroads under consideration are necessarily based upon such data as the commission has been able to obtain regarding both physical characteristics and probable tonnage. On some of the lines under consideration, no accurate location surveys or profiles have as yet been prepared; on others, such field work as has been done consists of rough exploratory traverses only, while on still other lines no information whatever is obtainable beyond that to be derived from the topographic maps of the United States Geological Survey. The analyses made by the commission, therefore, have comparative value only, and no reliable prediction concerning operating results can be made until accurate data is secured from actual location surveys and further observations in the field.

Because of the greater length of haul between its termini, its lack of good coal, and the complications involved by its crossing Canadian territory, the commission feels justified in making no operation study for the Haines-Fairbanks route. The Iliamna-Kuskowim route is also omitted from the operation analyses for the reason that the commission is convinced that there is no present warrant for the

construction of a line from Iliamna Bay or any near-by point, except such a short, cheap railroad as might be required to serve the development of the immediately adjacent region.

In making up an estimated annual balance sheet the question of taxes has been disregarded, with the exception of the existing license tax of $100 per mile, for the reasons that the corporation tax will be provided for whenever a net profit is shown and that the warehouse tonnage tax is included in terminal charges.

Where a proposed new road connects with, and involves operation over the trackage of an existing road owned by private corporate interests, the preparation of an accurate balance-sheet estimate is necessarily difficult, because the commission does not possess reliable information as to the amount of the investment in the privately owned roads on which to compute fixed charges. Lacking such data on the cost of existing roads, the commission has been compelled to make certain assumptions in regard to through traffic arrangements, which may or may not be possible to put into effect in actual practice. These assumptions are fully explained in the separate analyses.

It is obviously impossible to arrive at a fair comparison of operating costs on the various railroads if the motive power were varied in each case to fit the physical characteristics of the road. Accordingly, these studies have been based on the use of one type of locomotive for each line, viz, Baldwin Consolidation, class 10–E, type 2–8–0; weight, with tender, 170 tons. Rolling stock characteristics are assumed to be the same on all roads.

Trunk Lines.

CORDOVA-FAIRBANKS ROUTE.

Freight movements from Cordova to Fairbanks will be carried on the Copper River & Northwestern Railway Co.'s tracks for 132 miles to the town of Chitina and over the proposed Chitina-Fairbanks line 313 miles to Fairbanks. It is assumed that, whether the two lines be operated independently or under the same management, freight rates over the Copper River & Northwestern trackage will be the same as may be found to be necessary for the profitable operation of the Chitina-Fairbanks line. This assumption is made, first, because the Copper River & Northwestern Railway operates over much lighter grades than those involved in the Chitina-Fairbanks line, and, second, because the Copper River & Northwestern Railway Co.'s Kennicott branch and its proposed Bering River coal branch would give it a tonnage in all probability sufficient to pay the necessary overheads due to a greater cost of construction. The additional tonnage to be derived from the Chitina-Fairbanks line could thus be carried with profit at a comparatively low average rate. For the purpose of this analysis, therefore, the 313 miles between Chitina and Fairbanks will be considered as a distinct and separately operated road.

The average freight entering the Rampart-Fairbanks district during the last five years amounted to about 24,000 tons per year of all classes (see pp. 37–38), the maximum in any one year being approximately 33,000 tons and the minimum 15,000 tons. Having in mind the increase in freight movement to be expected and the natural

development of new territory following the construction of a railroad, the commission assumes that a line from Cordova to Fairbanks would carry, almost immediately, through freight at the rate of 45,000 tons of general merchandise northbound per year. The through southbound freight in sight is so very little as to be negligible for the purposes of this analysis. In addition to the through freight, it is estimated that coal mines will be operated in the Nenana lignite fields. This will involve the construction of a branch line from 30 to 50 miles in length, although it is at least possible that the Nenana coal may underlie certain territory through which the main line will be run (see p. 74). Without definite data, it is assumed that 30,000 tons of coal will be hauled an average distance of 20 miles on the main line and that 1,000 tons of local freight originating between Chitina and Richardson will be hauled an average of 150 miles. In round numbers, therefore, the annual freight ton-miles would amount to 15,000,000, or the equivalent of 50,000 tons of freight hauled over the entire 313 miles of line. It is assumed that there will be an annual through passenger traffic of about 10,000, or 3,000,000 passenger miles.

The Copper River & Northwestern Railway, from Cordova to Chitina, mile 132, has a ruling grade of 0.7 per cent and a general maximum curvature of 14°. On the proposed new line the maximum grade would be 1.13 per cent, and the maximum curvature approximately the same as on the Copper River & Northwestern Railway. With the assumed 100-ton consolidation locomotive, class 10–22–28–E, it would be possible to haul over the Copper River & Northwestern line to Chitina a net freight load of 700 tons at 10 miles per hour, or 360 tons at 25 miles per hour, in one train. This same engine could haul a net load over the 1.13 per cent grade, from Chitina northward, of 600 tons at a 10-mile speed, or 300 tons at a 25-mile speed. The 15,000,000 ton-miles assumed could be hauled by three trains per week carrying an average of 322 tons at a speed of 25 miles per hour, and, therefore, three trains per week is fixed as the basis of operation for the first five years.

Taking into account the grades, the alignment, and the character of the country, including maintenance menaces from snow, etc., the commission estimates the annual cost of operating from Chitina to Fairbanks, on a basis of three trains per week each way, at $2,200 per mile of track, or $7 per revenue train-mile.

The commission is of the opinion that an average freight rate exceeding 5 cents per ton-mile, and passenger rate in excess of 6 cents per mile would defeat the immediate object of the railroad, namely, the expeditious development of the interior of Alaska, and, furthermore, would introduce the question as to whether or not the Seattle-Cordova-Fairbanks freight route would be able to compete with the present all-water route via the Yukon River system, except on shipments in which the time element is of such importance as to warrant the payment of a higher freight rate.

The result of one year's operation at the average freight rate of 5 cents per ton-mile and 6 cents per passenger mile, using the commission's estimated cost of construction (p. 108), should be about as follows:

Estimate No. 1.

Expenditures:		
Operating expenses: 3 trains a week, 312 trains, or 97,656 train-miles at $7	$684,592	
Fixed charges: Interest on cost of construction, 6 per cent of $13,971,000	838,260	
Taxes, $100 per mile, 313 miles	31,300	
Total expenditures		$1,554,152
Income:		
Mail contract	100,000	
10,000 through passengers, or 3,000,000 passenger-miles at 6 cents	180,000	
15,000,000 ton-miles of freight at 5 cents	750,000	
Total income		1,030,000
Deficit with 5 cents per freight-ton-mile and 6 cents per passenger mile		524,152

Under this estimate the average through freight rate from Cordova to Fairbanks would be $22.25 per ton and the through passenger rate $26.70.

With a passenger rate of 7 cents per mile and an average freight rate of 8.3 cents per ton-mile, the road could, with the assumed tonnage, be operated without loss. This is shown in the following estimate of a year's operation at these tariffs.

Estimate No. 2.

Expenditures:		
Operating expenses, 3 trains a week, 312 trains, or 97,656 train-miles, at $7	$684,592	
Fixed charges: Interest on cost of construction, 6 per cent of $13,971,000	838,260	
Taxes, $100 per mile, 313 miles	31,300	
Total expenditures		$1,554,152
Income:		
Mail contract	100,000	
10,000 through passengers or 3,000,000 passenger-miles, at 7 cents	210,000	
15,000,000 ton-miles of freight, at 8.3 cents	1,244,152	
Total income		1,554,152

Under this estimate the average through freight rate from Cordova to Fairbanks would be $36.94 per ton and through passenger rate $31.15.

In both of the foregoing estimates it will be noted that no allowance is made for promotion expenses or stockholders' profits over and above interest on the amount invested, it being assumed that the line will be built by private corporate ownership, involving the necessity of earning 6 per cent on the capital used in construction. Were the road to be constructed by the Government or by private corporate ownership with a Government guaranty of principal and interest on bonded indebtedness, the capital required should be obtained at a much lower rate of interest, thus materially reducing the annual expenditures. Such an analysis is given below, using 3 per cent on the investment as fixed charges and omitting the mileage tax of $100 on the assumption that this tax would not be levied in the case of a Government owned or aided road.

Estimate No. 3.

Expenditures:		
Operating expenses, 3 trains a week, 312 trains, or 97,656 train-miles, at $7	$684,592	
Fixed charges: Interest on cost of construction, 3 per cent of $13,971,000	419,130	
Total expenditures		$1,103,722
Income:		
Mail contract	100,000	
10,000 through passengers, or 3,000,000 passenger-miles, at 6 cents	180,000	
15,000,000 ton-miles of freight, at 5.49 cents	823,722	
Total income		1,103,722

Under this estimate the average through freight rate from Cordova to Fairbanks would be $24.43 per ton, and through passenger rate $26.70.

THE VALDEZ-FAIRBANKS ROUTE.

This route involves the use of no part of any existing railroad. Running in a northerly direction for 101 miles it reaches a point on the proposed location of the Chitina-Fairbanks route considered in the foregoing section. From thence to Fairbanks, 279 miles, the two routes would be identical.

The business which a railroad connecting these two termini might reasonably expect would be practically the same as in the case of Chitina and Fairbanks, with a small increase for local freight originating in the immediate vicinity of Valdez. For this study, therefore, the tonnage for the first five years of the road's existence is assumed to be as follows:

	Tons.	Miles.
Through freight	45,000	380
Nenana coal	30,000	20
Local freight between Valdez and Richardson	2,000	150

In round numbers, 18,000,000 ton-miles, or the equivalent of 47,500 tons of freight, over the entire 380 miles of line. It is further assumed that there will be 10,000 through passengers annually, or 3,800,000 passenger-miles.

The maximum grade, north and south bound over Thompsons Pass, is practically 3 per cent, which means that with the assumed 100-ton consolidation locomotive only 110 tons of net load can be hauled. This grade will, therefore, require two pusher engines of the same type in order to haul the assumed annual tonnage on a schedule of three trains a week.

Taking into account the grades, alignment, character of country, probable maintenance expenses, etc., the commission estimates the operating cost per revenue train-mile of the 380 miles between Valdez and Fairbanks at $7.23, this figure being an average of a train-mile cost of $7.86 for the 101 miles over Thompsons Pass, and $7 for the remaining mileage to Fairbanks.

Three estimated balance sheets have been prepared, representing the result of one year's operation, on the following assumptions:

First. That the road is constructed by private capital, involving the necessity of earning 6 per cent return on investment; also that the income is provided at rates of 6 cents per passenger-mile and 5 cents per freight ton-mile.

Second. As in the first assumption, fixed charges will be 6 per cent upon the first cost of the line, but the income will be furnished by carrying passengers at 7 cents per passenger-mile and freight at such a rate as will result in no deficit.

Third. That the road is constructed by the Government, or by private capital with Government aid, reducing the fixed charges to 3 per cent of cost of construction, and omitting license tax.

Estimate No. 1.

Expenditures:		
Operating expenses, 118,940 train-miles, at $7.23	$859,607	
Fixed charges, 6 per cent of first cost $18,545,000	1,112,700	
License tax, 380 miles, at $100	38,000	
Total expenditures		$2,010,307
Income:		
Mail contract	100,000	
3,800,000 passenger-miles, at 6 cents	228,000	
18,000,000 freight ton-miles, at 5 cents	900,000	
Total income		1,228,000
Deficit with 6 cents per passenger-mile and 5 cents per freight-ton-mile		782,307

At these rates the following through tariff would result:

Passenger tariff, Valdez to Fairbanks	$22.80
Freight tariff, per ton, Valdez to Fairbanks	19.00

Estimate No. 2.

Expenditures:		
Operating expenses, 118,940 train-miles, at $7.23	$859,607	
Fixed charges, 6 per cent of first cost, $18,545,000	1,112,700	
License tax, 380 miles, at $100	38,000	
Total expenditures		$2,010,307
Income:		
Mail contract	100,000	
3,800,000 passenger-miles, at 7 cents	266,000	
18,000,000 freight ton-miles, at 9.13 cents	1,644,307	
Total income		2,010,307

At these rates the following through tariffs would result:

Passenger tariff, Valdez to Fairbanks	$26.60
Freight tariff, per ton, Valdez to Fairbanks	34.69

Estimate No. 3.

Expenditures:		
Operating expenses, 118,940 train-miles, at $7.23	$859,607	
3 per cent first cost, $18,545,000	556,350	
Total expenditures		$1,415,957
Income:		
Mail contract	100,000	
3,800,000 passenger-miles, at 6 cents	228,000	
18,000,000 freight ton-miles, at 6.04 cents	1,087,957	
		1,415,957

At these rates the following through tariffs would result:

Passenger tariff, Valdez to Fairbanks	$22.80
Freight tariff, per ton, Valdez to Fairbanks	22.95

It should be here stated that in this, as in the operation studies of all trunk lines, freight costs and tariffs result from assumptions as to tonnage that do not include coal traffic from mines to the seacoast terminals. Coal tonnage of this character is made the subject of separate studies under the heading "Coal roads." Coal fields exist on the lines from Cordova and Seward, but there is no coal field properly tributary to the Valdez route except Matanuska when connected by a branch line 108 miles in length. The grades on this branch line and those over Thompsons Pass are such as to justify the belief that coal, essentially a low-grade freight, will never be shipped in considerable quantities over this route to Valdez from the Matanuska field. This fact is cited here as having a direct bearing on any comparison of the costs of haulage over the three through lines embraced in these studies, since with a considerable prospective coal movement on the other two lines a proper adjustment of rates to effect reductions would be made at an earlier date than could be expected in the case of the Valdez route.

THE SEWARD-FAIRBANKS ROUTE.

Freight movements from the seacoast to Fairbanks over the Seward-Fairbanks route would be carried for 71.6 miles over the existing tracks of the Alaska Northern Railroad and from thence to Fairbanks, a distance of 391.4 miles, over the proposed Susitna Valley route to Fairbanks. Since the commission has not evaluated the property of the Alaska Northern Railroad, this analysis will be made on the assumption of an independently operated road from Kern Creek to Fairbanks and a tariff differential in favor of the Alaska Northern Railroad to cover the excess cost of haulage from Kern Creek to Seward.

In the main, the tonnage expectancy of this route would be the same as that of the Cordova-Fairbanks line, previously considered, with an allowance for coal traffic originating in the Matanuska district. Were this road built and operated on a traffic agreement with the Alaska Northern, the opening of the coal fields would result in a coal tonnage from a branch line tapping the Matanuska district. The bulk of this coal movement would go southward to Seward and therefore become a source of revenue mainly to the Alaska Northern Railroad. A part would undoubtedly be distributed in the Susitna Valley, but as the amount of this which could be counted upon for revenue would necessarily be small during the early part of the road's existence, it is only placed at 1,000 tons annually. The estimate of tonnage to be expected during the first 5 years following construction is, therefore, as follows:

	Tons.
Through freight, 391 miles	45,000
Nenana coal, 20 miles	30,000
Local freight, Susitna Valley, 150 miles	1,000
Local coal shipment, Susitna Valley, 150 miles	1,000

Total movement 18,500,000 ton-miles, or 47,000 tons of through-train haul. The passenger movement is estimated at 10,000 over the entire trackage, or 3,910,000 passenger miles.

The Commission has been unable to obtain the results of reconnoissance surveys over Broad Pass, if any such have been made, and therefore has no accurate information concerning the grades on this part of the line. It has been stated by one of the engineers connected with the exploration of this part of the route that the ruling grades north and south bound over Broad Pass would not be less than 1.5 per cent. This exceeds the 1.13 per cent grade over Isabel Pass on the Cordova-Fairbanks route, but the Commission, basing its opinion upon what is known of the general character of the country traversed, believes that there would be no great difference in gradients and alignments between the roads possible to construct over the two routes. It feels justfied in this belief by the fact that the surveys run over both routes were preliminary in character, and scarcely more than exploratory methods were used. It is therefore assumed in this analysis that the ruling grade on the Seward-Fairbanks route will not exceed 1.13 per cent as used on the main divide of the Cordova-Fairbanks line. The assumed locomotive would therefore haul northbound, from Kern Creek to Fairbanks, a net load of 600 tons at a speed of 10 miles per hour, or 300 tons at a speed of 25 miles per hour for each train. The 18,500,000 ton-miles assumed could be hauled on three northbound trains per week, each train carrying an average of 300 tons at a speed of 25 miles per hour. The basis of operation for the first five years is therefore assumed at three trains a week of 300 tons.

Using $2,200 as the operation cost per mile of track, as in the Chitina-Fairbanks analysis for three trains a week each way (see p. 117), the cost per revenue train-mile would be $7. For a considerable portion of this road, where it passes through the Susitna Valley, grades would be less than 1.13 per cent, but would still average 1 per cent. This slight difference would not warrant a change in character of equipment, and therefore would not enable an appreciable saving in cost to be effected over that assumed for a ruling grade of 1.13 per cent.

From Seward to Kern Creek (mile 71.6), there are two stretches ruled by 2.2 per cent grades, the first being located between miles 0 and 12, and the second between miles 40 and 45, necessitating an extra heavy pusher engine, or two pusher engines of the same type as the train locomotives, over a distance of 17 miles. It may however prove expedient to operate these pusher engines throughout the entire distance between mile 0 and mile 45. The Commission estimates that the cost per train-mile of operating three trains both ways per week over a 2.2 per cent grade is $9.90, leaving approximately 54.6 miles with an operating cost of $7. This would make the average cost of operation over the 71.6 miles of the Alaska Northern Railroad $7.70, or $0.70 per mile in excess of the train-mile operation cost over the 391.4 miles from Kern Creek to Fairbanks.

If the income due to through-train traffic were divided in proportion to train-mile operation costs, the rate per mile received by the Alaska Northern should be 1.10 times the rate per mile received on the line from Kern Creek to Fairbanks. This assumption does not, however, take into consideration the possible difference in cost of construction of the two lines.

The Commission has made as careful an estimate of the cost of constructing the 391.4 miles between Kern Creek and Fairbanks as the character of the data in its possession will permit, and fixes the amount

at $17,708,000. With fixed charges based on this cost of construction, and the assumed freight movement set forth above, there have been prepared three estimates showing the results which may be expected of a year's operation during the first five years following construction. These estimates, as in the operation studies of the Cordova-Fairbanks route, have been made on three different assumptions:

First. That the road is built by private capital, necessitating a 6 per cent return on the investment; also on an assumed rate over the 391.4 miles to be constructed of 5 cents per freight ton-mile and 6 cents per passenger-mile.

Second. That the method of constructing and financing is the same as in the first assumption, with an income produced by such freight and passenger tariffs as would result in no deficit.

Third. On the assumption that the road is constructed by the Government, or by private corporate interests with Government guaranty of principal and interest on bonded indebtedness, and that the capital thus obtained would demand only 3 per cent return. Also that no license tax would be imposed on a Government owned or aided road.

These estimates are given below:

Estimate No. 1.

Expenditures:		
Operating expenses, 3 trains a week, 312 trains, or 121,992 train-miles, at $7	$853,944	
Fixed charges, interest on cost of construction, 6 per cent of $17,708,000	1,062,480	
Taxes, $100 per mile, 391 miles	39,100	
Total expenditures		$1,955,524
Income:		
Mail contract	100,000	
10,000 through passengers, or 3,910,000 passenger-miles, at 6 cents	234,600	
18,500,000 ton-miles of freight, at 5 cents	925,000	
Total income		1,259,600
Deficit on a 5 cents per freight ton and 6 cents per passenger mile		695,924

The corresponding tariffs over the 71.6 miles of the Alaska Northern Railroad would therefore be 6.6 cents per passenger-mile and 5.5 cents per freight ton-mile. The through rate per ton for freight from Seward to Fairbanks would therefore be $23.51 and the through passenger rate $28.21.

Estimate No. 2.

Expenditures:		
Operating expenses, 3 trains a week, 312 trains, or 121,992 train-miles, at $7	$853,944	
Fixed charges, interest on cost of construction 6 per cent of $17,708,000	1,062,480	
Taxes, $100 per mile, 391 miles	39,100	
Total expenditures		$1,955,524
Income:		
Mail contract	100,000	
10,000 through passengers, or 3,910,000 passenger-miles, at 7 cents	273,700	
18,500,000 ton-miles of freight, at 8.55 cents	1,581,824	
Total income		1,955,524

Under this estimate the rate on the Alaska Northern would be 7.7 cents per passenger mile and 9.4 cents per freight ton-mile. The through rates, Seward to Fairbanks, would be $40.20 per ton for freight and $32.90 for passengers.

Estimate No. 3.

Expenditures:		
Operating expenses, 3 trains a week, 312 trains, or 121,992 train-miles, at $7	$853,944	
Fixed charges, interest 3 per cent on $17,708,000	531,240	
Total expenditures		1,385,184
Income:		
Mail contract	100,000	
10,000 through passengers or 3,910,000 passenger-miles, at 6 cents	234,600	
18,500,000 freight ton-miles, at 5.68 cents	1,050,584	
Total income		1,385,184

Under this estimate the rates on the Alaska Northern are assumed to be, for passengers, 6.6 cents per mile, and for freight per ton-mile, 6.25 cents, making the through rates as follows:

Seward-Fairbanks, for passengers	$28.20
Seward-Fairbanks, for freight (per ton)	26.71

SEWARD-IDITAROD ROUTE.

Freight movements between the Iditarod district and Seward will be carried over the trackage of the Alaska Northern Railroad for 71.6 miles, thence over the proposed new line for approximately 344 miles. This new line is identical, as far north as Willow Creek, with the Susitna route to Fairbanks already described, 115 miles from the present terminus of the Alaska Northern Railroad at Kern Creek. From Willow Creek the line runs westwardly over Rainy Pass for 229 miles to the McGrath district on the Kuskokwim River.

No survey has been made through this country having in view the location of a railroad. From reports of exploratory expeditions and from data in the possession of the Geological Survey, it is known that railroad construction is possible, but that, through the pass, maximum grades of at least 2 per cent may be expected. For the purpose of this estimate, it is assumed that of the 344 miles, 100 miles will be ruled by a 2 per cent grade, while the remainder of the road will be the same type as was assumed for the Cordova-Fairbanks and Seward-Fairbanks lines.

Inasmuch as the Commission has no information concerning the value of the Alaska Northern property, an analysis will be made for the new construction only, and a freight rate determined for this part of the line which would result in profitable operation. The freight rate for the remainder of the haul, between Seward and Kern Creek, will be obtained as in the case of the Seward-Fairbanks line, from the ratio of annual operation expenses.

It is assumed that operation will be based on three trains per week each way, which, with the assumed locomotive, could haul considerably more freight than would be in sight for some time. The Commission estimates the operating cost of three trains both ways per week over the 100 miles of 2 per cent grade at $9.30 per train mile,

and the operating cost of the same number of trains per day over the 244 miles, the remainder of the new construction, at $7 per train mile.

Based upon such information as the Commission was able to obtain concerning freight movements in this district in the year 1910–11, the following tonnage assumptions are made:

Through freight between Seward and McGrath, 344 miles new line, 72 miles Alaska Northern	Tons. 15,000
Local freight, 100 miles	10,000
Coal, 230 miles	10,000
Coal, 120 miles	10,000
Coal, 30 miles	10,000

A total of 9,960,000 ton miles, or 29,000 tons through freight haul. In addition to this, it is assumed that there will be a through passenger traffic of 5,000 annually over the new line of 344 miles, or 1,720,000 passenger miles.

The Commission estimates the cost of the new line involved in the Iditarod-Seward route at $17,970,000.

Three operation estimates have been prepared on the following assumptions:

First. That the road is built by private capital, necessitating a return on investment of 6 per cent per annum. Also on an assumed rate over the 344 miles to be constructed of 5 cents per freight ton mile, and 6 cents per passenger mile.

Second. That the method of constructing and financing the road is the same as in the first assumption, with an income produced by such freight and passenger tariffs as would result in no deficit.

Third. On the assumption that the road is constructed by the Government, or by private corporate interests with Government guarantee of principal and interest on bonded indebtedness, and that the capital thus obtained would demand only 3 per cent return. Also that the income is derived from a 6 cent passenger mile rate together with such a ton mile freight rate as would result in no deficit.

Estimate No. 1.

Expenditures:			
Operating expenses, 3 trains a week, 312 trains, or 76,128 train-miles, at $7	$532,896		
31,200 train-miles, at $9.30	290,160		
		$823,056	
Fixed charges, 6 per cent interest on cost of construction, $17,970,000		1,078,200	
Taxes, $100 per mile, 344 miles		34,400	
Total expenditures			$1,935,656
Income:			
Mail contract		100,000	
1,720,000 through-passenger-miles, at 6 cents		103,200	
9,960,000 ton-miles freight, at 5 cents		498,000	
Total income			701,200
Deficit with 6 cents per passenger-mile and 5 cents per freight ton-mile			1,234,456

The commission also estimates that the cost of operation over the 71.6 miles of the Alaska Northern Railroad, based on three trains each way per week, would be $7.70 per mile, or exactly the same as the average cost of operation over the 344 miles of new construction.

It is therefore assumed that whatever rate may be determined upon as profitable for the operation of the 344 miles of new line would serve to carry the freight over the part of the line owned by the Alaska Northern Railroad. This assumption does not, however, take into consideration the possible differences in cost of construction of the two lines.

Under estimate No. 1 the through tariffs between Seward and McGrath would be as follows:

Passenger	$24.96
Freight, per ton	20.80

Estimate No. 2.

Expenditures:			
Operating expenses, 3 trains a week, 312 trains, or 76,128 train-miles, at $7	$532,896		
31,200 train-miles, at $9.30	290,160		
		$823,056	
Fixed charges, 6 per cent interest on cost of construction, $17,970,000		1,078,200	
Taxes, $100 per mile, 344 miles		34,400	
Total expenditures			$1,935,656
Income:			
Mail contract		100,000	
1,720,000 passenger-miles, at 10 cents		172,000	
9,960,000 ton-miles of freight, at 16.5 cents		1,663,656	
Total income			1,935,656

Under estimate No. 2 the through tariffs would be as follows:

Passenger rate	$41.60
Freight rate, per ton	68.64

Estimate No. 3.

Expenditures:			
Operating expenses, 3 trains a week, 312 trains, or 76,128 train-miles, at $7	$532,896		
31,200 train-miles, at $9.30	290,160		
		$823,056	
Fixed charges, 3 per cent interest on cost of construction, $17,970,000		539,100	
Total expenditures			$1,362,156
Income:			
Mail contract		$100,000	
1,720,000 passenger-miles at 6 cents		103,200	
9,960,000 ton-miles of freight at 11.63 cents		1,158,956	
Total income			1,362,156

Under estimate No. 3, the through tariffs would be as follows:

Passenger rate	$33.28
Freight rate, per ton	48.38

Coal Roads.

CORDOVA-BERING RIVER COAL FIELD LINE VIA KATALLA.

It is assumed that this route will have no traffic other than coal, and that the output of the mines will be 1,500 tons per day for the first five years.

It will be necessary to construct 55 miles of new line, which will join the Copper River & Northwestern Railroad at mile 38 of that line, and will require a haul of 38 miles over a different road, unless the two be operated under one management. For estimating purposes, it is assumed that the coal can be hauled over the Copper River & Northwestern Railroad at the same rate per ton-mile as may be found necessary for profitable operation over the new construction.

The grades on the new construction are very flat, the maximum being 0.58 per cent, and extending for a short distance only. Two trains per day will carry the estimated output.

Taking into consideration the character of the road, the Commission estimates the average cost per train mile, on the basis of two trains per day over the 55 miles of new construction, would be $2.86 per revenue train mile. Assuming that the new line is constructed by private corporate interests, necessitating 6 per cent return on investment, the following estimated balance sheet for the new construction considered as separately operated is obtained:

Expenditures:		
Operating expenses, 2 trains a day, 313 days, 55 miles at $2.86	$197,100	
Fixed charges, 6 per cent interest on cost of construction, $2,700,000	162,000	
Taxes, $100 per mile, 55 miles	5,500	
Total expenditures		$364,600
Income:		
1,500 tons of coal, 313 days, 55 miles, 1.39 cents per ton-mile		364,600

At this rate it would cost 76 cents per ton to haul coal between the mines and the junction, and $1.29 between the mines and Cordova; to which it would be necessary to add the 25 cents per ton to cover terminal charges and wharf tax, making a total tariff from the mines to the ship of $1.54.

Were the assumption permissible that the new line would be operated by the same company which does or may operate the Copper River & Northwestern Railroad, it is believed that the increase in economy and efficiency that would result in the use of the larger company's organization and plant would lower this rate to at least 85 cents per ton, which, with the terminal charges as before, would permit of delivery of coal to ship at Cordova at $1.10 per ton.

The Commission has made similar estimates for other outputs, and have arrived at the conclusion that with an output of 1,000 tons per day the average rate from the mines to Cordova, less terminal charges and wharfage fees, would be $1.66, and for 3,000 tons per day, 79 cents per ton.

CORDOVA-BERING RIVER COAL FIELD LINE VIA LAKE CHARLOTTE.

As in the case of the Katalla Line from the Bering River coal field, it is assumed that this road will carry coal traffic only, also that freight can be carried over the Copper River & Northwestern Railroad Co.'s tracks at a per ton rate which would permit of profitable operation over the new construction.

The new line will be 38 miles in length, and will involve heavy grades against the traffic. The maximum grades are 1.7 per cent, 1.13 per cent, and 0.85 per cent over a distance of 5½ miles.

With an output of 1,500 tons of coal per day, it will be necessary with the locomotive assumed to operate two trains a day with

pusher engines over the 5½-mile climb to the summit. Taking into consideration the grade, curvature, and pushers, the commission estimates the average cost per revenue train mile to operate two trains a day each way at $3.09.

Assuming that this new line is constructed by private corporate interests, necessitating an earning of 6 per cent on the investment, the following estimated balance sheet results:

Expenditures:	
Operating expenses, 2 trains a day, 313 days, 38 miles, at $3.09	$147,234
Fixed charges: 6 per cent on estimate cost of new line, $2,054,000	123,240
Taxes, $100 per mile, 38 miles	3,800
Total expenditures	274,274
1,500 tons of coal, 313 days, 38 miles, at $1.54 per ton-mile	274,274

At this per ton freight rate over the entire 76 miles from the mines to Cordova the through tariff would amount to $1.17 per ton. To this it would be necessary to add an item for terminal charges and wharfage tax, which is roughly estimated at 25 cents per ton, making a total rate from mine to ship of $1.42.

Were the assumption permissible that the new line would be operated by the same management which would control the Copper River & Northwestern Railroad, it is believed that the increase in economy and efficiency that would result in the use of the larger company's organization and plant would lower this freight rate to $1 per ton, which, with the terminal charges as before, would permit of delivery of coal to ships at Cordova at $1.25 per ton.

The Commission has made similar estimates for other outputs, and has arrived at the conclusion that at an output of 1,000 tons per day the freight rate from the mines to Cordova, exclusive of terminal charges and wharfage fees would be $1.44, while for an output of 3,000 tons per day it would be 70 cents.

LINES FROM CONTROLLER BAY AND KATALLA TO BERING RIVER COAL FIELD.

If either Controller Bay or Katalla were adopted as a port for shipment of Bering River coal it would become necessary to construct terminal facilities at a cost of approximately $2,500,000. The railroad construction required in the case of Controller Bay would be 25 miles, and Katalla 31 miles. The character of the roads as far as gradient, curvature, and cost is concerned, is comparable to the proposed branch from Cordova to the Bering River coal field via Katalla, and the same operating costs may be used. On an estimated coal output of 1,500 tons the following balance sheet is obtained for the Controller Bay Line:

Expenditures:	
Operating expenses, 4 trains a day, 313 days, 25 miles, at $2.86 per train mile	$89,518
Fixed charges, 6 per cent of cost of road, $1,430,000	85,800
Six per cent of cost of terminals, $2,500,000	150,000
Tax, 25 miles, at $100	2,500
Total expenditures	327,818
Income:	
1,500 tons of coal, 313 days, 25 miles, 11,737,500 ton miles, at $2.79	327,818

Total rate from mines to Controller Bay, exclusive of terminal charges and warehouse tonnage tax, would be 69 cents per ton.

In like manner, the following estimated balance sheet is obtained on the operation from the coal fields to the terminals at Katalla.

Expenditures:	
Operating expenses, 4 trains a day, 31 miles, at $2.86 per train mile	$111,000
Fixed charges, 6 per cent on cost of construction, $1,702,000	102,120
Six per cent on first cost of terminals, $2,500,000	150,000
Tax, 31 miles, at $100	3,100
Total expenditures	366,220
Income:	
1,500 tons of coal, 313 days, 31 miles, at 2.5 cents per ton mile	366,220

At this rate the through tariff per ton from mines to Katalla would be 77 cents, exclusive of terminal charges and wharfage tax.

CORDOVA-CHITINA-MATANUSKA COAL FIELD LINE.

As in the case of the other coal branches considered, it is estimated that this line will carry coal traffic only, and that freight may be carried over the 132 miles of the Copper River & Northwestern Railroad Co.'s tracks at a per ton rate which would provide for profitable operation over the necessary new construction.

The new construction will be 163 miles in length from the coal fields to mile 132 of the Copper River & Northwestern Railroad at the town of Chitina. From the coal fields to the summit, a distance of 45 miles, the ruling grade is 2.2 per cent. Taking into consideration the grades, curvature, and necessity of pushers, the commission estimates the average cost of operation per train mile, on the basis of two trains per day over 163 miles, will be $3.64.

Assuming that the new line is constructed by private corporate interests, necessitating the earning of 6 per cent on investment, the following estimated balance sheet is obtained:

Expenditures:		
Operating expenses, two trains a day, 163 miles, at average rate of $3.64	$744,318	
Fixed charges, 6 per cent on estimated cost of new line, $8,434,000	506,040	
Taxes, $100 per mile, 163 miles	16,300	
Total expenditures		$1,266,658
Income:		
1,500 tons of coal, 313 days, 163 miles, at 1.66 cents per ton mile		1,266,658

At this freight rate the through tariff from the mines to Cordova would amount to $4.90 per ton. Adding 25 cents per ton for terminal charges and wharfage fees, the total rate from mines to ship would amount to $5.15.

The commission has made similar estimates for other outputs, and has arrived at the conclusion that with an output of 1,000 tons of coal per day, the freight rate from mines to Cordova, exclusive of terminal charges and wharfage fees, would be $6.05 per ton, while for an output of 3,000 tons per day, the rate would be $2.74 per ton.

SEWARD-KERN CREEK-MATANUSKA COAL FIELD LINE.

Like the other coal roads, it is assumed that this line will haul coal traffic only. It will necessitate the construction of 115 miles of new line from the Matanuska coal fields to mile 72 of the Alaska Northern Railroad Co.'s tracks at Kern Creek on the north shore of Turnagain Arm. In this case the most difficult part of the haul will be over the Alaska Northern Railroad, involving two summits with 2.2 per cent adverse grade. For this reason the assumption that coal can be hauled over the Alaska Northern Railroad at the same rate per ton as will be necessary for profitable operation over the new construction is not permissible. The operating expenses have been determined for the whole mileage from mines to Seward, and the resulting tariff is divided between the new construction and the existing road in proportion to the operation costs over the respective lines. This assumption is necessarily unsatisfactory, but is unavoidable because of lack of information as to the property investment of the Alaska Northern.

For the 38 miles between the coal fields and Matanuska Junction, the assumed output of 1,500 tons per day can be carried by two trains daily, 750 net tons each. From Matanuska Junction to Kern Creek, 77 miles, the maximum grade against traffic is 1 per cent. The output can be hauled in two trains daily with a pusher engine operating over 9½ miles of the ruling grade. Taking into consideration the additional expense due to grade, curvature, and pusher service, the commission estimates the average cost of operating two trains over the 115 miles of new construction as $2.98 per revenue train mile. Assuming that the new line is constructed by private corporate interests necessitating an earning of 6 per cent on amount invested, the following estimated balance sheet is obtained:

Expenditures:		
Operating expenses, 2 trains per day over 115 miles, at $2.98	$428,798	
Fixed charges, 6 per cent on cost of construction $4,945,000	296,700	
Taxes $100 per mile, 115 miles	11,500	
Total expenditures		$736,998
Income:		
1,500 tons of coal, 313 days, 115 miles, at 1.36 cents per ton-mile		736,998

The haul southbound over the Alaska Northern involves a pusher engine over a 2.2 per cent grade for 55 of the 72 miles. The assumed locomotive can haul a net load of 320 tons over this grade, and by doubling this capacity by means of pusher engines, the 1,500 tons can be hauled by means of 3 trains daily. The commission finds that the operation per train mile, 3 trains per day over the 72 miles is $3.15. If the assumption is permissible that the Alaska Northern Railroad can haul this coal at a rate fixed on the ratio of total operating expenses over the two lines, the per ton rate would be 160 per cent of 1.36 cents or 2.18 cents per ton mile. The total cost per ton over the Alaska Northern Railroad would therefore be $1.57 per ton, and the through rate from mines to Kern Creek 115 miles at 1.36 cents would be $1.56. The through rate from the mines to Seward therefore would be $3.13, exclusive of terminal and wharfage tax.

The Commission has also estimated the cost of hauling the coal on a basis of 1,000 ton per day and 3,000 ton per day outputs. The through rates from the mine to Seward exclusive of terminal and wharfage charges would be $4.27, and $1.81 per ton, respectively, for these outputs.

It is possible that were the present Alaska Northern and the 115 miles of new construction to be operated under the same management considerable gain in economy and efficiency would result, and the price at which coal could be placed in Seward materially reduced.

VALDEZ-MATANUSKA COAL FIELD LINE.

Like the other coal roads, it is assumed that this line will haul coal traffic only. It necessitates the construction of 230 miles of new line, running from Valdez over Thompson Pass, Ernestine Pass, and Tahneta Pass. Coal movements would be south bound and would have adverse grades of 2.2 per cent over the Tahneta Pass and 3 per cent over the Thompson Pass. Taking into consideration the additional operating expense due to grade, curvature, and pusher service, the commission estimates the average cost of operating two trains a day for an output of 1,500 tons of coal per day at $3.67 per revenue train-mile. Assuming that the new line is constructed by private corporate interests, necessitating an earning of 6 per cent on the capital invested, the following estimated balance sheet is obtained:

Expenditures:		
Operating expenses, 2 trains a day, 230 miles, at $3.67	$1,054,000	
Fixed charges, 6 per cent on cost of construction, $12,662,000	759,720	
Taxes, $100 per mile, 230 miles	23,000	
Total expenditures		$1,836,720
Income:		
1,500 tons per day, 313 days, 230 miles, at 1.7 cents per ton mile		1,836,720

At this train-mile rate the through tariff from the mines to Valdez, 230 miles, would be $3.91, exclusive of terminal and wharfage charges, or $4.16 from mine to ship.

MARKET FOR ALASKA COAL.

Alaska is suffering from high rates enforced on all supplies by lack of proper transportation facilities. Unfortunately, about six years ago, just as railroad construction appeared most promising, the question of the development of coal resources was precipitated with great rancor and with considerable misrepresentation on both sides. This has resulted in an absolute cessation of railroad construction and a gradual shutting down of railroad operations, which is now almost complete. No definite policy in regard to Alaska coal lands has been determined on, and no one can safely predict when coal-mining operations on a commercial scale will be begun. There is much confusion of counsel as to the proper methods to adopt to remedy this unfortunate situation.

While this has been unfortunate to the entire Pacific seaboard, which needs a low-priced fuel, the result to Alaskans has been particularly distressing. There are many claimants to coal land in Alaska who have been unable to obtain patents to which they feel they are entitled. There are owners of other kinds of mineral properties who can neither sell nor work them because transportation costs are above the point where operations can be carried on at a profit, and who feel that the interruption to railroad work has prevented the development of their properties. There are numerous promising mineral fields which are kept closed by the present condition of transportation, as only the richest discoveries would prove of value. By far the greater number of those who desire the development of Alaska, however, have no direct interest in any coal lands, the claimants to which are few in number. The interests of most of the settlers in Alaska are intimately bound up in the business revival which is expected as soon as the coal lands are opened and railroad construction follows.

The situation above referred to is particularly to be deprecated on account of its effect on the coal situation. It is believed that except for the controversy precipitated six years ago, at least one of the coal fields would have been extensively developed, and if it contains valuable deposits, as seems probable, markets might have been developed by this time from which other fuels would have found it difficult to dislodge it. This opportunity may now be lost, as the California oils and the eastern coals via Panama may largely operate to keep Alaskan coal out of any west-coast markets except for local use.

NAVAL COAL MARKET.

The United States Navy now uses coal on the Pacific coast, its ships being supplied from its two depots in Puget Sound and San Francisco Bay. Most of this coal is shipped around Cape Horn and costs about $7.30 per ton delivered at San Francisco in foreign bottoms and about $2 more if shipped in domestic bottoms. This price includes the cost of the coal and will vary considerably, principally

on account of the state of the transportation market. Coal is also shipped to Manila for the use of the Asiatic fleet, some around Cape Horn and some around Cape of Good Hope. The cost at Manila is about $9 per ton in foreign bottoms, including the cost of the coal, and runs considerably higher in domestic bottoms. These costs vary with the transportation market. The Navy also maintains a storage pile in the Hawaiian Islands, where it is now engaged in the construction of a large coal storage plant.

The total coal consumption of the Navy is between 700,000 and 800,000 tons annually, and of this about 150,000 tons are used in the Pacific, exclusive of that supplied to the Asiatic fleet. It is estimated that the department will require 300,000 tons annually on our Pacific coast after the completion of the canal, as it is anticipated that a large part of the fleet now on the Atlantic coast will be frequently transferred to the Pacific.

The Navy Department will probably construct coaling stations at different points in the Pacific and provide them with coal piles of about 200,000 tons each. There may be three or four such equipments, and to complete the storage from 600,000 to 800,000 tons in excess of current consumption will be required within a period of a few years. It is quite likely that after the completion of the canal the Navy will be in the market for coal for use and storage in the Pacific to the extent of about 450,000 tons annually, until the coal-storage plants are filled. This market, however, will never exceed this figure, as new ships are being equipped for oil burning. This large demand will cease as soon as the storage piles are stocked, and the regular demand will begin to decline as the coal-burning ships pass out. Purchases of this extent can not be definitely planned and the figures are given as a maximum. It may be stated, however, that to be assured of any portion of this market the Alaska coal will first have to show its suitability and then meet the price of the known and established eastern coals, such as New River, Pocahontas, and Georges Creek. The best information at hand seems to indicate that while Alaska coal seems to be suitable as to composition, it may run too high in slack to meet naval requirements.

Besides changing the quantities required by the Navy, the completion of the Panama Canal will effect an immediate change in the Pacific coal markets. This is difficult to forecast, depending as it does on prices of coal in the east and on the condition of the transportation market. It is probable that, if the present prices continue, the Navy can deliver coal in San Francisco from the eastern mines, at a price including the cost of the coal, of about $6.60 per ton; this by using large colliers with no return cargo. If commercial ships can be assured of obtaining suitable return cargo they should be able to deliver coal at a lower price. It is possible that these coals may be bought in cargo lots at San Francisco at as low a price as $5.50 per ton, and at Seattle at prices but little higher. Should Alaska coal prove suitable for naval use it will have to meet whatever these prices may be; and it is probable that if it can meet the San Francisco price, it can also meet the price of the eastern coals delivered at Honolulu and Manila.

PACIFIC COAST CONSUMPTION.

The question of the establishment of Alaskan coal in the Pacific markets is finally one of cost. In a recent bulletin of the Geological Survey a member of this commission gives an analysis [1] of the consumption of coal in Pacific waters. This analysis would tend to show that despite the advances in the use of oil for fuel purposes there is on the Pacific coast an annual market for nearly 1,500,000 tons of coal at points where competition by Alaska coals is not impossible; this amount being considerably less than half the total present coal consumption of the Pacific coast States and Alaska.

The principal objection to such coal as has been obtained from the Bering fields is the low proportion of lump in the product. A development of the fields may locate coals running considerably higher in lump, but the geological indications are such as to give little promise of this. While this may remove the coal from consideration as a naval supply except in emergency cases, the high percentage of slack does not lower its value as a coking coal, nor as a steaming coal where forced draft is not used. The statistics referred to show that in the Pacific coast States about 200,000 tons per annum are used for coking purposes for which Alaska coal seems entirely suitable, to the exclusion of other Pacific coals. It seems suitable also to supply about 25,000 tons per annum of blacksmith coal which now comes from Georges Creek at high freight rates.

The cost of handling coal from an Alaskan port to Seattle or San Francisco would be dependent mainly on the quantity that could be sold in those markets. The size of the collier, numbers of them required to handle the tonnage, regularity and continuity of service, would have to be determined after other factors now unknown are fixed, the principal of which is the price at which the eastern coal can be laid down in these markets.

The best information at the disposal of the Commission would indicate that coal can be mined in the Bering River and Matanuska fields at from $2 to $2.25 per ton. In operations of magnitude these figures should not be exceeded. If there is a market for 500,000 tons a year, Bering coal can be delivered aboard colliers at Cordova at about $1.42 per ton. It is estimated that a freight rate from this point to Seattle will be between $1 and $2, depending on the size of collier and regularity of service, and that corresponding figures for San Francisco will be $1.50 to $2.50. With a 1,000,000-ton output the lesser figures should be reached and might be lowered. These figures would indicate that coal from this field has a chance of excluding the eastern coals from Pacific ports north of San Francisco, and possibly also from that port, and on account of its superiority in fuel value to coals from British Columbia and other western mines it should be able to compete successfully with them.

THE LOCAL COAL MARKET.

There is not much coal used in Alaska at the present time, and oil is rapidly supplanting it. This, of course, is due to the high cost of coals, most of which are imported from British Columbia mines.

[1] Alaska Coal and its Utilization, by Alfred H. Brooks, Bull. 442-J, U. S. Geol. Survey, 1911.

It is believed that this condition would not continue if Alaskan fields were opened, as the price of oil is advancing, and present prices of a much inferior coal are excessive.

The present coal consumption in Alaska is about 100,000 tons a year, but it is believed that if the Bering River coal is as good as is expected and if the field is opened to development and railroad construction resumed, an immediate local market of considerable size will be created. Smelters in Prince William Sound, local demands for fuel at Cordova, Valdez, and the mines in Prince William Sound and in the Kotsina-Chitina district, a supply for Alaska steamers and and for water shipments to other Alaskan ports seem to justify a belief that 150,000 tons per annum would find ready a sale almost at once and that with the development of the country this local market would grow rapidly.

The situation as to Matanuska coal is not so favorable. The haul to Seward is expensive, the cost of transportation and delivery aboard ship running from $3.38 per ton on a 500,000-ton output to $2.06 per ton on a 1,000,000-ton output. Unless it should develop that the coal is much better in quality or that the mining cost is greatly less, this coal can not compete at Seward with the Bering coal at Cordova, and it could not hope to compete with it in the larger Pacific markets, and possibly not with the coals from the east. If both fields are opened it seems evident that the markets for this coal would have to be found largely on the railroad itself, and while these markets will probably be ultimately very valuable they may not hold out enough immediate prospect to justify extensive mining operations.

SUMMARY AND RECOMMENDATIONS.

Less than five months ago the Alaska Railroad Commission was appointed to investigate the problems of transportation in Alaska involving the comparative study of a dozen terminals, and railway routes aggregating over 3,000 miles, and was directed to submit its report "on or before the 1st day of December, 1912, or as soon thereafter as practicable." This duty involved a consideration not only of the physical and engineering features connected with each project, but also the various industrial phases of no less importance. The great mass of data has been digested and the results are presented in the preceding pages. It remains to summarize these results briefly and to present the conclusions of the commission.

The data presented shows that the United States possesses in Alaska a frontier territory of great size and of wonderful industrial possibilities. The Commission believes that its climate is favorable to permanent settlement and to agriculture; that its mineral resources are vast and as yet but little exploited; that its population is sparse, but only by reason of its inadequate transportation facilities; and that its people are of the same type of hardy pioneers that have carried the United States frontier to its present limits.

In arriving at conclusions and formulating findings the Commission has had in mind the terms of the act of Congress constituting its precept, which, briefly stated, provide for recommendations in respect to the best and most feasible railroad routes in Alaska from the seaboard to the coal fields and to the interior navigable waterways "which will best develop the country and resources thereof for the use of the people of the United States." It interprets this precept to mean recommendations:

1. For a railway or railways which give promise of affording the lowest transportation cost to tidewater of coal from one or both of the two best coal fields.

2. The projection of railways along such route or routes as would open the interior to commerce and colonization; the selection of such route or routes to be made after giving due weight to lowest cost, and shortest time of construction, maximum economy of operation, and service to the largest areas of known natural wealth, best adapted to permanent colonization; and, finally,

3. That these proposed railways must be based on the best ocean terminals.

The provisions of the enacting clause clearly compels the Commission to make choice of routes solely on the basis of physical and economic facts. It therefore can not admit as factors in the problem the existence of railways already built except in so far as these lines meet the conditions prescribed above. Nor can the local interests of existing coastal settlements be given weight and still less the personnel or organization of corporations owning interests in existing lines or terminals. The Commission conceives its duty to lie in pointing out the route or routes which will best accomplish the ends specified in the act without regard to local, corporate, or individual interests.

The routes considered by the Commission fall into three classes:

First. Those which reach the interior, but do not give economical access to either of the two principal coal fields. In this class are: The Skagway route; the Haines-Fairbanks route; the Iliamna-Kuskokwim route; the Valdez-Fairbanks route.

Second. Routes which reach the coal fields only. In this class fall the routes from Katalla and Controller Bay.

Third. The routes which reach the interior and at the same time will furnish economical transportation for the two coal fields. In this class are the Cordova-Fairbanks route; the Seward-Fairbanks route; the Seward-Innoko-Iditarod route. These routes will be considered in the order above presented.

For convenience in discussing the relative merits of the various routes under consideration, it has been deemed expedient to arrange the physical and economic characteristics of each in such form as to facilitate comparison. Accordingly, two tables have been prepared and are here inserted. Table A shows the various features of the six through or trunk routes, while Table B refers to the proposed coal roads. The headings of the different columns are descriptive of the data furnished and therefore require no further explanation.

TABLE A.—*Comparison of trunk lines.*

Name of route.	New track mileage.	Existing track mileage.	Total cost of new construction.	Average construction cost per mile.	Maximum grade.	
					North bound.	South bound.
					P. ct.	*P. ct.*
Haines-Fairbanks	638	.....	$28,186,000	$44,300	[1] 2	[1] 2
Cordova-Fairbanks	313	132	13,971,000	44,600	1.13	1.51
Valdez-Fairbanks	380	.....	18,545,000	48,800	3	3
Seward-Fairbanks	391	72	17,708,000	45,300	2.3	2.2
Seward-Iditarod	344	72	17,970,000	52,300	[1] 2	[1] 2
Iliamna-Kuskokwim	400	.....	22,199,000	55,400	[2]	[2]

Name of route.	Number of summits.	Total lift north bound.	Average freight rate per ton-mile.	Average rate per passenger-mile.	Through freight rate per ton.	Through passenger rate.
		Feet.	*Cents.*	*Cents.*		
Haines-Fairbanks	2	[1] 4,000	[3]	[3]	[3]	[3]
Cordova-Fairbanks	1	4,260	[4] 8.30 [5] 5.49	[4] 7 [5] 6	[4] $36.94 [5] 24.43	[4] $31.15 [5] 26.70
Valdez-Fairbanks	3	5,970	[4] 9.13 [5] 6.04	[4] 7 [5] 6	[4] 34.69 [5] 22.95	[4] 26.60 [5] 22.80
Seward-Fairbanks	3	4,900	[4] 8.55 [5] 5.68	[4] 7 [5] 6	[4] 40.20 [5] 26.71	[4] 32.90 [5] 28.20
Seward-Iditarod	[2]	[2]	[4] 16.5 [5] 11.63	[4] 10 [5] 6	[4] 68.64 [5] 48.38	[4] 41.60 [5] 33.28
Iliamna-Kuskokwim	[2]	[2]	[3]	[3]	[3]	[3]

[1] Estimated from U. S. Geological Survey topographical maps.
[2] Not known.
[3] No operation studies made.
[4] Rate taken from estimate No. 2 (p. 108).
[5] Rate taken from estimate No. 3 (p. 108).

Cost of new construction contains equipment and overhead charges.

TABLE B.—*Comparison of coal lines.*

[Freight rate is calculated for 1,500 tons daily output at mines.]

Name of route.	New track mileage.	Existing track mileage.	Total cost of new construction.	Average construction cost per mile.
Bering River-Katalla-Cordova	55	38	$2,700,000	$49,000
Bering River-Lake Charlotte-Cordova	38	38	2,054,000	54,000
Bering River-Katalla Bay	31	.....	[1] 1,702,000	55,000
Bering River-Controller Bay	25	.....	[1] 1,430,000	57,000
Matanuska-Chitina-Cordova	163	132	8,434,000	51,700
Matanuska-Kern Creek-Seward	115	72	4,945,000	43,000
Matanuska-Valdez	230	.....	12,662,000	55,000

Name of route.	Maximum grade.		Number of summits.	Total lift south bound.	Average freight rate per ton-mile.	Through freight rate, mines to terminal.	Through freight rate, mines to ship.
	North bound.	South bound.					
	Per cent.	*Per cent.*		*Feet.*	*Cents.*		
Bering River-Katalla-Cordova	1.3	0.58	.....	145	1.39	$1.29	$1.54
Bering River-Lake Charlotte-Cordova	1.3	1.7	1	360	1.51	1.17	1.42
Bering River-Katalla Bay	1.3	0.58	.....	145	2.50	.77	.97
Bering River-Controller Bay	1.3	0.58	.....	145	2.79	.69	.89
Matanuska-Chitina-Cordova	1.13	2.2	1	2,180	1.66	4.90	5.15
Matanuska-Kern Creek-Seward	2.3	2.2	2	1,750	1.36	3.13	3.38
Matanuska-Valdez	3	3	3	3,980	1.70	3.91	4.16

[1] Exclusive of terminal, which is estimated at $2,500,000.

Cost of new construction contains equipment and overhead charges.

Of the routes that do not reach either of the principal coal fields, two have their coastal terminals in southeastern Alaska, namely, at Skagway and at Haines-Pyramid Harbor. These two routes have much in common, but as between the two harbors, the location at Haines, with its possibilities of development on both sides of the peninsula, and with its good anchorage area, possesses advantages over Skagway.

The Commission believes that a railroad will be built at an early date connecting Haines with the Canadian interior, for the development of local resources, and that the development of central Alaska and adjacent portions of Canada will ultimately call for an extension of this line into the Tanana Valley and possibly on to the Seward Peninsula. The route presents many attractive features; but in common with the route based on Skagway, the mileage to Fairbanks is excessive, is partly in foreign territory, and as yet no high-grade coal has been discovered which can be conveniently served by either of these routes. The Commission therefore feels justified in confining its further considerations to the routes reaching the interior from ports on the Gulf of Alaska west of the one hundred and forty-first meridian.

The third route, which does not give access to either of the principal coal fields, is the route from one of the harbors on Cook Inlet into the valley of the Kuskokwim. These harbors may be passed over with the statement that no railroad can be based on any of them that will assist in the development of the Territory as efficiently or as economically as can be done by lines reaching the coast farther north and east. They lie too far southwest to develop con-

veniently the known resources of the interior. The Commission, however, desires to state that Iliamna Bay or Iniskin Bay has possibilities for use as a terminal for a short line intended to develop the resources and industries of the immediately tributary region. This eliminates all routes to the interior that will not economically serve either of the two principal coal fields, excepting the route from Valdez.

Valdez has a harbor inferior only to that of Cordova and about equal to that of Seward. There is no probability, however, of its being utilized as an outlet for either Bering River or Matanuska coal. The commission considered the possibilities of developing Matanuska coal by way of this port; but the haul involves the surmounting of two major summits (Tahneta and Thompson Passes) and one minor summit (Ernestine), besides being longer in distance than the haul over the alternate route to Seward. It is not surprising, therefore, that operating costs are shown to be excessive. With industrial advancement it is probable that Valdez will require the construction of one or the other of the lines connecting it with the Copper River Valley. The Thompson Pass route would also have value in case equitable trackage arrangements for traffic through to tidewater can not be effected by the proposed Chitina-Fairbanks road.

This leaves for consideration the routes giving economical access to the two coal fields. Before discussing these routes which are affected by the development of these fields it is desirable to briefly consider the coal question.

In the absence of information to the contrary the Commission assumes that the coal deposits of the Bering River and Matanuska fields are on a parity as to quality of product and cost of mining. The heart of the Bering field lies about 30 miles from the coast at either Katalla or Controller Bay, about 76 miles from Cordova, and about 38 miles from the existing tracks of the Copper River & Northwestern Railway. The heart of the Matanuska field is 187 miles from Seward, 115 miles from the present northern terminus of the Alaska Northern Railway. Both fields are reported to contain bituminous coal of good coking and steaming quality, in composition approximating the best coals of the eastern fields in the United States, but both are so folded and crushed as to add to the expense of mining and to much reduce the percentage of lump in the output.

It has been shown by analyses of operation costs (see pp. 125 to 130) that these coals can probably be delivered at their respective terminal points for the following figures per ton. These figures are based on an assumed output of about 500,000 tons annually, and include only transportation and terminal costs.

Estimate of cost of transporting and loading coal:

	Per ton.
Bering River coal to—	
Katalla	$0.97
Controller Bay	.89
Cordova via Lake Charlotte	1.44
Matanuska coal to Seward	3.38

The coal markets of the Pacific have also been discussed (see p. 131), and it has been shown that Alaska coal could probably compete with other coals in the west coast markets, provided that the operators both of the mines and of the transportation lines are content with reasonable profits.

Controller Bay and Katalla each require for terminal development a first cost of construction that will assuredly be high and will certainly require high maintenance charges. Moreover, the completion of such terminal would offer harbor facilities very inferior to those that can, at little expense and at low maintenance charge, be had at Cordova. While the costs of transportation to these points are lower than that to Cordova, the Commission believes that, for the reasons cited above and discussed more fully elsewhere (see p. 96 to p. 98), it would be unwise to attempt harbor construction at either Katalla or Controller Bay at present. An additional and important reason for this decision lies in the fact that if either of these places were developed as a coal-shipping port all Bering River coal used in Alaska would have to be transshipped unless a line from Katalla to a junction with the Copper River Railway were built. It is evident that such a railway would serve, for the present at least, to make harbor construction at either Katalla or Controller Bay superfluous, for it would at once give the coal an outlet to tidewater at Cordova, as well as inland by the Copper River Valley.

The Commission is of opinion that the routes based on Skagway, Haines, Iliamna Bay, and Valdez are eliminated for the lack of high-grade coal, and those based on Katalla and Controller Bay by the present unsuitable harbor facilities, which would be remedied only by difficult and costly construction. This reduces the discussion to the three routes which penetrate inland Alaska and at the same time give convenient access to the two coal fields. Two of these routes reach the heart of the Tanana Valley, one from Cordova and one from Seward. The third reaches the Kuskokwim from Seward. The two routes into the Tanana will first be compared.

After its study of all available harbors, the Commission is of the opinion that the one at Cordova is, without question, the best. It has no disadvantage not possessed by all and one great advantage possessed by no other, namely, an ample area of good anchorage. Seward is evidently the seaport for the Matanuska coal and Cordova the logical outlet for the Bering River coal. The comparisons of transportation rates given in the foregoing table show that for an output of 500,000 tons annually it will cost $1.96 a ton more to haul Matanuska coal to Seward than it will to haul the Bering River coal to Cordova, and the analysis further shows that for double this output the additional cost will be $1.11. This places the Matanuska coal at such disadvantage that it could probably not be marketed at tidewater in competition with the Bering River coal.

To now consider the trunk lines to Fairbanks over their two routes: For the purpose of comparison a digest of the analyses of mileage and cost of new construction, mileage between terminals, and freight rates on these two lines is here again presented.

Terminals.	Distance.	New mileage.	Cost of new construction.	Average freight per ton.	
				Estimate 2.	Estimate 3.
Cordova-Fairbanks	445	313	$13,971,000	$36.94	$24.43
Seward-Fairbanks	463	391	17,708,000	40.20	27.71

It is evident that, on the Cordova route, the first investment will be less than on the Seward route; the resulting freight rates will be lower; the terminal port offers a better harbor than the one at Seward; and the tributary coal field promises the earlier development because its product can be marketed cheaper. Each of these economic features points clearly to the advisability of reaching the Tanana Valley via the valley of the Copper River, and the Commission therefore recommends the construction of a railway from Chitina to Fairbanks.

The construction of a railway through the Copper River Valley to the Tanana would leave a large and very important part of Alaska unprovided for. It would in no way furnish transportation facilities to the rich agricultural lands and mineral wealth of the lower Susitna or make available the coals of the Matanuska fields. While this coal is probably barred for the present from tidewater competition with the Bering River coal, it yet has great value for local use. Moreover, and still more important, a railway to Fairbanks from Cordova will not serve the great Kuskokwim Valley, and therefore not fulfill all the demands for rail connection with inland navigable waters. Fortunately both the Kuskokwim and Susitna Valleys can be developed by a railway from Seward to navigable waters on the Kuskokwim.

The building of this line into the Susitna Valley is second in importance only to a line to Fairbanks, and its extension into the Kuskokwim should also be provided for as soon as possible, and the Commission so recommends.

The Commission believes that the two railway lines into which this discussion has resolved itself will form two systems that will at once advance development in the Territory. This recommendation for two trunk lines connecting navigable waters is in accord with the natural evolution of railway construction. In new countries the first lines of communication established are always those built over the main divides and connecting with navigable waters, and thus serving to supplement water transportation. It is only in well-settled countries that lines tying together such transverse systems and paralleling waterways are built.

The industrial advancement which will follow the building of the main trunk lines can not fail to call for the extension of many branches to serve adjacent districts. There is no reason to believe that such branches will not follow in Alaska as they have in all railroad history, and such extensions will ultimately provide for intercommunication between the two systems here recommended. Several such extension lines have been mentioned in this report. Those most important, in the opinion of the Commission, are the coal branches; the extensions from Fairbanks to the Yukon River, so that the scope of rail service may reach the main Yukon Valley; the extension from the Chitina-Fairbanks line to reach the Nebesna Valley; and one at least of the two routes connecting Valdez with the Copper River Valley. In the opinion of the Commission the two coal branches should be built at once; the others will follow the demand created by industrial development.

The Commission therefore recommend the construction of railway lines as follows:

1. Chitina to Fairbanks, 313 miles	$13,971,000
2. Bering River coal branch, via Lake Charlotte, 38 miles	2,054,000
3. Kern Creek to Susitna Valley, 115 miles	5,209,500
4. Matanuska coal branch, 38 miles	1,616,000
5. Susitna Valley to Kuskokwim, 229 miles	12,760,500

In conclusion, it should be stated that the Commission is unanimously of opinion that this development should be undertaken at once and prosecuted with vigor; that it can not be accomplished without providing the railroads herein recommended under some system which will insure low transportation charges and the consequent rapid settlement of this new land and the utilization of its great resources.

Respectfully submitted.

JAY J. MORROW,
Major, Corps of Engineers, U. S. Army, Chairman.

ALFRED H. BROOKS,
U. S. Geological Survey, Vice Chairman.

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APPENDIX A.

MEMORANDUM OF MATERIAL AVAILABLE FOR TRANSFER FROM THE ISTHMIAN CANAL COMMISSION, FURNISHED THE ALASKA RAILROAD COMMISSION BY THE SECRETARY OF THE INTERIOR, SEPT. 1, 1912.

1. *List of equipment in service of Isthmian Canal Commission, suitable for railway construction work, that will be available Jan. 1, 1913.*

36-INCH GAUGE.

Number.	Class.	Price.	Description and date of release.
82	Cars, steel flat (narrow gauge).	$390	Bought in 1909 from Youngstown Car Mfg. Co. 36-inch gauge. 8-wheel, all steel flat cars, 30,000 pounds capacity; platform, 7 feet wide; train length, 18 feet; height of car rail to platform, 2 feet 4 inches; M. C. B. trucks, couplers, and brake beams. Operate on 70-pound rail. Retire at end of year 1912.
35	Cars, steel dump (narrow gauge).	227	Bought in 1907 from Western Wheeled Scraper Co. 36-inch gauge. 4-yard capacity, double dump; capacity, 12 tons. Operate on 70-pound rail. Retire at end of year 1912.
8	.....do.....	348	Bought in 1909 from Wonham-Magor Co. 36-inch gauge. 5 yards double dump; capacity, 12 tons. Operate on 70-pound rail. Retire at end of year 1912.
4	Locomotives (narrow gauge).	3,163	10 by 16 inches, simple, built by Davenport Locomotive Co. in 1908; 36-inch gauge; bituminous coal; 4-wheel saddle type; steel cabs; air brakes.
14	.....do.....	2,980	8 by 14 inches, simple; built by H. K. Porter Co. in 1910, 36-inch gauge; 24-inch driving wheels; bituminous coal; 6 drivers; 350 gallons water; driving-wheel base, 5 feet 6 inches; total wheel base, 14 feet 6 inches; tractive power, 4,000 pounds; air brakes; steel cab.
4	.....do.....	2,950	10 by 16 inches, simple; 4-wheel saddle tank; 36-inch gauge; bituminous coal; steel cabs; built by Vulcan Iron Works in 1910.
8	Concrete mixers.....	1,000–1,500	All ¾ cubic yard capacity; built by Contractors Supply Co.; Ransome Concrete Machine Co.; of the following types: Chicago, Smith, Ransome, etc.
50	Miles rail.....	[1] 31	This rail has been in service from 3 to 4 years in construction service and is 70 pounds to the yard, A. S. C. E. section. Has necessary angle bars, bolts, and tie plates. Retire by Dec. 31, 1912. It is estimated that it would last from 4 to 5 years in ordinary freight service.
145	Switches (complete).....	70–125	Each switch consisting of points, low-ground throw stands, and frogs, with necessary rods and fastenings; high-price manganese steel switch point tips and frogs with manganese steel centers; low-price open hearth steel points and frogs.
			Total narrow gauge=$273,682.

[1] Per ton.

FIVE-FOOT GAUGE EQUIPMENT.

(Available in 1913.)

A large number of steel flat and dump cars, 5-foot gauge, and wooden flat cars of same gauge will be ready to retire June 30, 1913, or later in that year. These cars must all be changed to 4 foot 8½ inch gauge at an average cost of $30 each. They may be used in filling in trestles, etc., and on heavy work on 4 foot 8½ inch gauge.

This list may be materially increased January 1, 1915, but it will suffice for needs of such items until then. If not used for a Government road in Alaska, there is no apparent use for this plant.

The following are recommended to be taken:

400 wooden flat cars, purchased in 1907 and 1908, American Car & Foundry Co., for use with Lidgerwood cable plow unloaders, 5-foot gauge. Original cost, $1,110 each. Estimated cost conversion, $28.50 each.
100 steel dump cars, purchased in 1910, William J. Oliver Manufacturing Co.
100 steel dump cars, purchased in 1908, William J. Oliver Manufacturing Co.
200 steel dump cars, purchased in 1908, Western Wheel Scraper Co., 12 cubic yards capacity. Average cost conversion, $28.50 each.
24 American Locomotive Co. locomotives. Nos. 101–124, retired June 30, 1913. Estimated cost conversion $775 each. Original cost $11,000. (These are all the locomotives that may be converted. If the standard gauge is limited to road from Seward to coal field, 15 locomotives will suffice.)

EXCAVATING MACHINERY.

15 dredge buckets; clam shell and orange peel. Selected from those retired in 1913 for use with locomotive cranes or derricks.
10 locomotive cranes to be selected from those retired in 1913:
4, 15-ton capacity.
4, 20-ton capacity.
2, 25-ton capacity.
6 well drills, Star Drilling Co., 4 inches, mounted on wheels, with engines and boilers for same arranged to be operated by steam.
25 drills Tripod, with steam heads, selected from those retired in 1913, —by 7½-inch stroke, 145 pounds and 400 pounds weight.
2 pile drivers, long reach leads for driving trestles to be mounted on Lidgerwood cars.
2 pile drivers, self propelling swing drivers, with boilers and patent hammers.
3 earth spreaders to be selected from those retired in 1912.
8 steam shovels, Marion and Bucyrus, 2½-yard dippers, 70 tons or less.
1 steam shovel, 5 cubic yard dipper, 90 ton.
4 Lidgerwood unloaders, 60-inch ton pull, 12 by 12-inch double engines.
8 Marion plow unloaders, 4 right and 4 left hand.

MISCELLANEOUS.

6 rock crushers 40 to 300 cubic yards per day capacity, to be selected from those retired in 1912–13, with necessary boilers, engines, etc.
12 concrete mixers, ¾ yard capacity.

MATERIAL.

100 miles 70-pound rails, with fish bars, angleplates, bolts and nuts.
100 switches, ground throw stands, points and frogs, rods and fastenings.

All excavating equipment, locomotives, and steam plant to be equipped with necessary hand tools for operation and field repairs.

Also tools serviceable for track work, namely: Spike mauls, track drills, track wrenches, jim crows, track levels, track gauges, spike pullers, lining bars, tamping picks, shovels, sufficient for 1,000 men six months.

Appendix B.

Statistics of commerce and industries of the Territory of Alaska.[1]

VALUE OF THE OUTPUT OF SEA, FUR, AND MINERAL PRODUCTS FROM ALASKA, 1868 TO 1911, INCLUSIVE.

Year.	Sea and fur products.					
	Fur-seal skins.	Aquatic furs, except seals.[2]	Furs of land animals.	Walrus and whale-bone products.	Fishery products.	Total.
1868	$708,734	$446,245	.....	.....	$306,638	$1,461,617
1869	653,118	446,245	.....	.....	276,630	1,375,993
1870	188,126	446,245	.....	.....	263,648	898,019
1871	1,584,986	437,555	$61,012	.....	175,268	2,258,821
1872	1,231,580	437,555	281,838	.....	157,300	2,108,273
1873	1,439,307	437,555	127,478	.....	101,200	2,105,540
1874	1,498,176	437,555	129,149	.....	116,182	2,181,062
1875	1,402,662	437,555	135,931	.....	137,646	2,113,794
1876	857,203	437,555	189,503	.....	231,201	1,715,462
1877	853,283	437,555	150,340	.....	122,700	1,563,878
1878	1,110,145	437,555	149,394	.....	184,422	1,881,516
1879	2,451,954	437,555	171,200	.....	246,399	3,307,108
1880	2,465,539	437,555	200,651	.....	179,200	3,282,946
1881	2,167,172	523,205	152,664	.....	168,008	3,011,049
1882	1,436,906	523,205	128,952	.....	257,111	2,346,174
1883	1,710,580	523,205	179,148	.....	467,692	2,880,625
1884	1,454,650	523,205	269,710	.....	500,145	2,747,710
1885	1,641,101	523,205	256,217	.....	527,679	2,948,202
1886	1,987,793	523,205	266,134	.....	746,186	3,523,318
1887	1,716,476	523,205	288,604	.....	917,007	3,445,292
1888	2,298,204	523,205	232,185	.....	1,447,478	4,501,072
1889	2,035,605	523,205	291,940	.....	2,352,652	5,203,402
1890	1,673,757	523,205	294,562	.....	2,360,500	4,852,024
1891	1,370,376	86,225	265,010	.....	2,756,742	4,478,353
1892	1,018,184	86,225	286,768	.....	1,784,510	3,175,687
1893	584,680	86,225	387,294	.....	2,322,308	3,380,507
1894	859,259	86,225	383,235	.....	2,486,852	3,815,571
1895	877,614	86,225	367,615	.....	2,123,107	3,454,561
1896	872,454	86,225	227,432	.....	3,120,844	4,306,955
1897	455,758	86,225	144,048	.....	3,132,976	3,819,007
1898	474,320	86,225	81,372	.....	3,429,529	4,071,446
1899	787,334	86,225	45,724	.....	3,749,110	4,668,393
1900	1,282,096	86,225	147,633	.....	5,303,294	6,819,248
1901	1,137,611	37,167	243,784	.....	6,685,262	8,103,824
1902	1,160,306	37,167	240,589	.....	8,310,304	9,748,366
1903	1,066,254	37,167	287,013	.....	7,505,245	8,895,679
1904	620,940	37,167	126,829	.....	6,458,585	7,243,521
1905	762,120	[3] 232,230	182,326	[4] $910,959	7,908,243	9,995,878
1906	756,757	30,369	108,049	196,838	8,524,372	9,616,385
1907	851,427	23,351	231,747	373,543	9,518,918	10,998,986
1908	822,970	31,828	323,480	148,382	11,140,161	12,466,821
1909	[5] 601,506	69,508	[6] 318,605	194,073	10,422,169	11,287,256
1910	[5] 473,207	111,790	[6] 318,605	136,791	12,650,191	13,371,979
1911	[5] 432,913	39,733	313,730	114,877	16,377,463	17,278,716
Total	51,835,143	12,496,063	8,350,290	2,075,463	147,953,077	222,710,036

[1] Statistics on Commerce, compiled by H. L. Muchemore.

[2] The following data of the Bureau of Fisheries with respect to aquatic furs have been distributed by annual averages: 1868–1870, $1,338,735; 1871–1880, $4,375,551; 1881–1890, $5,232,050; 1891–1900, $862,250; 1901–1904, $148,668.

[3] Includes hair seal, 1868–1905, which can not be accurately distributed by years.

[4] 1868–1905.

[5] Product of seal islands only.

[6] Estimated.

Statistics of commerce and industries of the Territory of Alaska—Continued.

VALUE OF THE OUTPUT OF SEA, FUR, AND MINERAL PRODUCTS FROM ALASKA, 1868 TO 1911, INCLUSIVE—Continued.

Year.	Mineral products.						Grand total.
	Gold.	Silver.	Copper.	Gypsum, marble, and tin.	Coal.	Total.	
1868							$1,461,617
1869							1,375,993
1870							898,019
1871							2,258,821
1872							2,108,273
1873							2,105,540
1874							2,181,062
1875							2,113,794
1876							1,715,462
1877							1,563,878
1878							1,881,516
1879							3,307,108
1880	$20,000		$826			$20,826	3,303,772
1881	40,000					40,000	3,051,049
1882	150,000					150,000	2,496,174
1883	301,000	$11,146				312,146	3,192,771
1884	201,000					201,000	2,948,710
1885	300,000					300,000	3,248,202
1886	446,000					446,000	3,969,318
1887	675,000					675,000	4,120,292
1888	850,000	2,181				852,181	5,353,253
1889	900,000	7,490				907,490	6,110,892
1890	762,000	6,071				768,071	5,620,095
1891	900,000	7,920				907,920	5,386,273
1892	1,080,000	7,000				1,087,000	4,262,687
1893	1,038,000	6,570				1,044,570	4,425,077
1894	1,282,000	14,257				1,296,257	5,111,828
1895	2,328,500	44,222				2,372,722	5,827,283
1896	2,861,000	99,087			$84,000	3,044,087	7,351,042
1897	2,439,500	70,741			28,000	2,538,241	6,357,248
1898	2,517,000	54,575			14,000	2,585,575	6,657,021
1899	5,602,000	84,276			16,800	5,703,076	10,371,469
1900	8,166,000	45,494			16,800	8,228,294	15,047,542
1901	6,932,700	28,598	40,000		15,600	7,016,898	15,120,722
1902	8,283,400	48,590	41,400		19,048	8,392,438	18,140,804
1903	8,683,600	77,843	156,000		9,782	8,927,225	17,822,904
1904	9,160,000	114,934	275,676		7,225	9,557,835	16,801,356
1905	15,630,000	80,165	749,617		13,250	16,473,032	26,468,910
1906	22,036,794	136,345	1,133,260		17,974	23,324,373	32,940,758
1907	19,349,743	98,857	1,261,757	$125,644	53,600	20,889,601	31,888,587
1908	19,292,818	71,906	605,267	141,348	14,810	20,126,149	32,592,970
1909	20,411,716	76,934	536,211	168,747	12,300	21,205,908	32,493,164
1910	16,126,749	85,239	538,695	169,626	15,000	16,935,309	30,307,288
1911	[1] 17,150,000	[1] 220,000	2,898,885	215,485	(1)	20,484,370	37,763,086
Total	195,916,520	1,500,441	8,237,594	820,850	338,189	206,813,594	429,523,630

[1] Estimated.

Value of total mineral production of Alaska, 1880–1912.

By years:	
1880–1890	$4,686,714
1891	916,920
1892	1,096,000
1893	1,048,570
1894	1,310,257
1895	2,386,722
1896	2,980,087
1897	2,538,241
1898	2,585,575
1899	5,703,076
1900	8,238,294
1901	7,007,398
1902	8,400,693
1903	8,941,614
1904	9,567,135
1905	16,478,142
1906	23,375,008
1907	20,847,055
1908	$20,142,272
1909	21,141,019
1910	16,887,244
1911	20,691,906
1912	[1] 21,850,000
	228,819,942
By substances:	
Gold	212,269,776
Silver (commercial value)	1,824,364
Copper	13,377,194
Coal	355,489
Marble, gypsum, tin, etc	993,119
	228,819,942

[1] Preliminary estimate.

Value of gold production of Alaska, with approximate distribution, 1880–1911.

Year.	Pacific coast belt.	Copper River and Cook Inlet region.	Yukon Basin.	Seward Peninsula and northwestern Alaska.	Total.
1880	$20,000				$20,000
1881	40,000				40,000
1882	150,000				150,000
1883	300,000		$1,000		301,000
1884	200,000		1,000		201,000
1885	275,000		25,000		300,000
1886	416,000		30,000		446,000
1887	645,000		30,000		675,000
1888	815,000		35,000		850,000
1889	860,000		40,000		900,000
1890	712,000		50,000		762,000
1891	800,000		100,000		900,000
1892	970,000		110,000		1,080,000
1893	838,000		200,000		1,038,000
1894	882,000		400,000		1,282,000
1895	1,569,500	$50,000	709,000		2,328,500
1896	1,941,000	120,000	800,000		2,861,000
1897	1,799,500	175,000	450,000	$15,000	2,439,500
1898	1,892,000	150,000	400,000	75,000	2,517,000
1899	2,152,000	150,000	500,000	2,800,000	5,602,000
1900	2,606,000	160,000	650,000	4,750,000	8,166,000
1901	2,072,000	180,000	550,000	4,130,700	6,932,700
1902	2,546,600	375,000	800,000	4,561,800	8,283,400
1903	2,843,000	375,000	1,000,000	4,465,600	8,683,600
1904	3,195,400	500,000	1,300,000	4,164,600	9,160,000
1905	3,430,000	500,000	6,900,000	4,800,000	15,630,000
1906	3,454,794	332,000	10,750,000	7,500,000	22,036,794
1907	2,891,743	275,000	9,183,000	7,000,000	19,349,743
1908	3,448,318	401,500	10,323,000	5,120,000	19,292,818
1909	4,264,716	265,000	11,580,000	4,302,000	20,411,716
1910	4,182,730	351,630	8,062,389	3,530,000	16,126,749
1911	4,265,573	313,538	9,139,145	3,135,000	16,853,256
Total	56,477,874	4,673,668	74,118,534	60,349,700	195,619,776

Production of gold, silver, and copper in Alaska, 1880–1911.

Year.	Gold.		Silver.		Copper.	
	Quantity (fine ounces).	Value.	Quantity (fine ounces).	Commercial value.	Quantity (pounds).	Value.
1880	967	$20,000			3,933	$826
1881	1,935	40,000				
1882	7,256	150,000				
1883	14,561	301,000	10,320	$11,146		
1884	9,723	201,000				
1885	14,512	300,000				
1886	21,575	446,000				
1887	32,653	675,000				
1888	41,119	850,000	2,320	2,181		
1889	43,538	900,000	8,000	7,490		
1890	36,862	762,000	7,500	6,071		
1891	43,538	900,000	8,000	7,920		
1892	52,245	1,080,000	8,000	7,000		
1893	50,213	1,038,000	8,400	6,570		
1894	62,017	1,282,000	22,261	14,257		
1895	112,642	2,328,500	67,200	44,222		
1896	138,401	2,861,000	145,300	99,087		
1897	118,011	2,439,500	116,400	70,741		
1898	121,760	2,517,000	92,400	54,575		
1899	270,997	5,602,000	140,100	84,276		
1900	395,030	8,166,000	73,300	45,494		
1901	335,369	6,932,700	47,900	28,598	250,000	40,000
1902	400,709	8,283,400	92,000	48,590	360,000	41,400
1903	420,069	8,683,600	143,600	77,843	1,200,000	156,000
1904	443,115	9,160,000	198,700	114,934	2,043,586	275,676
1905	756,101	15,630,000	132,174	80,165	4,805,236	749,617
1906	1,066,030	22,036,794	203,500	136,345	5,871,811	1,133,260
1907	936,044	19,349,743	149,784	98,857	6,308,786	1,261,757
1908	933,290	19,292,818	135,672	71,906	4,585,362	605,267
1909	987,417	20,411,716	147,950	76,934	4,124,705	536,211
1910	780,131	16,126,749	157,850	85,239	4,241,689	538,695
1911	815,276	18,853,256	460,231	243,923	27,267,878	3,408,485
Total	9,463,106	195,619,776	2,578,862	1,524,364	61,063,986	8,747,194

Comparative statement of valuation of commodities (domestic merchandise) shipped from the United States to Alaska, years 1907–1911.

Commodity.	1907	1908	1909	1910	1911
Agricultural implements	$2,704	$5,044	$3,340	$1,958	$2,212
Aluminum	210	3,905	272,811	162,434	190,797
Animals	391,378	256,048	.....	.....	.....
Art works	315	5,461	.....	.....	.....
Books, printed matter	141,330	145,371	.....	.....	.....
Brass	30,407	14,338	13,317	12,573	12,311
Breadstuffs	588,014	667,812	890,349	708,242	599,213
Brooms and brushes	12,045	12,602	14,153	14,908	11,841
Candles	61,912	43,517	75,043	38,950	28,804
Vehicles and parts	163,794	170,138	154,762	56,295	58,371
Cement	16,265	7,181	9,799	13,139	4,865
Chemicals and drugs	193,422	179,262	175,406	184,077	173,369
Clocks and watches	9,361	14,740	8,914	9,307	8,939
Coal:					
Anthracite	13,514	6,842	.....	.....	.....
Bituminous	243,333	128,003	190,223	174,971	159,769
Coke	18,889	2,722	1,197	2,166	3,132
Cocoa and chocolate	13,437	15,029	15,049	13,606	11,627
Coffee	130,681	128,481	158,664	130,763	115,706
Copper and manufactures	18,024	15,359	6,671	9,367	13,175
Cotton:					
Cloths	16,217	22,907	28,388	62,704	26,540
Manufactured	662,176	517,939	621,723	610,116	643,614
Earthenware	44,392	30,912	34,448	37,306	37,663
Eggs	373,691	351,866	469,956	416,523	287,365
Explosives	318,836	417,490	730,263	457,715	431,453
Felt and roofing	10,625	7,912	.....	.....	.....
Fibers and manufactures	206,986	164,405	144,320	250,610	256,597
Fish	100,438	98,181	96,093	84,391	75,866
Fruits and nuts	455,177	438,105	458,375	402,645	354,261
Furs and skins	46,029	30,011	26,287	37,735	15,615
Glass	80,801	55,272	50,415	59,349	42,884
Hay	290,100	209,083	199,204	170,481	135,908
India rubber belts, packing, and hose	101,485	81,490	73,237	55,666	61,692
Boots and shoes	192,275	174,848	203,470	176,526	129,973
Other	33,377	20,287	21,077	23,336	20,587
Instruments and electrical apparatus	137,102	173,680	156,640	123,286	115,124
IRON AND STEEL.					
Rails	242,528	182,105	281,935	370,745	9,502
Tin sheets and plates	892,838	1,135,298	1,170,875	1,358,335	1,431,055
Structural	23,627	30,055	235,548	406,914	30,232
Hardware and tools	266,831	174,765	155,515	170,550	153,549
Firearms	50,307	34,248	30,856	41,683	36,480
Machinery	1,420,769	1,162,267	1,123,806	1,318,160	1,346,713
Nails and spikes	60,792	53,222	56,459	64,829	47,685
Pipe and fittings	210,938	105,103	79,426	86,074	65,121
All other	691,704	523,092	374,485	404,754	474,863
	3,860,311	3,400,160	3,508,905	4,222,044	3,595,200
Jewelry	89,068	95,872	43,812	65,673	36,819
Lamps, etc	21,662	15,004	14,583	15,372	12,944
Lead	69,178	55,667	64,112	69,402	62,059
Leather	6,006	7,124	7,034	9,172	3,854
Leather manufactures	362,830	314,688	308,093	325,268	257,186
MEAT AND DAIRY PRODUCTS.					
Beef products	435,185	408,005	411,620	481,786	390,533
Hog products	615,801	623,676	707,707	686,838	466,449
Butter	376,697	387,820	542,928	436,543	297,473
Cheese	46,633	43,983	62,692	50,587	37,185
Milk	299,986	327,005	357,452	319,077	263,982
All others	238,807	213,229	228,106	224,304	221,450
	2,013,091	2,003,718	2,310,505	2,199,135	1,677,072
Motor boats	6,188	11,713	27,303	53,695	70,449
Musical instruments	48,400	35,198	27,625	34,207	24,848
Naval stores	7,061	4,930	4,819	8,159	17,832
Oil cloths	25,977	15,108	19,150	16,322	19,287
Oils:					
Animal	1,175	1,081	1,378	2,063	703
Mineral	400,122	462,577	593,703	776,877	745,138
Vegetable	13,126	14,416	17,266	17,342	15,178
Paints and pigments	51,402	44,988	75,446	72,369	60,564
Paper and manufactures	139,521	124,190	298,763	279,999	282,492
Phonographs, etc	.....	.....	18,222	33,037	24,747
Rice	33,938	41,152	.....	.....	.....
Salt	34,975	43,394	.....	.....	.....

Comparative statement of valuation of commodities (domestic merchandise) shipped from the United States to Alaska, years 1907–1911—Continued.

Commodity.	1907	1908	1909	1910	1911
MEAT AND DAIRY PRODUCTS—continued.					
Silks	$36,001	$33,681	$37,146	$27,562	$13,740
Soap	32,670	38,933	48,796	44,697	41,724
SPIRITS, WINES, AND LIQUORS.					
Malt liquors	250,447	257,920	184,785	249,017	183,297
Spirits, distilled	461,301	414,189	403,978	415,464	288,474
Wines	40,157	51,531	26,531	30,184	22,043
	751,905	723,640	615,294	694,665	493,814
Sugar, molasses, and confectionery	309,649	346,903	437,365	404,561	298,877
Tin and manufactures	182,228	51,535	164,040	186,608	559,165
Tobacco	642,854	575,664	649,804	530,671	451,558
Vegetables;					
Potatoes	214,389	146,349	241,013	144,665	141,397
All other	401,598	337,506	398,561	359,410	282,926
Wood, rough	542,052	521,232	455,317	461,540	459,666
Wood, manufactured	323,305	229,546	287,131	247,721	244,666
Wool and manufactures	850,823	608,429	692,906	624,744	440,264
Zinc	4,964	4,051	4,417	5,707	6,193
All other	333,200	324,221	440,723	388,849	323,953
Grand total	16,928,411	15,248,913	17,089,826	16,822,732	14,693,588
THE ABOVE MERCHANDISE SHIPPED FROM—					
Puget Sound	$14,963,179	$12,888,286	$13,989,947	$13,326,811	$10,925,230
San Francisco	1,723,904	2,234,237	2,868,943	3,174,973	3,246,899
All other	241,328	126,390	230,936	320,948	521,459

Comparative statement of commodities (foreign merchandise) shipped from United States to Alaska, years 1907–1911.

Commodity.	1907	1908	1909	1910	1911
Tea	$32,365	$42,562	.....	.....	.....
Tin	356,794	272,434	.....	.....	.....
Coal, bituminous	19,793	105,771	.....	.....	.....
Rice	13,336	20,662	.....	.....	.....
Spirits, wines, and liquors	112,193	113,186	.....	.....	.....
All other	50,689	59,143	.....	.....	.....
Total	585,170	613,758	$615,504	$608,856	$476,561

Comparative statement of commodities (foreign merchandise) shipped from Alaska to United States, years 1907–1911.

Commodity.	1907	1908	1909	1910	1911
Total	$54,208	$37,176	$114,987	$235,269	$162,289

Comparative statement of valuations of domestic merchandise received at various points in southeastern Alaska for the years 1906–1911.

Ports.	1906	1907	1908	1909	1910	1911
Amalga	$1,997	$1,038	$525	$1,724	$107	$1,060
Baldwin	8,702	.....	.....	.....	.....	.....
Baranof	.....	.....	464	469	.....	.....
Berners Bay	2,682	.....	.....	.....	.....	.....
Blind Point	99	.....	.....	.....	.....	.....
Calder	.....	9,082	6,166	16,484	.....	.....
Cape Edwards	.....	.....	.....	.....	.....	43,910

Comparative statement of valuations of domestic merchandise received at various points in southeastern Alaska for the years 1906–1911—Continued.

Ports.	1906	1907	1908	1909	1910	1911
Cape Fanshaw				$4,133	$4,645	$462
Chatham	$34,952		$93,443	61,561	44,695	92,278
Chicagof		$2,423	1,727	12,856	5,453	17,520
Chilkat	86,547	77,737	982			
Chilkoot	29,806	40,470	18,818	33,027	35,675	45,424
Chomly	2,443	2,712	2,737			97,931
Copper City	2,646		3,249	663	178	1,660
Copper Mount	42,055	1,041				
Cordova Bay			17,530			
Dolomi	8,525	4,647	2,786	6,947	1,804	210
Douglas	258,825	251,528	256,223	310,908	362,290	357,467
Dundas	28,885	39,431	30,153	33,399	42,099	28,680
Excursion Inlet			99,922	50,776	101,876	75,410
Fish Egg Island			586	1,619	11,791	24,776
Funter Bay	57,330	94,360	46,346	80,961	105,219	59,079
Gambier Bay						1,889
Glacier Bay			28,257		22,754	17,436
Grace Harbor		2,526				
Gypsum	2,046	3,171	2,233	15,497	9,096	7,067
Hadley	113,409	102,979	15,047	1,673	290	
Haines	260,991	277,469	289,077	243,370	274,953	248,700
Harder			116			
Hattie Camp	293	3,447				
Hawk Inlet					978	35,508
Helm Bay	1,927					
Hidden Inlet						11,672
Holbrook	900		1,722	325		2,623
Honah	8,276	7,726	9,895	8,405	13,782	10,281
Howkan	22,079	3,728	3,599	2,557	3,245	7,693
Hudson Bay		13,485				
Hunter Bay		50,206	51,794	31,448	17,320	38,959
Icy Strait			13,381			
Juneau	653,287	711,745	639,093	658,768	745,822	655,182
Kake	9,903	8,970	4,371	9,974	10,335	8,089
Karta Bay			2,322			
Kasaan	29,827	36,065	47,278	7,654	66,235	111,020
Ketchikan	724,370	650,249	513,166	429,179	564,894	711,144
Killisnoo	28,632	19,366	24,765	36,795	62,039	38,951
Klawak	11,233	58,221	52,970	51,189	55,202	77,125
Klinquan	1,058	2,635	3,423	1,804	250	50
Lake Bay	1,175	36,930	13,552	13,151	33,160	33,059
Loring	71,413	122,265	112,525	111,182	116,284	159,463
Metlakatla	28,567	36,466	32,146	32,843	47,382	27,076
Mount Andrew		3,689				4,726
Murder Cove	8,688					
Niblack	9,825	9,703	1,263			
North Arm			3,951			
Petersburg	89,906	113,166	163,060	151,253	263,627	238,075
Pillar Bay						1,839
Pleasant Bay	6,270	15,766	301			
Point Astley	175					
Point Ellis	27,863	34,247	29,487	24,156	42,708	34,205
Point Retreat		563				
Portland					6,960	5,114
Pyramid Harbor	50,807	36,711	49,523			
Quadra		31,107	37,149	24,648	43,736	36,643
Red Wing		562				
Roe Point						51,696
St. John Harbor	297	220				
Santa Ana	21,129	30,848	25,696	14,945	36,932	40,309
Scow Bay	2,357	2,823	3,225			
Shakan	47,320	56,666	52,691	39,798	50,757	78,429
Sitka	125,564	180,120	155,373	169,183	212,000	171,138
Sitka Bay	7,599	98,550				
Skagway	557,266	423,660	520,296	374,573	275,738	225,785
Squaw Harbor		3,446				
Sulzer	17,790	29,229	28,167	34,978	17,067	16,729
Taku	13,581	35,198			33,675	74,193
Taku Harbor	13,641	7,451	42,495	29,183		
Tee Harbor	1,650	3,311	4,067	40	21	63,421
Tenakee	3,848	5,643	5,598	6,116	7,539	6,989
Tokeen					6,821	11,715
Tongass		3,809				
Treadwell	712,790	764,674	843,656	1,287,170	1,321,739	1,061,545
Tyee	7,533	25,082	34,216	27,547	21,586	5,800
Warm Springs Bay			362			
Wrangell	174,457	227,156	243,831	231,155	245,820	248,627
Wyndham Bay	325	246	195	96		
Yes Bay	16,003	32,698	35,153	33,479	48,118	66,590
Total	4,451,203	4,848,491	4,722,144	4,719,664	5,367,697	5,492,416

Comparative statement of valuations of domestic merchandise received at various points in southern Alaska, from Yakutat to Unalaska, for the years 1906–1911.

Ports.	1906	1907	1908	1909	1910	1911
Afognak	$7,709	$11,157	$5,035	$2,547	$4,034	$5,370
Akutan Harbor			221	1,323	440	
Alitak	14,522	19,385	47,919	38,813	45,698	22,180
Apollo	439					
Balboa Bay		663	1,538	963	3,768	522
Bear Harbor and Point Bennett			3,205	40		
Belkofski		1,832	100	235	1,381	1,913
Beluga				1,885	5,231	78
Boulder Bay	29,709	6,137	552			
Cape Elizabeth	164	285		1,084	248	
Carbon Center			692			
Chignik	167,727	64,846	140,670	6,368	319,298	307,273
Clearwater			303			
Coal Harbor	761		401	653	21	
Cold Bay	2,073	1,667		2,537	2,428	1,253
Controllers Bay				5,545	984	
Cooks Inlet	31,716			78,496	78,941	100,932
Copper Center	1,287	1,638	2,217	1,456	1,594	2,230
Cordova	239,992	121,017	1,303,168	3,066,769	2,071,007	775,981
Drier Bay			439	1,032		
Dutton			191			
Ellamar	98,745	79,401	26,758	39,837	34,862	25,960
Fidalgo Bay						5,897
Fort Liscum	60,016					
Fox				3,366		
Galena Bay		22,579	189	3,308		
Georgetown						6,731
Girdwood		6,834	124	968	1,208	877
Glacier Creek	21,257	704	100			
Glendenning Bay			1,013			
Gulkana				1,620		
Herring Bay		2,631				
Hinchinbrook				35,228	7,781	
Hogans Bay		3,604	3,255			
Homer	2,510	5,075	894	561	171	636
Hope	21,907	2,375	4,488	2,438	3,746	8,327
Horseshoe Bay	9,087	73,815	2,286	1,105	100	
Icy Point	2,322					
Iliamna	5,884	7,829	5,993		8,537	5,198
Innerskin	1,564	418				
Jamestown		380				
Katalla	42,032	1,569,064	93,685	72,810	85,395	73,803
Karluk	137,191	180,850	201,280	139,022	129,511	174,480
Kasilof	33,340	34,456	76,340	413	75	41
Kayak	21,144	330	684	153		
Kenai	23,577	19,880	17,984	14,129	101,361	14,992
King Cove						81,682
Knights Island		56,742	335			
Knik	29,613	12,219	15,813	20,154	32,352	47,081
Kodiak	54,703	61,881	80,973	82,149	81,436	69,390
Lake Creek				19,872	12,053	
Landlock Bay	10,589	11,480	5,394	7,721	2,460	2,014
Latouche	46,854	108,740	35,787	27,443	66,823	66,687
Louie Bay		1,093				
Midnight Bay			1,225			
Montgomery Bay		1,921				
Mouse Point	12,084					
Orca	111,084	63,612	55,361	57,493	55,687	57,163
Palmer Station	783					
Pavlof		3,547	3,418	5,079	5,951	8,521
Pearl Island		268				
Pirate Cove	10,265	25,571	5,870	30,708	19,164	20,331
Point Blank			398			
Portage Bay		1,412				
Port Graham		912		60,932	32,199	3,567
Prospect Bay			544			
Reynolds			550			
Sanak	3,009	3,067	925			
Sand Point	7,110	11,730	9,818	9,273	9,263	5,799
Seldovia	56,709	41,325	40,800	31,252	65,302	97,470
Seward	800,918	193,947	122,124	222,341	230,206	280,095
Squaw Harbor			4,043	440		
Sunrise	23,972	7,601	9,821	4,499	10,815	9,187
Susitna	6,203	13,440	45,636	125,441	41,552	19,451
Tatilek				1,322	753	106
Turnagain Arm	702	872				
Tyonek	15,151	9,532	13,285	7,364	201	3,474
Unalaska and Dutch Harbor	59,761	27,083	51,920	44,965	35,439	31,776
Unga	15,501	16,193	13,616	43,083	80,971	20,965
Uyak	50,561	164,469	63,133	231,283	30,164	42,665
Uzinka		2,188	1,052			
Valdez	863,392	1,411,671	1,120,060	918,372	805,295	685,203

Comparative statement of valuations of domestic merchandise received at various points in southern Alaska, from Yakutat to Unalaska, for the years 1906–1911—Continued.

Ports.	1906	1907	1908	1909	1910	1911
Wilson Bay		$10,000				
Wood Island		1,294	$518	$207	$335	$308
Yakataga	$7,014	4,310	3,608	6,009	118	
Yakutat	43,660	59,950	83,506	71,940	124,664	95,353
Chitina				110	8,602	63,502
Total	3,205,913	4,566,920	3,731,914	5,554,156	4,659,598	3,246,464

Comparative statement of valuations of domestic merchandise received at various points on the Bering Sea, except St. Michael, for the years 1906–1911.

Ports.	1906	1907	1908	1909	1910	1911
Bethel				$12,373	$16,267	$98,941
Bluff	$4,613	$5,077				
Bristol Bay	985,810	1,048,419	$1,068,365	1,567,655	667,829	861,620
Candle	9,008	58,228	33,221	33,262	20,205	33,859
Cape Blossom				11,812	13,632	3,291
Cape Vancouver		1,041	2,043	3,802	3,659	12,168
Cheenik			152	149,856		
Council	189,376	49,831	30,018	33,755	25,074	35,421
Corwin	756					
Dahl			674			
Dearing	2,707	124,442	46,834	36,623	41,827	23,710
Dicksen	200,744	17,492	3,507			
Diomedes		1,825	1,225	371	397	395
Diskaket			1,361			
Eak River		14,790				
Ester				1,665		
Gambell			386	3,197	2,111	465
Golovin	108,487	52,488	43,412	67,960	121,818	43,899
Gotham Inlet			1,485			
Herendeen Bay		4,015				
Hooper Bay					2,134	1,556
Icy Cape		1,447	1,041	613	1,609	1,374
Igloo		2,758	357	493	2,621	599
Johnsonville						6,365
Kewalik	151,558	213,899	40,391	46,928	58,849	19,675
Kivalina River		3,428	1,228	768	873	
Kobuk		1,609	107	237		
Kogiung				156,481	542	65,959
Kotlik			110	1,643		
Kotzebue	10,396	2,350	11,016	24,944	14,628	45,187
Kugerok	9,628	3,489				
Kuskokwim	27,025	43,626	35,829	41,154	172,349	57,042
Kvichak					450,570	127,901
Lelaska Bay	48,460					
Lost River	2,646					
Mount Village			938	1,017	2,586	3,442
Natnek					162,865	225,780
Nelsons Lagoon		6,114	7,301	6,744		8,777
Noatak			120	391	1,095	1,550
Nome	3,740,188	2,428,440	1,834,934	1,701,623	1,145,758	1,060,993
Nushhagak	310,941				1,165,750	
Ottumwa			611			
Pauloff	5,541					
Point Barrow	29,623	3,303	24,850	22,213	10,416	33,660
Point Hope	2,283	3,650	4,812	9,653	3,671	2,685
Pribilof Islands						1,274
Quinhagak				6,578	9,964	1,669
Rex		1,595				
St. Lawrence Island		3,188	1,370	673	777	3,899
St. Paul and St. George	6,844	37,381	30,901	28,694	258	
Shishmaref		1,395	1,809	1,433	158	374
Sinel City		273				
Sinuk		2,793	648	1,516	6,360	4,505
Solomon	56,158	31,945	33,579	29,514	111,784	64,801
Teller and Point Clarence	125,903	105,206	42,402	19,704	13,362	48,450
Tin City	16,897					
Tishon River		4,008				
Togiak					2,535	
Unalaklik		2,614	3,244	6,168	10,359	1,115
Wainwright	535	1,449	1,659	6,167	4,606	
Wales	5,058	3,425	4,031	2,695	2,754	2,521
Winter		7,217				
York		1,288				14,534
Total	6,051,185	4,293,943	3,317,571	4,040,375	4,272,053	2,919,456

Comparative statement of valuations of domestic merchandise received at various points on the Yukon Basin and tributaries and St. Michael for the years 1906–1911.

Ports.	1906	1907	1908	1909	1910	1911
Akularak			$1,192	$1,845	$3,099	$1,008
Anvik	$3,525	$10,639	6,327	10,791	11,348	10,711
Arctic City			696	12,717	5,099	
Bettles	22,990	16,856	35,223	105,544	19,374	13,924
Bluff				21,514	6,875	10,913
Cantwell River	943		387			
Caro			290			
Chandlar River			2,291			
Chatinika			614	1,637	1,777	104
Chena	468,479	483,003	509,699	259,643	120,799	120,589
Circle	49,357	46,617	83,114	74,243	50,639	31,489
Cleary		9,955	5,157	171		
Coldfoot			1,064	9,802	366	
Davidson		2,099				
Diskaket				6,792	4,799	10,969
Dome City		9,564	2,627	13,608	325	
Eagle	28,051	82,598	127,418	323,824	75,198	25,672
Fairbanks	2,128,392	1,669,409	1,457,417	2,305,993	1,096,558	895,101
Fort Egbert	50,937					
Fort Hamlin	406	1,331				
Fort Yukon	4,009	11,156	6,811	15,960	15,067	15,482
Forty Mile		43,236	5,952	4,231		
Halpin			337			
Hamilton			1,952	5,090	11,367	7,534
Hot Springs		23,415	73,512	71,840	51,529	83,830
Iditarod					241,179	523,234
Ikogmut				2,748		
Innoko			247	23,034	8,065	4,992
Kaltag		3,456	7,558	6,337	10,211	1,178
Kokrines		3,934	1,897	5,701	4,089	2,249
Koserefsky and Holy Cross		361	7,359	36,182	110,135	14,482
Koyukuk	13,973	3,924	6,506	5,796	7,867	12,389
Little Delta		2,131		3,618		
Louden		2,793	3,736	5,101	4,548	6,199
Nation			325	50		
Nenana			2,850	9,307	3,669	5,117
Novakaket	4,262					
Nulato	24,060	9,352	24,076	15,039	24,355	37,630
Ophir						931
Rampart	41,259	45,082	35,495	35,416	13,888	3,264
Ruby City						13,784
St. Michael	1,676,577	890,544	731,006	1,003,348	1,544,101	1,458,616
Stevens Village		1,450		720	2,623	3,160
Tanana	143,567	176,240	147,026	210,964	170,926	186,422
Tolovana		3,658	3,241	127	7,860	9,840
Transit		3,346				
Vault Creek			929	929		
Other places		7,499				
Total	4,659,844	3,564,591	3,294,689	4,609,692	3,627,735	3,510,813

Comparative statement of valuations (domestic merchandise) shipped from the United States to principal points in the Yukon Basin, years 1903–1911.

Ports.	1903	1904	1905	1906	1907
Chena	$28,139	$74,114	$219,699	$468,479	$483,003
Circle	41,531	21,849	51,495	49,357	46,617
Eagle	100,989	97,924	105,776	78,988	82,598
Fairbanks	53,859	367,591	1,569,613	2,128,392	1,669,409
Hot Springs					23,415
Rampart	71,305	38,489	127,053	41,259	45,082
St. Michael	215,371	502,820	1,025,011	1,676,577	890,544
Tanana	68,279	36,861	77,943	143,567	176,240
All other places	109,976	63,244	95,821	73,225	207,593
	689,449	1,202,892	3,272,411	4,659,844	3,624,501

Ports.	1908	1909	1910	1911
Chena	$509,699	$259,643	$120,799	$120,589
Circle	83,114	74,243	50,639	31,489
Eagle	127,418	323,854	75,198	25,672
Fairbanks	1,457,417	2,305,993	1,096,558	895,101
Hot Springs	73,512	71,840	51,529	83,830
Rampart	35,495	35,416	13,888	3,264
St. Michael	731,006	1,003,348	1,544,101	1,458,616
Tanana	147,026	210,964	170,926	186,422
All other places	329,091	19,752	382,721	705,830
	3,493,778	4,305,053	3,506,359	3,510,813

Comparative statement of tonnage (domestic merchandise) shipped from the United States to principal points in the Yukon Basin, years 1903–1911.

[Based on valuation of $86.50 per ton.]

Ports.	1903	1904	1905	1906	1907	1908	1909	1910	1911
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Chena	325	857	2,520	5,415	5,580	5,890	3,000	1,395	1,392
Circle	480	253	595	570	539	961	858	586	364
Eagle	1,168	1,132	1,220	913	955	1,472	3,740	869	296
Fairbanks	623	4,250	18,150	14,628	19,300	16,830	26,650	12,660	10,330
Hot Springs	.....	.....	.....	.....	271	850	830	592	968
Rampart	825	444	1,469	477	520	410	410	160	38
St. Michael	2,485	5,790	11,840	19,390	10,290	8,450	11,600	17,850	16,850
Tanana	789	425	900	1,660	2,040	1,700	2,440	1,975	2,150
All others	1,270	729	1,106	847	2,395	3,800	226	4,420	8,150
	7,965	13,880	37,800	53,900	41,890	40,350	49,750	40,507	40,548

Comparative statement of inward business at St. Michael, 1897–1911, showing imports and exports, passenger traffic, and shipping movement.

	1897	1898	1899	1900	1901
FREIGHT TONS.					
Ocean steamers:					
Coal	}	7,800	6,175	12,445	11,080
Fuel oil (crude)					
Live stock	12,200	.....	.....	.....	.....
Lumber	.....	3,600	2,000	6,744	1,313
General merchandise	.....	35,070	16,620	25,066	16,916
Foreign merchandise in transit	1,200	7,350	4,100	5,100	5,796
Total, ocean vessels	13,400	53,820	28,895	49,355	35,108
River boats	.....	.....	.....	350	305
Coastwise vessels	.....	.....	.....	300	199
Total freight in tons	13,400	53,820	28,895	50,005	35,612
FREIGHT VALUATION.					
Ocean vessels:					
Domestic merchandise	$852,000	$3,044,550	$1,538,800	$2,637,308	$1,858,747
Foreign merchandise	$126,000	$749,700	$451,000	$530,400	$592,786
River boats	.....	.....	.....	$78,750	$68,625
Coastwise vessels	.....	.....	.....	$31,500	$20,900
Total freight valuation	$978,000	$3,794,250	$1,989,800	$3,277,958	$2,541,058
GOLD DUST AND BULLION.					
River boats	.....	.....	.....	$6,682,616	$7,085,710
PASSENGERS.					
Ocean vessels	.....	.....	.....	.....	1,150
River boats	.....	.....	.....	.....	2,160
SHIPPING MOVEMENT.					
Ocean steamers	24	115	56	157	83
Ocean sailing vessels	16	49	29	32	19
Ocean tonnage	24,765	115,782	60,007	150,009	92,906
River boats	28	71	97	62	77
River barges	5	10	20	12	23
River tonnage	6,385	40,961	53,454	36,771	45,122

Comparative statement of inward business at St. Michael, 1897–1911, showing imports and exports, passenger traffic, and shipping movement—Continued.

	1902	1903	1904	1905	1906
FREIGHT TONS.					
Ocean steamers:					
Coal	7,100	4,100	1,840	4,160	2,467
Fuel oil (crude)		5,599	7,131	5,829	6,064
Live stock					
Lumber	1,386	114	164	601	1,026
General merchandise	16,220	14,534	13,198	23,131	30,472
Foreign merchandise in transit	4,206	5,311	1,834	2,060	662
Total, ocean vessels	28,812	29,658	24,167	35,781	40,691
River boats	355	202	223	309	327
Coastwise vessels	140	180	324	205	190
Total freight in tons	29,307	30,040	24,714	36,295	41,108
FREIGHT VALUATION.					
Ocean vessels:					
Domestic merchandise	$1,707,034	$1,275,081	$1,240,329	$2,105,576	$3,740,348
Foreign merchandise	$476,171	$512,454	$163,920	$212,300	$89,111
River boats	$86,740	$116,688	$108,205	$124,478	$130,800
Coastwise vessels	$13,928	$18,900	$35,600	$22,245	$20,300
Total freight valuation	$2,283,873	$1,923,123	$1,548,054	$2,464,599	$3,980,559
GOLD DUST AND BULLION.					
River boats	$1,725,126	$755,714	$1,136,280	$1,788,239	$2,728,000
PASSENGERS.					
Ocean vessels	1,092	590	832	747	1,047
River boats	1,041	837	676	1,241	1,658
SHIPPING MOVEMENT.					
Ocean steamers	88	86	86	89	87
Ocean sailing vessels	12	8	4	7	6
Ocean tonnage	107,042	77,098	68,725	107,890	99,555
River boats	66	40	50	61	75
River barges	16	32	25	51	48
River tonnage	48,051	37,491	36,605	57,957	43,154

	1907	1908	1909	1910	1911
FREIGHT TONS.					
Ocean steamers:					
Coal	4,252	2,440	2,348	2,477	2,108
Fuel oil (crude)	7,718	6,250	3,485	7,345	6,660
Live stock					1,051
Lumber	723	1,265	1,556	1,579	1,621
General merchandise	27,134	20,476	29,385	23,742	29,147
Foreign merchandise in transit	1,279	772	785	100	1,210
Total, ocean vessels	41,106	31,203	37,559	35,243	41,797
River boats	210	154	111	160	215
Coastwise vessels	120	32	44	47	41
Total freight in tons	41,436	31,389	37,714	35,450	42,053
FREIGHT VALUATION.					
Ocean vessels:					
Domestic merchandise	$3,136,280	$2,268,917	$2,846,267	$3,627,732	$3,643,375
Foreign merchandise	$62,769	$47,552	$42,095	$25,050	$159,985
River boats	$84,000	$86,874	$64,935	$97,125	$101,480
Coastwise vessels	$13,200	$21,780	$12,250	$13,160	$11,439
Total freight valuation	$3,296,249	$2,425,123	$2,965,547	$3,763,067	$3,916,279
GOLD DUST AND BULLION.					
River boats	$539,241	$314,100	$589,762	$1,401,075	$2,891,204
PASSENGERS.					
Ocean vessels	938	1,193	646	1,222	835
River boats	1,583	1,458	1,654	2,029	1,286
SHIPPING MOVEMENT.					
Ocean steamers	108	85	60	124	60
Ocean sailing vessels	3	1	1	1	
Ocean tonnage	100,309	131,281	101,784	107,161	99,946
River boats	77	52	41	57	49
River barges	61	49	55	63	83
River tonnage	53,417	59,706	52,696	64,404	57,582

N. B.—Average value of inbound freight per ton for years 1906–1911, $86.50.

Comparative statement of outward business at St. Michael, 1897–1911, showing imports and exports, passenger traffic, and shipping movement.

	1897	1898	1899	1900	1901
FREIGHT TONS.					
Ocean steamers: General merchandise	.....	.....	.....	2,100	1,375
River steamers:					
Foreign merchandise to foreign Yukon points.	1,200	7,350	4,100	5,100	5,796
Domestic merchandise to foreign Yukon points	2,350	6,770	7,980	8,390	7,795
Fuel oil to United States Yukon points	.....	.....	.....	.....	.....
Live stock to United States Yukon points	.....	.....	.....	.....	.....
Domestic merchandise to United States Yukon and tributaries	1,720	7,997	5,215	5,680	4,562
Total to all Yukon and tributaries	5,270	22,117	17,295	19,170	18,153
FREIGHT VALUATION.					
Ocean steamers: General merchandise	.....	.....	.....	$262,500	$221,875
River boats					
Foreign merchandise to foreign Yukon points.	$126,000	$749,700	$451,000	$530,400	$592,786
Domestic merchandise to foreign Yukon points	$223,250	$663,150	$758,100	$880,950	$818,475
Domestic merchandise to United States Yukon and tributaries	$163,400	$719,730	$495,425	$539,600	$433,390
Total value merchandise to all Yukon and tributaries	$512,650	$2,132,580	$1,704,525	$1,950,950	$1,844,651
GOLD DUST AND BULLION.					
Ocean steamers	.....	.....	.....	$6,942,077	$7,254,740
PASSENGERS.					
Ocean steamers	.....	.....	.....	.....	2,642
River boats	.....	.....	.....	.....	620
SHIPPING MOVEMENT.					
Ocean steamers	24	62	51	158	80
Ocean sailing vessels	15	48	27	29	19
Ocean tonnage	24,745	98,392	59,303	145,761	91,623
River boats	40	188	54	55	71
River barges	9	27	12	20	25
River tonnage	8,207	60,818	35,767	37,672	47,392
Harbor boats and tugs	3	10	11	13	14
Harbor lighters and barges	3	6	11	11	20
Harbor tonnage	138	1,188	2,800	2,883	3,685

	1902	1903	1904	1905	1906
FREIGHT TONS.					
Ocean steamers: General merchandise	1,335	737	366	305	541
River steamers:					
Foreign merchandise to foreign Yukon points.	4,206	5,311	1,834	2,060	662
Domestic merchandise to foreign Yukon points	6,978	5,724	1,445	1,414	954
Fuel oil to United States Yukon points	.....	3,428	4,513	4,170	4,250
Live stock to United States Yukon points	.....	.....	.....	.....	.....
Domestic merchandise to United States Yukon and tributaries	5,824	5,537	9,564	18,211	26,133
Total to all Yukon and tributaries	16,008	20,000	17,356	25,855	31,999
FREIGHT VALUATION.					
Ocean steamers: General merchandise	$225,480	$158,510	$135,390	$142,300	$167,577
River boats:					
Foreign merchandise to foreign Yukon points.	$476,171	$512,454	$163,920	$212,300	$89,111
Domestic merchandise to foreign Yukon points	$686,850	$567,180	$166,725	$156,060	$44,510
Domestic merchandise to United States Yukon and tributaries	$467,929	$573,257	$985,592	$1,852,470	$2,665,566
Total value merchandise to all Yukon and tributaries	$1,630,950	$1,652,891	$1,316,237	$2,220,830	$2,799,187

Comparative statement of outward business at St. Michael, 1897–1911, showing imports and exports, passenger traffic, and shipping movement—Continued.

	1902	1903	1904	1905	1906
GOLD DUST AND BULLION.					
Ocean steamers	$1,758,120	$851,025	$1,241,278	$1,932,538	$2,729,886
PASSENGERS.					
Ocean steamers	1,675	1,182	963	1,548	2,518
River boats	430	342	542	446	459
SHIPPING MOVEMENT.					
Ocean steamers	88	85	84	90	88
Ocean sailing vessels	10	8	4	7	6
Ocean tonnage	106,914	77,450	68,587	108,009	99,641
River boats	60	45	52	62	79
River barges	27	34	30	53	53
River tonnage	59,645	41,430	38,333	58,249	49,813
Harbor boats and tugs	12	12	11	11	7
Harbor lighters and barges	18	18	19	20	20
Harbor tonnage	3,613	3,613	5,075	5,344	5,150

	1907	1908	1909	1910	1911
FREIGHT TONS.					
Ocean steamers: General merchandise	260	122	155	347	335
River steamers:					
Foreign merchandise to foreign Yukon points	1,279	772	78	100	1,210
Domestic merchandise to foreign Yukon points	1,465	1,255	747	264	925
Fuel oil to United States Yukon points	4,189	3,703	3,700	3,716	5,490
Live stock to United States Yukon points					1,050
Domestic merchandise to United States Yukon and tributaries	22,860	18,055	25,396	20,382	24,994
Total to all Yukon and tributaries	29,793	23,785	29,921	24,462	33,669
FREIGHT VALUATION.					
Ocean steamers: General merchandise	$167,360	$68,356	$77,135	$141,944	$137,350
River boats:					
Foreign merchandise to foreign Yukon points	$62,769	$47,532	$2,730	$25,050	$159,985
Domestic merchandise to foreign Yukon points	$76,348	$71,536	$117,475	$31,680	$115,625
Domestic merchandise to United States Yukon and tributaries	$2,354,580	$1,971,332	$2,333,077	$2,482,100	$3,124,250
Total value merchandise to all Yukon and tributaries	$2,493,697	$2,090,400	$2,453,282	$2,538,830	$3,399,860
GOLD DUST AND BULLION.					
Ocean steamers	$541,741	$325,867	$592,103	$1,402,678	$2,891,204
PASSENGERS.					
Ocean steamers	2,480	2,165	2,293	2,654	1,918
River boats	408	470	246	575	390
SHIPPING MOVEMENT.					
Ocean steamers	109	85	60	125	60
Ocean sailing vessels	3	1	1	1	
Ocean tonnage	100,788	131,281	101,784	107,222	99,946
River boats	79	51	43	53	50
River barges	65	59	71	64	95
River tonnage	56,217	66,724	61,187	66,838	60,788
Harbor boats and tugs	7	8	8	6	6
Harbor lighters and barges	20	23	22	18	16
Harbor tonnage	5,150	6,912	8,009	6,675	6,425

Comparative statement of through freight (in bond) over the White Pass & Yukon Ry. for points in the Yukon Basin, 1908–1912.

Destination.	1908	1909	1910	1911	1912
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Tanana	89	172	57	162	116
Yukon River, above Tanana	556	452	309	350	283
Yukon River, below Tanana	3	12	199	235	188
Fairbanks and Tanana River	1,081	1,833	900	429	630
Total	1,729	2,469	1,465	1,176	1,217

Passenger movement during years 1910 and 1911.

The following table of passenger movement indicates the travel by regularly established routes to and from the district and the Yukon territory. Tourists and cannery employees bound for remote places are not included.

The Eagle and Dawson movement shows the local frontier travel, which must not be considered with the general account, as the greater number of those passengers arrived or departed from Ketchikan or St. Michael and have been accounted for in their returns.

	1910	1911
Arrivals from United States and British Columbia to—		
Southeastern, southern, and western Alaska	24,780	19,924
Nome, St. Michael, and Bering Sea	2,156	2,203
Total	26,936	22,127
Departures to United States and British Columbia from—		
Southeastern, southern, and western Alaska	19,905	17,525
Nome, St. Michael, and Bering Sea	4,075	3,741
Total	23,980	21,266
Arrivals at Eagle from Dawson	1,645	1,107
Departures from Eagle to Dawson	905	808
Total	2,550	1,915

Classified statement of tonnage handled over the White Pass and Yukon route for the years 1906–1911.

Commodity.	1906	1907	1908	1909	1910	1911
Agricultural products:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Grain	2,289.2	2,845.8	1,890.0	2,182.5	1,963.0	1,214.1
Flour	964.7	928.1	517.8	967.6	588.9	524.1
Other mill products	120.5	267.5	222.6	212.2	61.2	109.8
Hay	2,780.1	2,209.4	2,058.0	1,813.0	1,795.8	1,515.1
Fruit and vegetables	2,202.0	1,817.1	1,471.0	1,251.0	1,003.0	1,082.9
Meat and dairy products:						
Cattle [1]	2,869.0	2,819.4	2,963.0	2,793.2	1,860.7	1,150.4
Sheep [2]	385.5	282.8	154.8	150.6	103.8	81.6
Hogs [3]	99.3	82.2	40.9	43.0	34.2	9.0
Horses [4]	199.9	236.8	172.1	161.8	374.2	488.5
Dressed meats	73.6	65.0	55.7	75.5	37.8	60.7
Other packing-house products	641.1	455.9	447.5	473.1	311.6	300.1
Poultry, game, and fish	58.3	60.3	33.4	27.2	20.4	27.7
Eggs, butter, and cheese	890.2	715.4	755.4	706.8	541.3	492.9
Mineral products:						
Coal	1,285.7	1,793.2	1,186.7	1,176.0	908.3	1,847.8
Ore	641.6	3,789.9	458.3	591.5	6,533.2	2,257.9
Forest products: Lumber	2,916.7	2,366.7	841.7	1,237.1	2,668.5	2,086.2
Manufactures:						
Sugar	155.1	264.7	303.6	270.8	219.3	144.7
Cream and milk (canned)	343.2	274.1	355.0	447.9	218.4	66.9
Iron (all kinds)	262.8	110.4	117.5	210.9	353.7	348.1
Machinery	3,207.0	6,031.0	2,791.0	2,925.4	6,003.7	3,074.0
Cement, bricks, etc	----------	----------	----------	357.4	58.0	30.0
Wines, liquors, and beers	1,552.4	1,098.0	639.7	507.5	496.8	341.4
Household goods	----------	----------	----------	----------	----------	72.0
Other manufactured articles	8,145.5	5,987.5	5,977.7	5,179.3	3,921.0	4,940.2
Construction material	2,089.0	140.0	----------	----------	----------	----------
Total	34,170.4	35,641.2	23,633.4	23,761.3	30,076.8	22,266.1

[1] Cattle: 1906, 3,081; 1907, 3,535; 1908, 3,529; 1909, 3,250; 1910, 2,145; 1911, 1,285.
[2] Sheep: 1906, 6,787; 1907, 4,480; 1908, 3,043; 1909, 2,909; 1910, 2,040; 1911, 1,257.
[3] Hogs: 1906, 805; 1907, 823; 1908, 421; 1909, 433; 1910, 338; 1911, 90.
[4] Horses: 1906, 259; 1907, 320; 1908, 246; 1909, 207; 1910, 465; 1911, 615.

Comparative statement of domestic tonnage cleared from United States ports for Alaska—years 1907–1911, 1912 (6 months).

	Puget Sound.		San Francisco.		Astoria.		Others.	
1907.	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*
January	16	16,257	1	218				
February	16	17,153						
March	27	20,397	4	1,965	3	3,581		
April	55	33,661	33	32,511				
May	49	37,969	5	2,130				
June	57	60,484	4	8,002				
July	42	43,485	4	4,078				
August	51	41,045	7	8,725				
September	41	39,086						
October	34	36,252	4	7,484				
November	19	17,350	2	648				
December	17	18,850	1	218				
	424	381,989	65	65,959	3	3,581		
1908.								
January	16	16,490	1	376				
February	18	15,277	1	1,816				
March	31	18,217	7	7,148				
April	38	31,374	37	32,270	3	3,221	[1] 1	1,416
May	37	26,205	6	6,191				
June	51	54,526	3	3,670				
July	37	39,755	4	2,213				
August	36	41,887	3	8,778				
September	36	38,450	1	647				
October	28	30,976	3	4,112				
November	17	17,188	1	3,524				
December	17	20,921	1	253				
	368	351,364	68	70,998	3	3,221	1	1,416
1909.								
January	15	16,654						
February	11	14,981						
March	26	27,616	7	7,538				
April	44	43,631	36	37,841	4	4,537	[1] 1	1,416
May	32	30,403	6	5,090				
June	46	43,008	4	8,488				
July	46	46,589	3	836				
August	35	39,911	3	4,435			[2] 1	1,816
September	33	34,777	4	4,952				
October	33	32,313	2	3,777				
November	21	21,401	1	253				
December	17	18,473						
	359	369,757	66	73,210	4	4,537	2	3,232
1910.								
January	17	19,091	1	3,524				
February	17	16,649	1	3,524	1	631		
March	27	27,200	7	4,508				
April	41	43,071	37	42,581	4	4,009	[1] 1	1,416
May	33	31,781	3	4,315				
June	48	43,616	4	7,605				
July	36	40,934	1	3,121				
August	32	35,564	3	3,814				
September	38	30,775	2	3,536			[2] 1	3,524
October	28	25,396	3	519				
November	21	24,194						
December	19	23,311	1	3,121				
	357	361,582	63	80,168	5	4,630	2	4,940
1911.								
January	15	15,323	3	3,828				
February	15	17,677						
March	35	38,508	6	8,861	1	1,494	[1] 1	1,475
April	46	41,219	39	41,587	4	4,272	1	1,416
May	41	40,719	5	4,079	1	1,601		
June	43	47,303	4	9,690				
July	35	42,655	5	7,199				
August	32	36,584	3	2,907				
September	34	39,675	1	247				
October	24	23,819	2	3,811				
November	17	19,435	2	4,756				
December	18	20,270	1	3,428				
	354	377,187	71	90,393	6	2,891	2	2,891

[1] Portland. [2] Los Angeles.

Comparative statement of domestic tonnage cleared from United States ports for Alaska—years 1907–1911, 1912 (6 months)—Continued.

	Puget Sound.		San Francisco.		Astoria.		Others.	
1912.	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*	*Number.*	*Tonnage.*
January	21	21,235	1	253	.....	.....	.....	.....
February	19	22,773	.....	.....	.....	.....	.....	.....
March	57	44,103	7	8,298	1	1,601	.....	.....
April	56	50,271	39	41,670	4	4,251	.....	.....
May	53	45,280	4	5,366	1	12	.....	.....
June	42	44,135	6	13,578	.....	.....	.....	.....
	248	227,797	57	69,165	6	5,870	.....	.....

Comparative statement of domestic tonnage entering and clearing from Alaskan ports for years 1906–1911.

	1906				1907			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	270	155,553	251	156,401	275	158,273	254	148,024
Wrangell	2	3,170	4	3,076	14	2,054	5	4,369
Juneau	42	35,479	49	43,400	30	32,478	49	47,468
Skagway	4	3,629	.....	.....	4	1,701	4	2,062
St. Michael	15	13,992	22	28,576	14	20,981	16	31,390
Nome	58	104,556	52	91,484	42	85,600	36	73,852
Unalaska	6	3,446	8	3,021	7	6,271	4	2,238
Seward	6	5,375	7	6,495	5	5,442	2	318
Kodiak	2	343	2	70	2	175	1	1,361
Valdez	30	45,297	31	41,947	51	85,486	55	92,517
Sitka	1	29	.....	.....	1	2,446	.....	.....
Total	436	370,869	426	374,472	445	400,907	426	403,599

	1908				1909			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	260	142,910	231	129,977	282	187,712	265	178,708
Wrangell	3	1,842	9	8,270	4	3,939	5	4,216
Juneau	32	38,851	43	52,357	31	56,597	58	88,129
Skagway	1	1,530	2	786	3	4,284	.....	.....
St. Michael	12	6,402	10	18,025	13	12,819	11	17,576
Nome	38	73,515	30	54,118	33	59,139	31	49,292
Unalaska	5	3,151	10	6,884	11	5,790	10	2,593
Seward	1	239	3	2,274	.....	.....	.....	.....
Kodiak	1	273	1	253	.....	.....	.....	.....
Valdez	29	53,013	33	56,869	6	10,284	3	7,246
Sitka	.....	.....	1	565	.....	.....	.....	.....
Tyee	.....	.....	.....	.....	4	2,418	6	5,994
Sulzer	5	6,652	13	9,368	2	969	.....	.....
Cordova	23	43,591	20	36,669	29	52,814	25	44,415
Total	410	371,969	406	376,415	418	396,765	414	398,169

Comparative statement of domestic tonnage entering and clearing from Alaskan ports for years 1906–1911—Continued.

	1910				1911			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	324	189,419	269	168,307	403	244,231	369	228,570
Wrangell	7	5,045	10	7,628	2	1,997	11	5,740
Juneau	23	41,325	35	50,273	12	27,247	21	35,042
Skagway	1	1,495	1	1,495	1	1,176	.....	.....
St. Michael	6	9,100	7	9,207	24	26,044	4	5,184
Nome	28	49,817	24	42,459	20	37,066	26	47,306
Unalaska	7	1,565	10	2,445	8	2,676	7	2,305
Valdez	4	5,814	7	9,833	(1)	(1)	1	1,530
Sulzer	.....	.....	7	2,747	1	1,565	7	7,304
Cordova	51	93,970	49	90,573	43	84,984	49	88,919
Total	451	396,740	419	384,967	514	426,986	495	421,905

[1] Abolished.

Comparative statement of foreign tonnage entering and clearing from Alaskan ports for years 1906–1911.

	1906				1907			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	271	135,757	191	70,720	221	116,272	187	88,283
Wrangell	8	1,940	12	3,994	10	2,141	12	5,215
Juneau	6	7,296	5	6,993	9	14,037	6	12,678
Skagway	.....	.....	10	9,214	1	1,377	4	5,067
Eagle	62	19,719	48	18,712	54	20,919	46	18,686
St. Michael	.....	.....	4	2,174	1	3,516	2	6,448
Nome	35	20,959	30	15,060	32	17,002	38	27,348
Unalaska	4	1,691	4	206	4	2,642	4	2,338
Seward	.....	.....	.....	.....	1	239	.....	.....
Valdez	2	4,540	.....	.....	7	11,927	3	5,212
Sitka	.....	.....	.....	.....	1	185	1	185
Total	388	191,902	304	127,073	341	190,257	303	171,460

	1908				1909			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	156	110,282	96	67,489	196	138,126	153	104,247
Wrangell	6	1,642	11	8,431	6	4,860	5	1,895
Juneau	1	1,208	2	2,056	11	24,573	5	5,775
Skagway	.....	.....	6	6,631	.....	.....	5	5,146
Eagle	58	22,599	53	21,738	46	16,317	39	15,265
St. Michael	1	1,451	.....	.....	2	252	.....	.....
Nome	31	20,031	23	10,929	36	12,963	35	13,143
Unalaska	8	7,868	4	176	8	4,263	2	1,624
Valdez	9	18,996	2	2,324	3	6,409	.....	.....
Cordova	7	15,860	.....	.....	5	8,762	2	3,711
Sulzer	3	1,556	.....	.....	5	1,836	16	12,394
Total	280	201,493	197	119,774	318	218,361	262	163,200

Comparative statement of foreign tonnage entering and clearing from Alaskan ports for years 1906–1911—Continued.

	1910				1911			
	Entered.		Cleared.		Entered.		Cleared.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Ketchikan	257	157,812	220	125,426	258	147,727	212	112,296
Wrangell	11	1,201	16	7,119	18	1,628	24	8,220
Juneau	10	12,081	3	2,861	1	1,176	.....	.....
Skagway	2	4,045	14	11,135	.....	.....	4	3,051
Eagle	37	14,911	39	15,556	48	16,415	46	20,087
St. Michael	.....	.....	1	448	.....	.....	2	2,528
Nome	40	9,046	47	9,151	27	3,085	31	6,517
Unalaska	6	4,559	5	4,301	5	2,967	4	709
Valdez	1	2,112	.....	.....	.....	.....	.....	.....
Cordova	21	37,295	.....	.....	9	15,032	.....	.....
Sulzer	8	1,632	21	7,287	1	219	8	3,239
Total	393	244,694	366	183,284	367	187,849	331	156,647

List of bottoms plying waters of Yukon and Kuskokwim Rivers.

STEAM.

Name.	Rig.	Tonnage.		Owner.	Where documented.
		Gross.	Net.		
Alice	St. p.[1]	400	200	Northern Navigation Co	St. Michael.
Arnold [2]	do	692	389	do	Do.
Bella [2]	do	370	185	do	Do.
Caribou	do	46	28	Wm. Daniels	Eagle.
Carrier	Ga. s.	6	5	Northern Commercial Co	Do.
Chas. Hamilton [2]	St. p.[1]	595	297	do	St. Michael.
Delta	do	293	237	do	Do.
D. R. Campbell [2]	do	718	409	do	Do.
Dusty Diamond	do	101	86	E. J. Hackett	Eagle.
Edna	Ga. p.[1]	15	9	J. M. Haley	Do.
Emily	Ga. s.	11	7	A. E. Edwards	St. Michael.
Evelyn	St. p.[1]	352	221	Merchants Yukon Line	Do.
F. K. Gustin [2]	do	718	409	Northern Navigation Co	Do.
Florence S	do	100	50	A. D. Wright	Eagle.
Herman	do	456	164	Northern Navigation Co	St. Michael.
Hannah [2]	do	1,130	588	do	Do.
Herbert	St. s.	12	8	G. M. Pilcher	Do.
Ida May [2]	St. p.[1]	278	175	Northern Navigation Co	Do.
Isabelle [2]	do	162	76	do	Do.
John Cudahay	do	819	481	Merchants Yukon Line	Do.
John C. Barr	do	546	315	do	Do.
John J. Healy	do	450	241	do	Do.
Julia B	do	835	511	Yukon Transportation & Trading Co.	Do.
Klondyke	do	406	242	Merchants Yukon Line	Do.
Leota	do	36	24	T. A. Horton	Do.
J. P. Light	do	785	451	Merchants Yukon Line	Do.
Lavelle Young [2]	do	506	396	Northern Navigation Co	Eagle.
Leon [2]	do	638	402	do	St. Michael.
Linda [2]	do	692	386	do	Do.
Little Delta [2]	do	71	44	C. B. Atwell	Eagle.
Little Snug [2]	do	50	31	A. J. Tucker	Do.
Louise [2]	do	717	384	Northern Navigation Co	St. Michael.
Luella	do	115	88	J. A. Northway	Eagle.
M. L. Washburn	do	284	179	Northern Navigation Co	St. Michael.
May D	do	66	48	H. M. Bolander	Do.
Margaret [2]	do	520	260	Northern Navigation Co	Do.
Marie Balmer	Ga. p.[1]	9	5	E. H. Flynn	Do.
Martha Clow	St. p.[1]	98	62	C. G. Finger	Do.
Messenger [2]	Ga. s.	10	9	Northern Commercial Co	Eagle.
Meteor	St. s.	68	40	Northern Navigation Co	St. Michael.
Minneapolis	St. p.[1]	235	157	Alaska Transportation Co	Do.
Monarch	do	463	269	A. R. Heilig	Do.
Oil City [2]	do	718	409	Northern Navigation Co	Do.
Pilgrim [2]	do	718	409	do	Do.
Portus B. Weare [2]	do	400	200	Merchants Yukon Line	Do.
Pup	do	33	21	C. E. Lake	Eagle.
Quickstep	do	343	233	Kuskokwim Commercial Co	St. Michael.
Reliance	do	291	171	Northern Navigation Co	Do.
Research	do	45	45	L. L. Lane	Do.
Robert Kerr	do	718	409	Pacific Cold Storage Co	Do.
St. Joseph	do	69	69	Roman Catholic mission	Do.
St. Michael	do	718	409	Northern Navigation Co	Do.

[1] On Kuskokwin.

[2] Not supposed to have been operated in 1912.

List of bottoms plying waters of Yukon and Kuskokwim Rivers—Continued.

STEAM—Continued.

Name.	Rig.	Tonnage.		Owner.	Where documented.
		Gross.	Net.		
Samson [1]	St. p.[2]	272	171	E. E. Kellogg	Eagle.
Sarah [1]	do	1,130	588	Northern Navigation Co	St. Michael.
Schwatka	do	484	291	do	Do.
Seattle [1]	do	718	409	do	Do.
Seattle No. 3 [1]	do	548	326	do	Do.
Susie	do	1,130	588	do	Do.
Tacoma [1]	do	718	409	do	Do.
Tana	do	234	175	Wallace Langley	Eagle.
Tanana	do	495	372	Northern Navigation Co	Do.
T. C. Power [1]	do	819	481	Merchants Yukon Line	St. Michael.
Teddy H.[1]	do	153	96	L. J. Heacock	Eagle.
Tetlin	do	65	40	T. Kettleson	Do.
Victoria [1]	do	718	409	Northern Navigation Co	St. Michael.
Victoria	do	55	30	G. A. Fredericks	Do.
Wave	Ga. s.	11	8	R. Johnson	Do.
White Seal	St. p.[2]	193	116	G. P. Sproul	Eagle.
Wilbur Crimmin [1]	do	124	59	Northern Navigation Co	St. Michael.
Will H. Isom	do	983	619	Merchants Yukon Line	Do.

SCOWS AND BARGES.

A. B. Shay		324	324	Merchants Yukon Line	Eagle.
Anvik		198	198	Northern Navigation Co	Do.
Arizona		923	923	Merchants Yukon Line	St. Michael.
Bear		539	539	Northern Navigation Co	Eagle.
Beaver		761	761	do	St. Michael.
Bill		624	624	do	Do.
Chena		440	440	do	Do.
Dakota		827	827	Merchants Yukon Line	Do.
Delta		76	76	Alaska Yukon Transportation Co	Eagle.
Elk		250	250	Northern Navigation Co	Do.
Erie		899	899	Merchants Yukon Line	St. Michael.
Ermine		250	250	Northern Navigation Co	Eagle.
Fox		539	539	do	St. Michael.
Huron		899	899	Merchants Yukon Line	Do.
Idaho		922	922	do	Do.
Independence		244	244	F. Bishoprick	Do.
Irene		616	616	Northern Navigation Co	Do.
John A		738	738	Yukon Transportation Co	Do.
John H. Dwight		375	375	Merchants Yukon Line	Do.
Lynx		539	539	Northern Navigation Co	Do.
Lithgow		370	370	Pacific Cold Storage Co	Eagle.
Moose		875	875	Northern Navigation Co	St. Michael.
McNab		633	633	Pacific Cold Storage Co	Do.
Marten		761	761	Northern Navigation Co	Do.
Mink		539	539	do	Do.
Mizzoo		550	550	J. D. Reagh	Do.
Montana		922	922	Merchants Yukon Line	Do.
New York		450	450	do	Do.
Omaha		344	344	do	Do.
Olive No. 3		54	54	H. Wachter	Eagle.
Ontario		899	899	Merchants Yukon Line	St. Michael.
Olive		50	50	A. Daub	Eagle.
Olympia		211	211	Northern Navigation Co	Do.
Otter		289	289	do	St. Michael.
Pelly		55	55	Wallace Langley	Eagle.
Pete		100	100	Northern Navigation Co	St. Michael.
Pup No. 1		24	24	C. E. Lake	Do.
Sable		186	186	Northern Navigation Co	Do.
St. Michael No. 3		228	228	do	Do.
St. Michael No. 4		479	479	do	Do.
St. Michael No. 5		350	350	do	Do.
St. Michael No. 7		240	240	do	Do.
St. Michael No. 9		366	366	do	Do.
St. Michael No. 10		240	240	do	Do.
St. Paul		494	494	Alaska Transportation Co	Do.
Seal		289	289	Northern Navigation Co	Do.
Seattle No. 1		446	446	do	Do.
Seattle No. 4		600	600	do	Do.
Skunk		251	251	do	Do.
Sterling		638	638	A. R. Heilig	Do.
Superior		285	285	Merchants Yukon Line	Do.
Thebo		299	299	Northern Navigation Co	Eagle.
T. H. Trahey		494	494	Yukon Transportation Co	St. Michael.
Tanana		383	355	Northern Navigation Co	Do.
Vachon		638	638	A. R. Heilig	Do.
Wolverine		406	406	Northern Navigation Co	Do.

[1] Not supposed to have been operated in 1912. [2] On Kuskokwim River.

List of bottoms clearing from San Francisco for Alaska.

Name.	Rig.	Destination.	Tons.	Voyages.				
				1908	1909	1910	1911	1912
Monterey	G. schooner	Kuskokwim	119		2			
Rosecrans	Steamship	Juneau	1,816	1		1		
Lizzie Prior	Schooner	Unalaska	91	1				
W. D. Porter	do	Nome	3,524	3	2	1	2	
Jennie	Steamship	Cooks Inlet	69		1			
Grace Dollar	Br.	Unalaska	289	2				
Chas. Hanson	Schooner	Kuskokwim	182	1				
Montana	Br.	St. Michael	1,695	1	1	2		
Yucatan	Steamship	do	2,317	1				
Edith	do	do	1,495	1				
Olympia	do	do	1,730	1				
Sybil Marston	do	Ketchikan	647	1				
Homer	do	Unalaska	402		2			
St. Helens	do	St. Michael	779		1	1	1	
Umatilla	do	do	2,168		1	1	1	1
Geneva	Brigantine	Nome	451		1			
San Quenaventura	Schooner	Unalaska	171		1			
Fresno	do	Tyee	1,149		1			
Catania	Steamship	Juneau	2,535		1			
Diamond Head	Bark	Ketchikan	952			1		1
Arcata	Steamship	Kuskokwim	415			2	2	
Ottilie Fjord	Schooner	Tyee	247			1	1	
Elvira	do	Dutch Harbor	86				1	
Expansion	do	Bristol	113				1	
Henry Wilson	do	do	400				1	
Asuncion	Steamship	St. Michael	1,328				1	1
Lansing	do	Juneau	3,428					2
Bertha Dolbeen	Schooner	Simonofsky	230					3
Admiralen	Steamship	Unalaska	906					1
Capt. A. F. Lucas	do	Nome	3,250					2
Mackinaw	do	do	2,005					2

The above list includes several whaling vessels and cannery tenders.

List of bottoms regularly engaged, clearing from Puget Sound for Alaska, but omitting many whaling boats, cannery tenders, and small gasoline boats.

STEAMERS.

Name.	Tonnage.	Name.	Tonnage.
Alameda	1,937	Mariposa	1,939
Admiral Sampson	1,432	Meteor	1,565
Alki	888	Mackinaw	2,005
Bertha	752	Northland	360
A. B. Carpenter	83	Northwestern	2,334
A. G. Lindsey	587	Philip F. Kelley	93
Chilkat	173	Pioneer	80
City of Seattle	767	Printer	55
Curacao	895	Prosper	132
Corwin	239	Queen	1,672
Cordova	1,406	Richard Holyoke	90
Delhi	582	Ramona	671
Dirigo	541	Resolute	44
Dolphin	498	Redondo	42
Dora	217	Santa Ana	720
Edith	2,095	Senator	1,835
Eureka	1,399	Seward	2,080
Elihu Thompson	448	Shelikof	101
Fresno	1,149	Spokane	1,289
Fearless	85	St. Helens	779
Georgia	255	State of California	1,260
Goliah	221	Tampico	1,481
Homer	331	Tatoosh	154
Humboldt	688	Toledo	135
Independent	123	Tyee	158
Jeannie	862	W. H. Bancroft	103
Jefferson	895	Wanderer	125
Kodiak	99	Victoria	2,112
Latouche	1,176	Yucatan	2,317
Luckenbach	3,192		

List of bottoms regularly engaged, clearing from Puget Sound for Alaska, but omitting many whaling boats, cannery tenders, and small gasoline boats—Continued.

SAILING VESSELS.

Name.	Tonnage.	Name.	Tonnage.
Bender Brothers (gas)	94	Harriette G	252
Camano	631	Prosper	513
Coronado	970	Vega	245
A. J. Fuller	1,675	William H. Smith	1,785

BARGES.

America	1,909	Palmyra	1,251
Big Bonanza	1,343	St. David	1,476
Diamond Head	952	St. James	1,453
Haydn Brown	769	Washington	674
James Drummond	1,476		

Appendix C.

Notes on Canadian Railroad Work.

In the course of its work the Alaska Railroad Commission secured some information in regard to railroad construction in Canada. This seemed necessary for two reasons:

First. The commission had under consideration two railway routes (those based on Skagway and on Haines) which had been proposed to reach the lower Yukon from Alaskan terminals, but each with a long stretch of line passing through Canadian territory; and

Second. A branch line has been proposed to extend from a point of Canada's most northerly transcontinental line directly into the Yukon Valley, and while this branch line was not under construction and was projected to lie entirely in Canadian territory, yet if completed, it would connect with any system of railroads in the Yukon Valley and would have an influence on Alaskan transportation problems that would require study.

Examination of Canadian work further seemed desirable for the following reasons:

Actual railroad construction in Alaska has not been extensive. In Canada much construction is under way, and a great deal of this is of the class that might be called pioneer work, where construction is in virgin country not differing greatly in character from large sections of Alaska. It was desired to obtain data as to costs of construction and operation, and information as to tonnage and growth of commerce after completion of the work, as it was believed that all such data would be useful to supplement the Alaska data on hand.

In addition to this examination into physical character the commission obtained some data as to the Canadian Government's policy in encouragement of such pioneer railroad construction. It was necessary to take up this question, as it was believed that if either of the two Alaskan-Canadian roads were constructed the effect of such assistance as Canada might give to the portion of the line lying within Dominion territory would have a direct bearing on costs of construction and operation.

There are in Canada a few examples of railroads owned and operated by the Government, and of railroads owned and leased by the Government, and many examples of railroads assisted by various methods, the assistance being granted not only by the Dominion Government but by the Provinces and municipalities. While the now well-established policy of Government assistance dates well back, the past few years marks the greatest activity. The examples of Government-owned railroads now in operation or under lease contain nothing that bear on the questions above referred to. They all occur in the eastern Provinces and are, in the main, examples of early construction. Similarly the Canadian Pacific system, Canada's first transcontinental line, received great assistance. But the Canadian policy toward it was adopted, in large measure, as a condition to the forming of the confederation; and while it was entered into mainly to develop the northwest Provinces for settlement, it may be here briefly passed over with the statement that in general the Government assistance closely parallels United States practice in assisting transcontinental roads at about the same time or earlier.

The largest and most important work, however, that is now engaging the Dominion Government is the construction of the National Transcontinental Railway, known popularly as the Grand Trunk Pacific. Under agreements dated in 1903 and modified in 1904, ratified by the Dominion acts of those years, the Grand Trunk Pacific Railway Co. has undertaken certain obligations with respect to a line of railway wholly in Canada, extending from Moncton, a seaport in New Brunswick, to Prince Rupert, the Pacific terminus in British Columbia, a distance of 3,600 miles. The railway is composed of two divisions, namely, the eastern division, extending from Moncton to Quebec, thence westerly through the northern parts of the Provinces of Quebec and Ontario to Winnipeg; and the western division, from Winnipeg to Prince Rupert, British Columbia. The eastern division is being constructed by the Government and on completion is to be leased to and operated by the company for a period of 50 years, of which period the first 7 years will be free of rent, the balance of the period calling for a rental of 3 per cent of the cost of construction, exclusive of equipment,

which is to be furnished by the company. The company is constructing the western division under the following arrangement: The Government guarantees the payment of principal and interest on the bonds to an amount equal to 75 per cent of the cost of actual construction, which is supervised by the Government; but it is further provided that this amount of guaranty is not to exceed $13,000 per mile in respect to the prairie section from Winnipeg to the eastern limit of the Rocky Mountain section, established at Wolf Creek, 120 miles west of Edmonton.

From Quebec westward, excepting at and in the vicinity of the city of Winnipeg, this transcontinental system is entirely in a virgin country, and is being constructed principally for freight haulage at low cost to handle the heavy crops of grain expected to result from the rapid development of the large areas of land opened up and tributary to the system. It will, however, also provide for efficient transcontinental service. The grades are low (0.4 per cent against east-bound traffic, excepting a 20-mile stretch of 1 per cent in the Rocky Mountains, and 0.6 per cent against west bound traffic) and the sharpest curve is 6°. The expense of construction as against the 2 per cent grades and 10° curves usual in most transcontinental lines is probably at least doubled. The average cost of the mileage from Winnipeg to Moncton is about $85,000 per mile, exclusive of rolling stock and of the great bridge at Quebec.

It is expected that this system will be completed and ready for through traffic in the spring of 1914, and it is an interesting fact that the large Government expenditures on the eastern division of this project are defrayed by direct appropriations from Dominion revenue, without the necessity of bond issues.

There has been under consideration the construction of a branch line extending from Hazelton, in the mountain section of this system, to Dawson, but a decision to construct this branch has not yet been made.

The Canadian Government has recently decided to construct a line from the great wheat belt northward to Hudson Bay, with a view of providing a summer water route with a short rail haul to the grain market of Liverpool. This project involves about 400 miles of construction.

The construction of the Timiskaming & Northern Ontario Railroad forms a most interesting study, as conditions here closely parallel those found in Alaska. This is a railroad that was projected by the provincial government of Ontario, and at the time of its projection the Government had no assurance that supporting traffic could be expected for a considerable period after completion. The province of Ontario was unprovided with railroads except in its narrow southern portion. The largest part of the provincial territory was north of any railroad and extended to the waters of James Bay, a large arm at the southern end of Hudson Bay. The climate of this portion does not differ materially from that of the interior of Alaska. It was entirely unsettled by reason of the absence of transportation facilities, but was known to have some timber resources, agricultural possibilities, and prospective mineral wealth. The basic idea, however, in its construction was the development of the virgin territory which comprised the larger part of the Province, and which held out promise of reasonably quick settlement by home builders. The success of this enterprise is now assured, its construction having effected the purposes for which it was designed, in settlement of the region, development of the agricultural and timber resources, and in the discovery of a rich mineral deposit (the "Cobalt" field) which was not known to exist when the project was undertaken. As originally projected its terminus was to have been in the heart of the wilderness, and called for about 50 miles less construction than has been executed, but the extension was decided upon for obvious reasons as soon as the route of the National Transcontinental line was fixed, and was made to effect a junction with that line. This can not, however, be regarded as having had a material bearing on the success of the provincial project, which was adopted and construction begun before the transcontinental project was undertaken.

Appendix D.

Publications Relating to Transportation and Railway Routes in Alaska.

The commission has made use of a large number of reports, articles, and maps relating to the resources, commerce, climate, and population of Alaska, as well as those dealing more specifically with the different railway routes. The following list presents the most important of these, but is in no sense a complete bibliography of the subjects. The arrangement is geographical, by routes, but a list of publications relating to the general problems of transportation, including commerce, resources, etc., will be first presented.

GENERAL.

Reports.

United States Coast Pilot: Pacific Coast of Alaska, fifth edition, 1908. Coast and Geodetic Survey.

Reports of the Governor of Alaska, 1885 to 1912. Interior Department.

Monthly Summary of Commerce and Finance. United States Bureau of Statistics, Department of Commerce and Labor, 1903–1912.

Report on Commerce and Navigation of the United States. Bureau of Statistics, Department of Commerce and Labor, 1903–1911.

Annual Reports of the Alaska Road Commission, 1905–1912. War Department.

Reports of the Collector of Customs for Alaska, 1903–1911. Treasury Department.

Population of Alaska: Thirteenth Census of the United States, 1910. Bureau of the Census, Department of Commerce and Labor. 1911.

Manufactures of Alaska: Thirteenth Census of the United States, 1910. Bureau of the Census, Department of Commerce and Labor. 1911.

Coal Land Laws and Regulations thereunder. General Land Office, Interior Department. 1910.

Report of the Secretary of the Interior for the fiscal year ending June 30, 1912. 1912. Pp. 52–58.

Railway and Telegraph and Telephone Lines in Alaska. H. Rept. No. 3874, 59th Cong., 1st sess., 1907.

Conditions in Alaska: Report of subcommittee of Committee on Territories, accompanied by general map of Alaska, scale 1:3,600,000, 1904. S. Rept. No. 282, pt. 1, 58th Cong., 2d sess., 1904.

Conditions in Alaska: Hearings before subcommittee of Committee on Territories. S. Rept. No. 282, pt. 2, 58th Cong., 2d sess., 1904.

Railroads in Alaska: Hearings before the Committee on the Territories of the House of Representatives. 59th Cong., 1st sess., 1906. Accompanied by sketch map showing railroads under construction and projected.

Bills and Reports of Committee on the Territories of the House of Representatives, by J. C. Hance. 58th Cong., 1st and 2d sess. 3 vols., 1904.

Investigations of the Department of the Interior and the Bureau of Forestry. By joint committee of Congress. 7 vols., 1910.

Conditions in Alaska: Hearings before the Committee on the Territories of the House of Representatives. 62d Cong., 2d sess., Jan. 16–Feb. 6, 8, 10, 13, 15, and 27, 1912.

Transportation in Alaska: Hearings before the Committee on the Territories of the House of Representatives. 62d Cong., 2d sess., Feb. 27, Mar. 5, Apr. 5, 6, 16, and 19, 1912.

Railroads for Alaska: Hearings before the Committee on Territories, United States Senate, April 12, 1912.

Government Railroad in Alaska: Hearings before the Committee on Public Lands, United States Senate. 62d Cong., 2d sess., May 22, 1912.

Coal Lands in Alaska: Hearings before the Committee on Public Lands, United States Senate. 62d Cong., 2d sess., June 1 and 5, 1912.

Data Relating to Alaska. S. Doc. No. 882, 62d Cong., 2d sess., 1912.

Railroad Construction in Alaska. S. Doc. No. 167, 59th Cong., 1st sess., 1906.

Alaska Coal Problems, by Hon. Walter L. Fisher. Bulletin Bureau of Mines No. 36, Department of the Interior. 1911.

Railway Routes (Alaska), by Alfred H. Brooks. Bulletin United States Geological Survey No. 284, 1906, pp. 10–17.
Transportation (Alaska), by Alfred H. Brooks. Bulletin United States Geological Survey No. 379, 1909, pp. 23–26; Bulletin United States Geological Survey No. 442, 1910, pp. 23–31; and Bulletin United States Geological Survey No. 480, 1911, pp. 23–24.
Railway Routes in Alaska, by Alfred H. Brooks. National Geographic Magazine, March, 1907.
Alaska Coal and its Utilization, by Alfred H. Brooks. Bulletin United States Geological Survey No. 442, 1910, pp. 47–100.
Railway Routes from Pacific Seaboard to Fairbanks, by Alfred H. Brooks. Bulletin United States Geological Survey No. 520, 1912, pp. 45–88.
The Future of Alaska Coal, by Alfred H. Brooks. Proceedings of American Mining Congress, Fourteenth Annual Session, 1911.
Geography in the Development of Alaska Coal Deposits, by Alfred H. Brooks. Annals of the Association of American Geographers, Vol. I, pp. 85–94, 1912.
Agriculture, Alaska: Bulletin Thirteenth Census, 1910. Bureau of the Census, 1913.
The Alaska of To-Day, by Alfred H. Brooks. The American Review of Reviews, Vol. XL, July, 1909, pp. 49-62.
Annual Reports on Agriculture in Alaska, by C. C. Georgeson, 1898–1910. Office of the Experiment Station, Department of Agriculture.
Grass Lands of the South Coast of Alaska, by C. V. Piper. Bulletin Bureau of Plant Industry No. 82, Department of Agriculture, 1905.
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Suggestions to Pioneer Farmers in Alaska, by C. C. Georgeson. Bulletin Alaska Agricultural Experiment Stations No. 1, Department of Agriculture, 1902.
Haymaking at Kenai Experiment Station, by P. H. Ross. Bulletin Alaska Agricultural Experiment Station No. 3, Department of Agriculture, 1907.
The Forests of Alaska, by R. S. Kellogg. Bulletin Forest Service No. 81, Department of Agriculture, 1905.
The Geography and Geology of Alaska, by Alfred H. Brooks, with a section on Climate, by Cleveland Abbe, jr. Professional Paper United States Geological Survey No. 45, 1906.
The Mineral Resources of Alaska: Reports on Progress of Investigations, by Alfred H. Brooks and others. Bulletins United States Geological Survey No. 259, 1905; No. 284, 1906; No. 314, 1907; No. 345, 1908; No. 379, 1909; No. 442, 1910; No. 480, 1911; No. 520, 1912.

Maps.

Map of Alaska. Alaska Road Commission, 1909. War Department.
Post Route Map of the Territory of Alaska, 1912. Post Office Department.
Map of Alaska. United States Geological Survey, 1910.
Map of Alaska: Alaska Map A. United States Geological Survey, 1910.
General Chart of Alaska: Chart T, Coast and Geodetic Survey, 1909.
Map of Alaska. General Land Office, 1909, Department of the Interior.
Map of Alaska, showing distribution of Mineral Resources. United States Geological Survey, 1912.

THE WHITE PASS & YUKON RY.

Transportation in Alaska: Statement by O. L. Dickison. Hearings before the Committee on Territories of the House of Representatives, April 6 and 7, 1912.
White Pass Route, by Alfred H. Brooks. Bulletin United States Geological Survey No. 520, 1912, p. 58.
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An Exploration in the Yukon District, Northwest Territory, and Adjacent Northern Portion of British Columbia, 1887, by Geo. M. Dawson. Geol. & Natl. Hist. Surv. Canada, Pt. B, Ann. Rept., 1887.
An Exploration in the Yukon and Mackenzie Basins, Northwest Territory, by R. G. McConnell. Geol. Surv. Canada, Pt. D, Ann. Rept., Vol. IV, 1988–89.
Reports on the Upper Stewart River Region, Yukon, by J. Kelle, and on the Peel River and Tributaries, Yukon and Mackenzie, by C. Camsell. Geol. Surv. Canada, Parts C and CC, Ann. Rept., Vol. XVI. 1904.

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Recent Mineral Discoveries on Windy Arm, Tagish Lake, Yukon, by R. G. McConnell. Geol. Surv. Canada, Rept. 1905.
Annual Report of the Minister of Mines for year 1900, Province of British Columbia, Victoria, British Columbia. 1901, pp. 771–782.
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A New Copper District, by J. W. Bryant. The Mining Magazine, Vol. VII, 1912, pp. 448–449. London, 1912.
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