REPORT

OF

THE COMMISSION TO STUDY THE PROPOSED HIGHWAY TO ALASKA

MOUNT MCKINLEY, ALASKA, THE HIGHEST PEAK IN NORTH AMERICA.

THE DEPARTMENT OF STATE

CONFERENCE SERIES No. 14

REPORT

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1933

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LETTER OF TRANSMITTAL

May 1, 1933.

THE PRESIDENT OF THE UNITED STATES,
Washington.

DEAR MR. PRESIDENT:

Pursuant to the act of Congress approved May 15, 1930 (Public No. 228, 71st Congress), the special commissioners appointed to cooperate with representatives of Canada in a study regarding the construction of a highway to connect the northwestern part of the United States with British Columbia, Yukon Territory, and Alaska, with a view to ascertaining whether such a highway is feasible and economically practicable, submit herewith their report for transmission to Congress.

The commissioners desire to acknowledge the cooperation that has been received from Canadian officials in the consideration of this project, particularly Honorable S. F. Tolmie, Prime Minister of British Columbia; Honorable George Black, Representative of Yukon Territory and Speaker of Canadian House of Commons; Mr. J. M. Wardle, Chief Engineer of Federal Parks Branch, Canadian Department of Public Works; and Mr. George P. Napier, Assistant Chief Engineer of the Department of Public Works of British Columbia.

The commissioners also acknowledge valuable help in compilation of this report received from Mr. Thomas H. MacDonald, Chief of the United States Bureau of Public Roads and Mr. E. W. James, Chief of Division of Highway Transport of the Bureau of Public Roads.

Faithfully yours,

HERBERT H. RICE
E. W. SAWYER
MALCOLM ELLIOTT

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TABLE OF CONTENTS

I. CONCLUSIONS AND RECOMMENDATIONS

The Special Commissioners appointed by the President of the United States for a study regarding the construction of a highway to connect the northwestern part of the United States with British Columbia, Yukon Territory, and Alaska have reached the following conclusions:

1. The highway is a feasible project and can be built at a reasonable cost, which should not exceed $2,000,000 for the Alaska section and $12,000,000 for the Canadian section. Considering the highway to begin at Seattle, Washington, and end at Fairbanks, Alaska, the approximate mileage of completed road and new construction needed for completion is as follows:

Route	Completed road	New construction needed	Total
	Miles	*Miles*	*Miles*
Seattle to Hazelton, British Columbia	882	0	882
Vancouver to Hazelton, British Columbia	830	0	830
Hazelton to Yukon Boundary	50	520	570
Yukon Boundary to Alaska Boundary	50	480	530
Alaska Boundary to Fairbanks	91	183	274
Seattle to Fairbanks	1, 073	1, 183	2, 256
Vancouver to Fairbanks	1, 021	1, 183	2, 204

2. If the project is adopted, the stage-construction process is favored. That is to say, the initial standard should be no higher than is required for the estimated traffic, and improvements to higher standards would be made as demanded by traffic and as funds may become available.

3. Financing is primarily the responsibility of each of the nations concerned for the section of the road within its own jurisdiction, and any departure from this principle should be covered by international agreement. The Alaska section of the road should be financed in about the same ratio between federal and local funds as obtains under the Federal Highway Act in the sparsely settled States, resulting probably in about 90

percent of the cost of construction being paid by the Federal Government.

4. There are two general routes for the northern end of the highway, either of which would serve to open new Alaskan territory of importance and contribute to the general development. The Dawson-Fairbanks route possesses the advantage of more comprehensive service to Yukon Territory and the Forty-mile and Chicken Creek mining areas in Alaska. The White-horse-Kluane Lake-Gulkana-Fairbanks route involves less new road construction in Alaska, saves several hundred miles of new construction, and also serves important mining territory in Alaska. Both routes are acceptable from the American viewpoint.

5. The benefits to be gained from the project from the American point of view are:

(*a*) Development of Alaska through making the territory accessible by highway, resulting in an increase of population and consequent increase in revenue from taxes, tending to decrease the present necessity for Federal appropriations for the support of the territory.

(*b*) The road would be a great contribution to the welfare of American citizens now living in Alaska under adverse conditions, by providing a physical connection with the vast continental road system.

(*c*) Opening of new country that is now practically inaccessible, giving opportunity for settlement, investment of capital and employment.

(*d*) The new road would make accessible to the continental highway system the existing road net in central Alaska comprising about 900 miles, providing a new and valuable area for exploration, for recreation, or for business purposes.

(*e*) The highway would foster air commerce with Alaska by furnishing a guiding landmark and providing service to aviators along the most practicable flying route to the interior of the territory and to Asia.

(*f*) Promotion of friendly relations between citizens of United States and Canada.

No attempt is made to evaluate the benefits Canada would derive from this project, but it may be mentioned that in addition to such direct development of new Canadian territory as might be brought about by the road, Canada would gain the business

and commerce incident to providing service and supplies to motorists using the road for access to Alaska.

6. Since the annual cost of operating Federal agencies in Alaska is about $7,000,000 in excess of revenues, the expenditure of an additional $3,000,000—spread over several years—for the purpose of development of the territory to a more nearly self-supporting basis is not unreasonable.

7. By the construction of about 200 miles of new road—in conjunction with about 1,000 miles of new construction in Canada—the territory would gain a physical connection with the vast continental system comprising hundreds of thousands of miles of road in United States, Canada, and Mexico. From the Alaskan or American standpoint, therefore, the advantages are obviously more than commensurate with the cost.

The Commissioners submit the following recommendations:

1. That negotiation be conducted with the Government of Canada, through regular channels, with a view to ascertaining the attitude of Canada with respect to entering into an agreement whereby each Government within its own borders would undertake to survey and locate the best and most practicable route for a highway which would connect the northwestern part of the United States with British Columbia, Yukon Territory, and Alaska, prepare specifications and reliable estimates of cost and resulting benefits of said project, and investigate plans for financing the project. The respective organizations should be authorized to communicate directly with each other for the purpose of coordination.

2. That if such agreement be reached, suitable allotments or appropriations should be made available to the Alaska Road Commission for carrying out the purposes of the agreement.

3. That the respective Governments in formulating their road construction programs conform so far as practicable in their own interests to the general route proposed for this highway so that as many as possible of the local projects will be available for and form a part of the main project.

4. That consideration be given by the road-building agencies of Alaska and Yukon Territory to the construction of the Fairbanks-Dawson road without waiting for the adoption of the entire project, in order to develop the intermediate territory and provide an early connection between these two communities, as well as complete a vital link in the proposed through highway.

II. INTRODUCTION

By act of Congress, approved May 15, 1930 (Public No. 228, 71st Cong., H.R. 8368) it was provided:

That the President of the United States is hereby authorized to designate three special commissioners to cooperate with representatives of the Dominion of Canada in a study regarding the construction of a highway to connect the northwestern part of the United States with British Columbia, Yukon Territory, and Alaska, with a view to ascertaining whether such a highway is feasible and economically practicable. Upon completion of such study the results shall be reported to Congress.

The act referred to also authorized the appropriation of $10,000 for carrying out the purposes of the act, and in pursuance of this authority the President appointed as Commissioners to cooperate with representatives of the Dominion of Canada:

Mr. Herbert H. Rice, of Detroit, Michigan, *Chairman*
Mr. Ernest Walker Sawyer, Assistant to the Secretary of the Interior
Major Malcolm Elliott, Corps of Engineers, U.S. Army, President, Alaska Road Commission

The appropriation authorized was carried in an act of Congress (Public No. 869, 71st Cong., H.R. 17163) in the following terms:

Study in cooperation with the Dominion of Canada regarding the construction of a highway to connect the United States, British Columbia, Yukon Territory, and Alaska: For the expenses of the United States of a study to be made in cooperation with the Dominion of Canada regarding the construction of a highway to connect the northwestern part of the United States with British Columbia, Yukon Territory, and Alaska, as provided by the Act approved May 15, 1930 (46 Stat., p. 335) including travel and subsistence or per diem in lieu of subsistence (notwithstanding the provisions of any other Act), compensation of employees, stenographic and other services, by contract if deemed necessary without regard to section 3709 of the Revised Statutes (U.S.C. title 41, sec. 5), rent, printing and binding, purchase of supplies and materials and necessary equipment, hire of motor-propelled vehicles, both passenger-carrying and freight-carrying, and such other expenses as may be authorized by the Secretary of State, fiscal years 1931 and 1932, $10,000.

The time for completion was extended by a third act (Public 235, 72d Cong., H.R. 12443) to include the fiscal year 1933.

The members of the Commission met in Washigton, D.C., November 7, 1930, organized, and discussed in detail the lines along which the investigation should proceed. Duties were assigned among the members and plans made for securing information necessary for consideration of the project.

An overland route between the United States and Alaska must cross Canadian territory, and a direct route between the State of Washington and the Alaskan boundary would cross British Columbia and, probably, Yukon Territory. It was imperative, therefore, that the Canadian Government, or at least the Provincial Governments concerned, should be approached to ascertain the extent to which those agencies would be willing to cooperate actively in the investigation; or, in the event that active cooperation could not be expected, to secure from them such information as might be available from official and other sources relative to the existing roads, projected works, topographic conditions, and economic development in line with the subject of the investigation.

The Dominion Government took the position that as the route likely to be selected would lie in either British Columbia or Yukon Territory, or both, the Canadian Government should consider the matter as one of essential interest to the Provinces. With the assent of the Dominion Prime Minister, therefore, representatives of the Provinces were named to act with the Commission.

This report includes the data made available through the cooperation of the Canadian Committee, supplemented by the more detailed knowledge as to the American section of the road furnished by the Alaskan Road Commission.

III. HISTORY OF THE PROJECT

Serious consideration of this project began in 1929. Prior to that time the possibility of such a project being carried through had been mentioned and discussed in a vague way by a number of people but no definite steps were taken toward its accomplishment. In 1929, however, International Highway Associations, formed for the purpose of advocating the project, were formed in Fairbanks, Alaska, and Dawson, Yukon Territory. These associations are still actively engaged in this work. Their mission is to interest the Canadian and American publics in the project and to advocate all necessary legislation and other arrangements for carrying it out. Coincidentally with these events, the Government of British Columbia initiated inquiries on the subject, and informal exchanges of views occurred between that government and officials in Alaska. The project was considered and endorsed by many associations and commercial bodies in Alaska and the United States. Those in Alaska that took such action include: The Chambers of Commerce of Fairbanks, Anchorage, Juneau, Wrangell, Ketchikan, Seward, Sitka, and Nome. The following local associations in the United States took similar action: Seattle Chamber of Commerce; Western Motor Clubs Conference 1929; Automobile Club of Washington; Seattle Mining Club; and Washington State Good Roads Association. The following national organizations also considered and endorsed the proposal for further study of the project: American Road Builders' Association; National Highways Association; American Automobile Association; and the United States Chamber of Commerce.

The Legislature of Alaska adopted a memorial, April 17, 1929, to the United States Congress endorsing the project and petitioning that steps be taken toward arranging for conferences on the subject between representatives of the United States and Canada. The same body, on May 1, 1929, passed an act providing for the advertisement of the advantages of the project and appropriating funds to be used for that purpose.

The United States Department of the Interior, which maintains general supervision over the Government of Alaska and is greatly interested in the development of the territory, has taken a keen interest in the investigation of the proposed highway. The United States Department of State has conducted conferences, through its

representatives, with the Canadian Government and has collected information, maps, etc. The Alaska Road Commission, which is charged by law with the lay-out, construction, and maintenance of roads in Alaska that are necessary for the development of the territory, has announced that it favors the construction of the Alaska end of the highway whenever the Canadian section of the project is undertaken. This Commission, after preliminary airplane flights over the general area, conducted a survey in 1931 to determine the best route from the Yukon frontier in the vicinity of Dawson to Fairbanks, Alaska. The report of this survey by Mr. Donald MacDonald, locating engineer, appears as appendix E to this report.

The Premier of British Columbia, Honorable Simon Fraser Tolmie, organized and conducted during 1930 an international automobile caravan from Vancouver to Hazelton for the purpose of exploring the northern roads and advocating the extension of the system. The Pacific-Yukon Highway, the name by which the project was designated, was featured on this trip; and it was announced on many occasions that the policy of the Government of British Columbia was in favor of the project, so far as it could be undertaken without interfering with the regular program for expansion of the provincial road system. Accompanying the caravan upon invitation from the Prime Minister of British Columbia were the following Americans: Representatives of various organizations and communities on the Pacific Coast; a representative of the United States Department of the Interior; a representative of the Alaska Road Commission; and representatives of the press. At Hazelton, the northern end of the trip, the caravan party was met by His Honor Randolph Bruce, Lieutenant Governor of British Columbia; Honorable George A. Parks, Governor of Alaska; and representatives from several Alaskan communities.

Airplane and ground reconnaissances were made in 1930 by the Government of British Columbia in the northern part of the Province for the purpose of locating the most favorable route. The results of these surveys and extracts from the reports of the engineers are included in this report. These indicate that a feasible and suitable location was found.

Along with these evidences of interest, there was the steady and substantial development of a highway system in British Columbia, which included a good gravel surfaced road from Vancouver to Hazelton, a distance of 815 miles. Even prior to the actual appropriation of funds for use of the American Commissioners, but following the act of authorization, it was possible for the members to take part in certain of the activities of the local organizations interested in securing data concerning the project. This circumstance

enabled the members to meet many of the local officials in Canada, and to learn of official projects under way in connection with the extension of the road beyond Hazelton. This work consisted of ground and aerial surveys in both British Columbia and Yukon Territory.

A meeting of the members of the Canadian Committee with the American Commissioners was held in Victoria, British Columbia, October 9, 1931, for the purpose of jointly considering the desirability, feasibility, value, route, and cost of the proposed project. The three American Commissioners were present and met with the following Canadian representatives: Honorable George Black of Yukon Territory, Speaker of the Canadian House of Commons; Mr. J. M. Wardle, Chief Engineer, Federal Parks Branch, Canadian Department of Public Works; and Mr. G. P. Napier, Assistant Chief Engineer of the Department of Public Works, British Columbia. Mr. Black was chosen chairman of the joint meeting.

Available data were considered and discussed and a thorough exchange of views was had, as a result of which it was concluded unanimously that the project was feasible from an engineering and constructional standpoint, that substantial benefits would accrue from the project, but that more information was necessary before it could be definitely determined that the project was economically sound.

IV. DESCRIPTION OF THE ROUTE

The Commission has had advantage of excellent cooperation by the Canadian representatives in securing the results of numerous ground and airplane reconnaissance surveys over the present unimproved sections of the route. Several of these have covered areas heretofore uninvestigated for road purposes; and frequently large areas have been included in both ground and air surveys which are today almost wholly wilderness.

A road along the rugged coastline of British Columbia and southeastern Alaska broken by glaciers and torrential rivers would obviously be enormously expensive, so consideration of route is limited to the area of more favorable topography east of the coastal mountains.

Climate

The service value of any highway is in some respects affected by seasonal conditions, and it is to be expected that a road reaching so far into the northland might have a somewhat reduced value on account of climatic conditions, and more particularly because of heavy snowfall. Highway maintenance in the United States has, however, clearly demonstrated, both in regions where mountains and where plains prevail, that snow removal or control is entirely feasible to an extent which will enable service to be maintained under practically any conditions prevailing within latitudes falling within the United States.

Consideration of the climatic conditions with special reference to precipitation and snowfall will indicate the probable open season of a road to Alaska during which a road will be practically unobstructed by snow. Traffic will not, of course, be limited to this season, but it must be recognized that general use of the route by tourists would not extend much beyond the limits of such a favorable period. During the winter months, the ordinary processes of winter maintenance would keep the route still passable for commercial and necessary traffic.

East of the Coast Range throughout British Columbia and northward, the precipitation is comparatively light. In Alaska, at Fairbanks, it is about 11.5 inches; at Dawson in Yukon Territory, about 13 inches. The snowfall in this district varies from 3 to 8 feet, and the snowfall at Dawson is reported to be the heaviest in the Territory.

Generally throughout Yukon the precipitation averages about 12.8 inches per year, with a snowfall seldom exceeding 2.5 feet on the level.

In the region around Fairbanks, the normal mean temperature shows a steady rise from 46° F. on May 15 to 60° F. on June 23. This normal mean is maintained until July 27, when it begins to decline, reaching 50° F. on August 31, and 45° F. on September 10.

The climate of the Yukon Territory is of moderate extremes. The winters, though long and cold, are dry and comparatively free of winds. The average day is generally pleasant, permitting outdoor activities during practically the entire season. The summers are delightfully bright and warm. The dryness of the summer season, together with the continuous light, makes it an enjoyable period, and throughout the year the climate is exceptionally healthful.

British Columbia claims the best climate of any of the Canadian Provinces, particularly because it favors outdoor life and industry. The lower mainland region has an average of 36° F. for its coldest month, with a winter mean of 41° F. and a summer mean of 59° F. East of the Coast Range the interior districts are characterized by greater variations in temperature, but have relatively less precipitation, and the low temperatures experienced farther to the east at Edmonton and Winnipeg do not occur in British Columbia.

Throughout the region the hours of sunshine per year range unusually high, with limits from about 1,800 to about 2,200 hours per year. In considering tourist traffic, therefore, a conservative season would extend from April to October, inclusive, five months of which may be expected to be unusually pleasant, with a high percent of sunshine and relatively little rain.

Connection with United States System

The existence in the United States of the system of coordinated Federal-aid highways makes it entirely feasible to effect connection at any point on such system along the Canadian boundary. At Blaine, Washington, a Federal-aid highway, connecting with the entire system in the States, makes connection also with the system of Canadian roads in British Columbia. This point on the international boundary is indicated, therefore, as the most feasible point of contact between the two countries.

On the United States side the road is improved to a high standard southward to the important cities of the entire Pacific Coast. Northward in British Columbia there is a connecting road westward to the city of Vancouver, British Columbia, the capital of the Province and the metropolis of western Canada.

FRASER RIVER CANYON ROAD BETWEEN HOPE AND LYTTON, BRITISH COLUMBIA.

SETON LAKE IN BRITISH COLUMBIA, REACHED BY THE PRESENT ROAD SYSTEM.

ROAD NORTH OF HAZELTON, BRITISH COLUMBIA, THE POINT OF DEPARTURE FOR THE NORTH.

BRITISH COLUMBIAN INDIANS MAKING SEINES AT FORT ST. JAMES.

Road to Hazelton

From Vancouver the present route to Hazelton follows the Fraser River valley eastward 103 miles to Hope. At this point a general change in the direction of flow of the river causes a turn to the north, and the highway continues, still following the Fraser to Lytton, at mile 176. The route then proceeds up the Thompson and Bonaparte Rivers, following the eastern slope of the watershed to Lac La Hache. Thence it descends the San José River to the Fraser at about mile 376. From this point the valley of the Fraser is closely followed to Prince George at the junction of the Fraser and Nechako Rivers, approximately 525 miles from Vancouver. The constructed road then ascends this stream westerly to Fort Fraser and continues in the same general valley northwesterly, here called the Endako, to Hazelton, 830 miles from Vancouver. The present highway continues about 20 miles beyond Hazelton to Kispiox.

Hazelton, British Columbia, to Whitehorse, Yukon Territory

From Hazelton northwestward in the direction of Atlin and Whitehorse the route has been reconnoitered a distance of approximately 655 miles to the north end of Tagish Lake. For 570 miles the line is in British Columbia and for 85 miles it is in the Yukon Territory.

Between Hazelton and the junction of the Klappan and Stikine Rivers, Colonel J. M. Rolston covered three separate routes and several possible alternate combinations, some lines being reconnoitered on the ground, others by plane, and some by a combination of methods. Generally throughout this region the line has been developed over low divides, lightly timbered or partly open country, and sufficiently toward the east to take advantage of light rainfall, dry ground, and open valleys.

Stikine River to Yukon Boundary

The crossing of the Stikine is indicated at some point near the mouth of the Klappan by the several lines reconnoitered from Hazelton.

From the Stikine the line enters a region that is practically continual wilderness to the vicinity of Atlin, and through this section careful studies will be required to locate the best available line. As a result of work so far done by Mr. J. H. Gray, Mr. J. H. McNeil, Colonel J. M. Rolston, and others, control points are established at head of Dease Lake, the Nahlin River, the crossing of the Nakina and Atlin on one line, or as an alternate the head of Dease Lake, the Jennings River, the head of Teslin Lake, Fish Lake, Surprise Lake

to Atlin. The former is approximately 251 miles from the Stikine to the boundary of Yukon Territory, as given by Mr. J. H. Gray's careful reconnaissance.

Stikine Crossing to Dease Lake	50 miles
Dease Lake to Nahlin River	80 miles
Nahlin River to Atlin	91 miles
Atlin to Yukon boundary	30 miles
Total	251 miles

As shown by Mr. J. H. McNeil, following the airplane reconnaissance of Colonel J. M. Rolston, the mileage is approximately as follows:

Stikine Crossing to Dease Lake	46 miles
Dease Lake to Teslin Lake	137 miles
Teslin Lake to foot of Surprise Lake	80 miles
Surprise Lake to Atlin	11 miles
Atlin to Yukon boundary	30 miles
Total	304 miles

The route via Teslin Lake keeps to the east and at the expense of greater mileage has the advantage of dryer ground and less precipitation. It is the preferred route of Mr. McNeil and Colonel Rolston. It was apparently not studied beyond Dease Lake by Mr. Gray who made a ground reconnaissance of the Nahlin River route.

Yukon Boundary to Alaska

Through this territory the routes explored offered less difficulty as the area is less broken and the existing trails, from the head of the White Pass and Yukon Railway, at Whitehorse to Dawson, have been in greater use than those south of Atlin. Mr. J. H. McNeil, Superintendent of Highways of Yukon Territory, supplied the information for this section and developed a line apparently closely following the preferred trail from the southern Provincial boundary to Dawson on the Klondike.

This follows the lake about 22 miles to Carcross and thence closely parallels the railroad to Whitehorse, a distance of approximately 43 miles, making a total of 110 miles in Yukon and 1,510 miles from Vancouver. The line then proceeds up the Takhini River to Little River and up that stream to the Yukon River divide, which is crossed near Kynocks. Thence the route continues down the Klusha River and the Nordenskiöld to Carmacks, 1,643 miles from Vancouver. From Carmacks to Minto the route is along the Lewes River (a name given to the upper reaches of the Yukon) which is crossed at mile 1,663 at Yukon Crossing. At Minto the recon-

ATLIN, BRITISH COLUMBIA.

NORTHERN BRITISH COLUMBIA IN VICINITY OF DEASE LAKE.

noitered line diverges to the northward, crossing the divide to the Stewart River (1,773 miles) which is then followed for about 35 miles, where the valley is again left to climb the comparatively low Klondike divide. The Klondike River is reached at a point near Glenboyle, 1,856 miles from Vancouver, and this stream is followed to Dawson, mile 1,865, at the junction with the Yukon River. From Dawson the remaining 65 miles to the Alaskan boundary are along a ridge location to a point near Walker Fork where the reconnaissance of the Alaska Road Commission ties in with the route.

In Alaska, the reconnoitered line will probably ascend some favorable branch of Fortymile River and crossing the divide at an elevation of about 3,500 feet descend the Tanana River to McCarty (Grundler), a distance of 183 miles in Alaska. At McCarty junction will be made with the Richardson Highway, 91 miles from Fairbanks.

The total approximate distance from Vancouver to Dawson is 1,865 miles; to the Alaska line, 1,930 miles; to McCarty, 2,113 miles; and to Fairbanks, 2,204 miles. From Whitehorse to Fairbanks via Dawson the total distance is 694 miles, of which 573 miles remain to be built and 31 miles to be surfaced and otherwise improved.

Alternate Routes from Whitehorse to Alaska

From the point of view of best serving Canadian interests, there is no alternate route to that shown on the maps accompanying this report via Whitehorse and Dawson. But from Alaska, it is possible to develop two alternate routes, either of which would serve Fairbanks and the interior equally well. From Fairbanks a route following the Tanana River practically to its headwaters would shorten the distance to Whitehorse and would decrease total required new construction by about 100 miles. This route would leave the Richardson Highway at McCarty, as in the case of the preferred route to Dawson. A second alternate leaves the Richardson Highway at Gulkana and extends practically due east to Kluane Lake via the headwaters of the White River and thence to Whitehorse.

The Tanana River route,[1] also via Kluane Lake, is about 650 miles long from Fairbanks to Whitehorse, and, of this, 350 miles are in Alaska and 300 in Yukon. Of the 350 miles in Alaska, 90 miles are already complete in the section of the Richardson Highway between Fairbanks and McCarty. The remaining 260 miles would have to be built. In Yukon Territory about 150 miles have been graded, leaving for construction about 150 miles. The total new construction required on this route is 360 miles of complete road and, in addition, 150 miles of improvement and surfacing.

[1] See appendix E.

The total length from Fairbanks to Whitehorse by Gulkana and Kluane Lake is about 724 miles, and the constructed section along the Richardson Highway in Alaska involved in this route is 240 miles in length. Of the balance to Kluane Lake (334 miles), the section between Gulkana and Chisana (154 miles)—all in Alaska—is under construction, leaving 180 miles to be built, of which 50 miles will be in Alaska and 130 miles in Yukon Territory. The road between Kluane Lake and Whitehorse will need extensive improvements and surfacing.

The following table compares these various routes from Whitehorse to Fairbanks:

Whitehorse to Fairbanks via—	Total length	On Richardson Highway (completed)	Other sections (completed or projected)	To be surfaced	To be entirely constructed
	Miles	*Miles*	*Miles*	*Miles*	*Miles*
Dawson	694	90	0	31	573
Kluane Lake-McCarty	650	90	0	150	500
Kluane Lake-Gulkana	724	240	154	150	180

Although from this comparison it appears that the Gulkana route would equally well serve Fairbanks and would require the least new construction in both Yukon and Alaska, its adoption would be at the expense of Dawson and the needed road between that place and Whitehorse.

Present General Condition

From Vancouver and Blaine the present road to Hazelton, known as far as Prince George as the Caribou Highway, is constructed with a gravel surface. All bridges are in and the road is available for use throughout the year. The surface is of ample width, having easy grades and curves, and is well maintained. At Yale, which is head of navigation on the Fraser, the road enters the picturesque Fraser River Canyon which extends to Lytton, a distance of 59 miles. The road is benched along the canyon wall and where necessary is protected along the outer edge by a stone guard wall. The total improved distance to Hazelton is 830 miles.

From Discovery to Atlin (11 miles) and for 10 miles beyond the road had been opened for motor travel (21 miles).

From Robinson, a station on the White Pass and Yukon Railroad, about 20 miles south of Whitehorse, a graded wagon road exists to

Whitehorse and beyond to Minto, a total distance of about 196 miles. The low grade road from Whitehorse to Kluane Lake, previously mentioned, is passable only in good weather but could be improved to suitable standard at reasonable cost. The length of this branch is about 150 miles.

In Alaska the Richardson and Steese Highways together form a link connecting the north Pacific Coast port of Valdez with the upper Yukon River at Circle. The Richardson Highway extends from Valdez to Fairbanks, 371 miles, and the Steese Highway from Fairbanks to Circle, 160 miles. This main axis has several branches, the aggregate length of the system being about 900 miles. South of Fairbanks, 91 miles, is McCarty, at which point the Whitehorse-Dawson-Fairbanks route would connect with the Richardson Highway system. About 240 miles south of Fairbanks the branch road connecting with Chisana turns eastwardly from Gulkana and would form a part of the Whitehorse-Kluane Lake-Gulkana-Fairbanks route. The Alaska roads to which the international project would give access are generally of fair gravel-surface standard. They are passable during the open season at all times except in a few spots where destructive freshets and slides sometimes carry away bridges or short sections of road, necessitating the occasional employment of tractors for assisting vehicles over critical places.

In British Columbia north of Hazelton there would probably be considerable difficulty in keeping roads open during the winter months especially in the mountainous sections. In the upland valleys less difficulty would be experienced. In Yukon Territory and central Alaska roads could be maintained in usable condition for automotive vehicles for about seven months of year—June to December—with only a moderate amount of snow removal. Tractor and horse-drawn sleds could generally use the roads all winter.

Summarizing the extent of the existing road system in the Canadian Provinces and Alaska applicable to the proposed project, it is seen that the total constructed grade from Seattle to Fairbanks by the Dawson route is about 1,073 miles, of which about 970 miles are surfaced with gravel. The rest of the distance, 1,183 miles, remains to be constructed. Of this, 196 miles are graded at least in part, and in Yukon Territory along the existing trail, there have already been constructed many bridges that are of a capacity to carry tractors and heavy vehicles. By the Kluane Lake-Gulkana route about 1,296 miles have been constructed or are under construction; 200 miles of reconstruction or improvement; and about 790 miles of new construction would be needed.

A more detailed description of the route from Vancouver to Hazelton appears in appendix A.

Hazelton is the possible point of departure for overland travel to the north. The most favorable route for a highway through this little-known country is still to be determined, but sufficient explorations have been made by airplane and otherwise to ascertain that there are practicable locations which will involve no insuperable or unusual difficulty.

The known resources along the route are: Copper, silver, and gold in the vicinity of Stewart, British Columbia; coal in the Groundhog section about 140 miles north of Hazelton and eastwardly thereof; gold in the Stikine River area (near Telegraph Creek); gold in the Taku River area (northeast of Juneau); gold, silver, and lead in the Atlin area; and furs and timber at many places along the entire route.

There is no overland route—other than trails—connecting these areas. They are reached individually by way of the rivers which cut through the Coast Range and discharge into the waters of southeastern Alaska. The rivers are swift, shallow in many places, and dangerous. Navigation on them is beset with many difficulties.

Atlin is a community of several hundred people whose activities consist of mining, prospecting, trapping, trading, agriculture for local supply, and fur farming. Mining is being conducted on a fairly large scale.

Access to this region is obtained over the White Pass and Yukon Railroad to Carcross, thence by boats operating on the lakes. Large numbers of tourists come each year over this route to enjoy the scenery and climate. Comfortable accommodations are found, and the train and boat service are excellent.

This lake region around Atlin is on the divide separating the Pacific Coast drainage from that of the Yukon River system, which flows over 2,000 miles into Bering Sea. Just east of Atlin is the crest of the Cassiar Mountains which at this point is the dividing line between the Pacific Ocean and Arctic Ocean drainage.

There are short roads leading in various directions from Atlin to connect with nearby areas. One of these—the road south to O'Donnel River, 25 miles, is favorably situated to be included in the Pacific-Yukon project. It is a fair country road, easily traveled in good weather.

Reconnaissance from Hazelton was made by Colonel Rolston and Mr. Gray, and extracts from their reports are included in appendices B and C.

These investigations covered three routes as far as the junction of the Stikine and Klappan Rivers, and alternate routes beyond the Stikine to Atlin on the lake of that name.

From Atlin a reconnaissance was made by Mr. J. H. McNeil, Superintendent of Works and Buildings of Yukon Territory, and extracts from the McNeil report appear in appendix D.

Whitehorse and Dawson are the two principal towns of Yukon Territory and are connected by the Yukon River, navigable about four months of the year, and a winter sled road which accommodates travel during the winter. A regular stage service is maintained all winter. During critical periods such as the break-up in early summer, there is no overland communication, as the ice, both on the river and road, is too soft to support traffic. Parts of the road will sustain traffic in dry weather during the summer months.

River traffic is cared for by steamboats of the stern-wheel type. They have good passenger accommodations. A large number of tourists go over this route each year. The downstream trip from Whitehorse to Dawson requires about 36 hours; the upstream trip, 4½ days. Whitehorse is the head of navigation of the Yukon system. This great waterway runs northwest, through Yukon Territory and continues westward through Alaska to Bering Sea. It is navigable during the open summer months throughout its 2,000 miles of length. The head of the river at Whitehorse is reached from Skagway, Alaska, by the White Pass and Yukon Railroad, 111 miles long.

So far as known, the topography and soil conditions in Yukon Territory are such that road building would not be difficult or expensive. The chief obstacles would be the river crossings—Yukon, Pelly, and Stewart; since all of these rivers are navigable, ferries could be employed until such time as traffic demands bridges.

Yukon Territory has an area of 207,000 square miles and though possessed of great resources is only scantily populated, the total population being not over 6,000 people—about one person for every 35 square miles. During the Klondike boom days there was a population of probably 30,000. With the exhaustion of the diggings that could be worked by hand or crude appliances, a large part of this population disappeared from the Territory. In these days under modern production methods, a few men do the work that required hundreds a generation ago.

The mineral resources still remaining in large quantities consist of gold, silver, copper, lead, antimony, tungsten, and iron, besides coal and other nonmetallic substances. The principal camps now under development are Carmacks, Kluane Lake, Dawson (Klondike), and Mayo. The production from the Dawson area is now running about $750,000 per year.

The valleys, hillsides and lower plateaus of the Yukon carry a good forest growth—white spruce, balsam fir, jack pine, cottonwood, poplar, and birch.

There is water power in abundance. Some development to meet the requirements of the mining industry has occurred.

Farm products include wheat, oats, barley, and hay. Garden products grow well—potatoes, carrots, beets, turnips, parsnips, cauliflower, cabbage, celery, strawberries, currants, etc.

The native fur-bearers are weasel, muskrat, lynx, wolverine, bear, otter, marten, mink, red fox, white fox, cross fox, silver fox, wolf, coyote and beaver. This has been a favorite trapping ground for over a hundred years. The raising of fur-bearers in captivity—fox and mink especially—has been profitable, and the possibilities for expansion in this activity are almost without limit.

The scenic attractions of Yukon Territory now draw hundreds of tourists every year. Thousands more would be able to enjoy this trip were there a road over which they could travel. During May, June, July, and August, there is practically no darkness, and though the sun is not visible at midnight until Fort Yukon, Alaska, is reached, its reflected light is seen in the sky all night, producing displays of color beyond description. The summer weather is generally fair, the average precipitation being but 12 inches per year. Residents and tourists alike enjoy the cool agreeable summers.

The general route from Dawson to Fairbanks is in a westerly direction and will probably ascend Fortymile Creek and, surmounting a divide at an elevation of about 3,500 feet above sea level, descend into the Tanana River valley to a junction with the Richardson Highway at McCarty (where Richardson Highway crosses the Tanana River). There is now a winter sled road from Dawson toward Chicken Creek, Alaska, which would need considerable improvement including some relocation to serve as a summer road. United States Geological Survey contour maps of the region between the Tanana and Yukon Rivers and reports of prospectors, trappers, and aviators who have seen the country, indicate that road building will not be unusually difficult. From the junction with the Richardson Highway at McCarty, the route will follow a good motor road 91 miles to Fairbanks. This road is open usually about six months—between June and December. It could be kept open all winter with relatively little work of snow removal if traffic volume should demand.

The section of the proposed road west of Dawson taps the Eagle-Chicken Creek gold mining area which has been a consistent producer for many years, and there is no evidence of approaching

exhaustion of the mineral resources. United States Geological Survey engineers who have inspected this region are of the opinion that further prospecting is justified. The existing wagon road south from Eagle could be extended to connect with the Pacific-Yukon Highway and would then be of service in connecting this highway with the Seventymile section which is along the south side of Yukon between Eagle and Circle.

All of the country touched by the proposed highway, between the Yukon border and the junction with the Richardson Highway, is favorable for trapping of wild fur-bearers. Caribou and moose are found. There are many areas capable of cultivation. Serviceable timber occurs in the valleys. The population is very scant as the whole region has been and is now quite inaccessible.

A continuation of the route in Alaska was reconnoitered by Mr. Donald MacDonald, Locating Engineer of the Alaska Road Commission. The report is included in appendix E.

TABLE OF DISTANCES AND ELEVATIONS, VANCOUVER, BRITISH COLUMBIA, TO FAIRBANKS, ALASKA

Place	From Vancouver	Elevation	Remarks
	Miles	*Feet*	
Vancouver	0	25–100	Seattle to Vancouver 133 miles. Good gravel road from Vancouver to Hazelton.
New Westminster	12		
Abbotsford	44		
Chilliwack	70		Direct route Seattle to Chilliwack 122 miles.
Rosedale	78		
Hope	103	214	Fraser River.
Yale	117		Head of navigation.
Alexandra Bridge	133		
Lytton	176	693	
Ashcroft	228	1,004	
Clinton	262	3,166	
Lac La Hache	331		
150-Mile House	365	3,188	
Williams Lake	376	1,925	
Quesnel	446	1,549	
Prince George	525	1,869	
Vanderhoof	594	2,096	
Burns Lake	689	2,313	
Smithers	780		
Hazelton	830	969	End gravel road.
Kispiox	850		
Cabin No. 1	860		Earth road to here. Trail begins.
Trout Lake	875	1,400	
Skeena-Nass	955	2,400	Divide.
East Fork of Nass	986	2,250	No trail.
Nass-Klappan	1,035	4,400	Divide.
Stikine River	1,113	2,800	No trail.
Ptarmigan-Gnat		5,405	Divide.
Dease Lake	1,163	2,450	No trail.
Teslin Lake	1,279		
Atlin	1,370	2,200	
Yukon boundary	1,400		
Carcross	1,467		
Whitehorse	1,510	2,081	Wagon road passable in dry season to Kluane Junction 31 miles north of Whitehorse.
Carmacks	1,643	1,718	
Yukon Crossing	1,663	1,597	Wagon road in poor condition.
Minto	1,686	1,521	
Pelly River	1,706		
Allgold	1,831		No road.
Dawson	1,865	1,200	Poor road.
Alaska boundary	1,930		Trail to boundary.
McCarty	2,113		No trail.
Fairbanks	2,204		Good road.

V. COST OF CONSTRUCTION

Estimates of cost are possible only by comparison with other construction of similar roads in the region. The costs furnished here are for a graveled road surface 16 feet wide on a graded roadway 24 feet wide, including all needed ditching, culverts, and bridges.

The excellent reconnaissance made by Mr. Donald MacDonald, Locating Engineer of the Alaska Road Commission furnishes the figures for the section in Alaska. The cost figures for the Canadian sections are taken from the reports of Colonel Rolston, Messrs. Gray and McNeil.

ALASKA SECTION [1]

149 miles @ $8,000 per mile	$1, 192, 000
34 miles @ $12,000 per mile	408, 000
Goodpaster Crossing	60, 000
Dennison Crossing	70, 000
Healy Crossing	20, 000
	$1, 750, 000
Surveys, engineering and contingencies	220, 000
Total	$1, 970, 000

CANADIAN SECTION

British Columbia

Hazelton to Stikine River Crossing [2]

253 miles @ $13,600	$3, 440, 800
34 50-foot spans @ $2,500	85, 000
3 100-foot spans @ $10,000	30, 000
	$3, 555, 800
Surveys, engineering and contingencies	444, 200
Total	$4, 000, 000

Stikine River to Yukon boundary [3]

130 miles to Nahlin River @ $12,000	$1, 560, 000
Tuya River Crossing	150, 000
91 miles Nahlin to Atlin @ $12,000	1, 092, 000
7 miles @ $10, 000	70, 000
23 miles surfacing @ $3,000	69, 000
	$2, 941, 000

[1] See appendix E for details.
[2] See appendix B for details.
[3] See appendix C for details.

Forwarded			$2. 941, 000
Surveys, engineering and contingencies			369, 000
Total			$3, 310, 000
Yukon Territory [1]			
530 miles @ $7,500			$3, 975, 000
Takhini Crossing	5	100-foot spans	50, 000
Tagish Crossing	9	100-foot spans	90, 000
McQuesten Crossing	2	100-foot and	
	1	50-foot spans	22, 500
Miscellaneous	10	50-foot spans	25, 000
			$4, 162, 500
Surveys, engineering and contingencies			517, 500
Total			$4, 680, 000

SUMMARY

British Columbia section	$7, 310, 000
Yukon Territory section	4, 680, 000
Total Canadian section	$11, 990, 000
Alaska section	1, 970, 000
Grand total	$13, 960, 000

[1] See appendix E for details.

VI. JUSTIFICATION FOR THE PROJECT

There are obviously two distinct points of view involved in setting out the reasons why a major highway project of the kind contemplated by this report might be undertaken. These are the American and the Canadian. About one tenth of the total length is in territory of the United States and about the same fraction of the total estimated cost would provide for this section.

Whatever reasons might be adduced, therefore, to support the building of the highway through Canadian territory must be subject to revision from the Canadian viewpoint. For this reason, this report will be confined to a statement of actual conditions existing along the route in British Columbia and Yukon Territory, and if these facts and conditions are sufficient to justify construction, this will be recognized by those having appropriate authority.

With respect to Alaska a more intensive consideration is warranted. That area is an outlying but continental possession of the United States, and physical connection with the States has obvious advantages of a political as well as an economic character.

In general the benefits that may be expected to follow the completion of the project, affecting Canada, Alaska, and the United States alike are:

(1) Development of the natural resources of the area now relatively inaccessible because of the lack of roads;
(2) Development of tourist traffic;
(3) Promotion of good will and trade between Canada and the United States, by facilitating travel between the two countries;
(4) Assistance to airplane travel.

Natural Resources

The natural resources of the country through which the Pacific-Yukon Highway will pass are shown in a general way on the map accompanying this report. They consist of gold, silver, copper, lead, zinc, gypsum, coal, timber, furs, wild game, and farm lands.

Minerals.—There is every expectation that important mineral resources will be tapped by the Pacific-Yukon project. The most important gold deposits in British Columbia are in the northern half of the province and can be reached now only with great difficulty.

In the Telegraph Creek, Taku, and Atlin areas the development has been greatly retarded by transportation difficulties which will be largely overcome by this new road.

Yukon Territory also has mineral resources, but they can be reached now only by the Yukon River and its upper tributaries. While these waterways provide adequately for through transportation of freight, the development of the country cannot be completed until a road system supplementary to the river is provided. The movement of freight from points on the river to the hinterland requires expensive rehandling between boats and trucks or wagons even when roads branching off from the river are available. If there were a road from Whitehorse to Dawson, with branches tapping the intermediate areas, freight needed for prospecting and developing this area could be moved from these supply points very readily by truck and without the present cost of handling to and from river steamers. By cheapening freighting costs in this way, large additional areas could probably be brought under intensive development.

The area in Alaska between Dawson and Fairbanks is known to contain gold in paying quantities. In the Chicken Creek area particularly there are extensive low-grade deposits, which could be worked profitably if transportation difficulties were overcome, as they would be by this new road. Investigations made by the United States Geological Survey show that conditions in the general area between the Tanana and Yukon Rivers are favorable to the occurrence of valuable metalliferous deposits. Their development is practically impossible under present transportation difficulties, but if there were an autotruck road across this area development of the resources would be feasible.

In considering the expediency of going through with this project, the difference between the present situation and that of twenty or thirty years ago must be kept in mind. In the early days rich concentrations of gold were found in British Columbia, the Klondike, Tanana valley, Nome, and elsewhere. These deposits were so rich that even individual miners with no more equipment than they could carry on their backs or on dog sleds could wash out gold in paying quantities. But these rich deposits have largely been exhausted, and the remaining metal is so diffused that mechanical processes are necessary for its extraction. Where pans or crude rockers and sluices once yielded paying quantities, now dredges or powerful hydraulicking outfits are required. The machinery, the fuel, the supplies, the labor required for these operations cannot be brought to the site of the work economically without modern transportation. Even the prospecting and development work which precedes the production phase demands economical transportation

which generally must involve the use of autotrucks. It is no longer generally possible for a couple of prospectors to go out and with pick and shovel uncover rich deposits of gold or other metals. The modern system of prospecting comprises a general observation of ground forms, geological investigations for the purpose of locating favorable conditions, extensive excavation, and sometimes tunneling so as to locate the deposits. All of this work must be done before a prospect is brought to a production basis and cannot be done without the use of modern overland transportation. Unless roads are provided, work of this kind must be confined to the areas immediately adjacent to the navigable waterways, leaving untouched large areas not so favorably situated.

In Alaska, and probably also in Yukon Territory, short roads have been built inland from various points on the navigable rivers for the development of nearby areas, and while these have answered the most urgent requirements the lack of a comprehensive trunk system has greatly retarded development. Under present conditions, the transportation of a shipment of freight from a Canadian or American supply point to the interior of British Columbia, Yukon Territory, or Alaska frequently demands the use of an ocean vessel, a railroad, a river steamer, an autotruck or wagon road and a pack trail in turn. If the gaps between the existing isolated road systems were filled in, some of these expensive rehandlings of cargo could be avoided, thus reducing the total freight charge which, under present conditions, is often prohibitive.

In Canada the area between Kitwanga and Bowser Lake has been prospected and many claims staked. In 1930 it drew the attention of several large companies who sent their engineers in, and it is understood that the region is very promising. Lack of transportation has retarded development. In the Topley and Smithers districts mines are under development, and the mineral area extends northward into the Babine Mountains, where extensive claims exist. During 1930 several large mining companies have investigated extensively along the Driftwood, Bear, and Omineca Rivers and westward of Takla Lake. On the lower Klappan, claims showing high values have already been staked, and the upper Stikine offers a good field for further promising investigation. These areas are now beyond the field of the ordinary prospector because of the expense and difficulty of entering the region. Large companies are exploring by plane. From the Stikine River northward, in the Dease Lake district and along Liard River, placer mines have been worked; but transportation costs of $160 per ton from Wrangell make profits doubtful.

On the upper Skeena River, north of the Bear River region the mineralized formation yields to the coal measures, and the route of the highway through this section would pass centrally through the well-known Groundhog coalfields. These are anthracite fields, but little development has been attempted, as transportation is lacking. Approaching the Stikine the coal measures run out and a mineral area recurs.

Timber.—Timber, both for structural purposes and for pulpwood, is found at many places in the area to be served by the proposed road. The extent of this resource cannot be estimated, but its importance will surely increase as the ever-increasing demand for this product continues in Canada and the United States. Cruising and evaluating of timber would be greatly facilitated by the proposed road, and the actual production would demand autotruck transportation.

The lower Nass valley, in the region of the Cranberry and Bell-Irving Rivers, carries a good stand of pulpwood (Engleman spruce) estimated by the Canadian Forestry reports at some two billion feet. A fair stand of pulpwood of the same species exists along the Skeena and in the valley of the lower Babine River. These areas at present are without adequate transport outlet facilities.

Centered at Hazelton is a small cedar post-and-pole industry. The product is floated out, all the way to the Alaskan boundary via the Skeena. To this could be added the tie industry, already a paying venture. Ties are made from the jack pine found in suitable sizes along the rivers. Tie timber extends along the Babine route to Bear Lake. The table following[2] shows the estimated merchantable timber in five of the principal drainage areas north of Hazelton.

[2] Taken from the Report of the Forest Branch, Lands Department, British Columbia, and based in part on the Report of the Commission of Conservation, 1917.

FOREST RESOURCES

MERCHANTABLE TIMBER

(Thousand board feet)

No.	Drainage basin		Hemlock	Spruce	Balsam	Lodge-pole pine	Cedar	Total
	River system	Timbered area						
		Acres						
1	Upper Skeena River	428, 760	1, 673, 600	955, 000	1, 389, 700	36, 400	51, 600	4, 106, 300
2	Upper Nass	833, 508	1, 893, 000	1, 197, 500	1, 202, 800	58, 300	111, 600	4, 463, 200
3	Stikine-Iskut Rivers	707, 800	1, 189, 400	1, 038, 700	284, 600	99, 800	----------	2, 612, 500
4	Taku River	71, 700	114, 200	102, 600	28, 200	10, 000	----------	255, 000
5	Atlin region	96, 000	----------	134, 400	19, 200	38, 400	----------	192, 000
	Total	2, 137, 768	4, 870, 200	3, 428, 200	2, 924, 500	242, 900	163, 200	11, 629, 000

NOTE.—The cedar given for the upper Skeena drainage is found in the Kitwanga valley; there is a small additional volume, suitable for poles, in the vicinity of Hazelton. Large black cottonwood, in small quantities, is found along all main watercourses.

Estimate for drainage basins, 3, 4, and 5 taken from Commission of Conservation Report dated 1917.

Fur.—Fur is an important resource of all the northern part of the continent. A new road such as the Pacific-Yukon Highway would open up a vast new area for trapping, increasing our production of this resource.

The raising of fur-bearing animals in captivity is a form of farming that deserves very careful study and attention in this great northern country where there are many conditions favoring it. Here is one farming activity in which there is produced a commodity that can be exported at a profit. The market for fur is widespread and will probably never be overstocked. The supply of wild fur will continuously decrease, however, as civilization spreads to the vacant spaces, a decrease which should be compensated for by increases in the raising of fur-bearers in captivity. This industry is in its infancy and is surely destined to increase to much larger proportions, especially in such regions as that tapped by the Pacific-Yukon Highway.

Big game hunting and fishing are possible attractions throughout the region, especially in the open mountains of the upper Skeena, Klappan, etc. Moose, caribou, mountain sheep, and goat are plentiful and already attract many hunters. This sport is expensive and is capable of providing a considerable seasonable payroll in the area. At present, owing to the excessive costs incident to entering the region with supplies, equipment, guides, etc., the cost of a 30-day hunting trip is about $3,000. The area centered around Atlin and Telegraph Creek is especially popular with hunters and depends today, to some extent, on the income from visitors of this class.

Agriculture.—Agricultural development generally follows mining or other industrial development if the soil and climatic conditions permit the growing of crops. This has been the experience of British Columbia, Yukon Territory, and Alaska; and there is every reason to believe that, as additional mining areas are opened and developed, farming will be done to supply the increased local markets. It is a matter of surprise to many that this northern country is suitable for agriculture. The popular imagination pictures it as a forbidding land of snow and glaciers, and no doubt this misconception has deterred agricultural development; but conditions are really favorable to farming in practically all of the valleys in the vicinity of this project. The rich soil, the ample moisture, and the long hours of summer daylight produce surprising crops of many different kinds of products. In Alaska, adjacent to or even north of the Arctic Circle, grains, hay, vegetables, small fruits, and flowers are grown successfully.

As an instance of what can be done in Alaska in the way of agriculture, the experiences of the Department of Agriculture in conducting the Agricultural Experiment Stations during 1929 may be

A Farm near Fairbanks, Alaska.

AIRVIEW OF FAIRBANKS, AVIATION FIELD IN FOREGROUND.

cited; particularly the accomplishments at the Fairbanks station, which is at the northern terminal of the proposed road.

Weather.—The minimum temperature during the winter was −38° F. Snowfall was 94 inches, which represented 6.63 inches of water and was about twice the normal winter snowfall. The mean summer temperature, May to September, inclusive, was 54° F., with the maximum 86° F. There were 117 frost-free days. The south slopes could be cultivated on May 17 and the north slopes two weeks later.

Grains.—Spring wheat of good quality required from 98 to 109 days to ripen and yielded 21 to 28 bushels per acre. Winter wheat was not successful. Oats of good quality required 96 to 111 days to ripen, yielding from 35 to 77 bushels per acre. Barley of good quality required about 89 days to ripen and yielded 28 to 49 bushels per acre. Flax was raised during a one-year test and is reported to be well adapted to local conditions, although further tests are necessary to determine the best varieties for Alaska.

Forage.—Alfalfa survived the winter practically 100 percent, yielding at the rate of 6.2 tons per acre. Clovers survived about 30 percent. Further experiments are in progress with hardy varieties. Vetch survived the winter well and made rapid growth, yielding about 6 tons per acre. Field peas yielded hay of high quality at the rate of 1.3 tons per acre. Grasses also survived the winter and yielded up to 4.3 tons per acre.

Vegetables.—Potatoes were planted May 24 and matured about September 20. They were of fine quality and yielded from 193 to 214 bushels per acre. Other vegetables grown were spinach, kale, cabbage, celery, onions, parsnips, salsify, beets, carrots, turnips, radishes, cauliflower, brussels sprouts, tomatoes, sweet corn, leek, Swiss chard, peas, head lettuce, and rutabagas. All did well except tomatoes and sweet corn. The tomatoes made a large yield of green fruit, none of which ripened. Sweet corn grew slowly, tasseled and silked but produced no ears.

Berries.—Cranberries and blueberries grow wild very profusely over a large portion of the territory. In 1929, a Fairbanks merchant purchased 2,300 pounds of wild cranberries which he shipped to the United States. The venture proved to be a success and indicates that a large quantity of Alaskan cranberries may be marketed in the near future. Native blueberries are very plentiful, but cannot under present conditions be exported successfully. The local market, however, is quite considerable. Raspberries were raised successfully. The Cuthbert variety over-wintered well and produced a satisfactory yield of excellent quality. Strawberries do not do well in the Fairbanks region, but elsewhere in Alaska are very successfully grown.

In Canada there are few agricultural settlers north of the Kitwanga at the present time, but the valley of the lower Nass has been surveyed and good land is reported. Agricultural land exists probably also in the Bell-Irving valley. Along the Kispiox development has extended for about 20 miles north of Hazelton. The Babine and Takla Lake regions, being characterized by large areas of flat or undulating land, should prove suitable for farming similar to that carried on in the Bulkley valley south and east of Hazelton. Short roads connecting the main highway with the lakes will, by means of gas launch service, open up relatively large areas not actually reached by highway.

Dairying.—In the vicinity of Fairbanks eighty-seven dairy cattle produce milk and cream for the local market. This industry will increase as settlement develops.

Stock raising.—Raising cattle, sheep, goats, and reindeer is another possibility for producing commodities for export. There are thousands of square miles of suitable grazing land where stock can be raised for meat, hides, and wool. The present increase in reindeer herds in western Alaska—where the winter climate is even more severe than along the greater part of the proposed Pacific-Yukon Highway—has been amazing. The herds are increasing about a third of their number each year, and from just a few thousand head which were introduced from Siberia a few years ago, the number of animals has increased to nearly a million. A large herd has recently been moved overland—grazing *en route*—to northern Canada. Experiments in raising domestic sheep in Alaska have indicated that the industry is a promising one, owing to the abundance of feed and the high quality of wool which nature provides for these animals in the north country. Mountain or wild sheep are native to Alaska, and thrive and multiply if not over-hunted. This is evident from the large and increasing number of these animals in McKinley Park, Alaska, where hunting is prohibited. Experiments in raising these wild sheep in captivity have been made at the Alaska Agricultural College and School of Mines, near Fairbanks, and seem to prove that they can be successfully raised and domesticated. The hair of these sheep is not of a high quality and in fact is not suitable for wool, but the meat is excellent—far superior to ordinary domestic mutton. Goat culture for the production of milk for cheese is also a possibility for the new area which would be opened up by this road project and, if successful, would provide a product which we now import from Europe in considerable quantities. These possibilities are conceded by those who are familiar with the country. The Pacific-Yukon Highway, by making large areas of suitable land more accessible, would tend to encourage and develop the raising of live stock for these purposes.

Some areas, like the Klappan valley with its large meadows and bunch-grass hillsides, which extend easterly for relatively long distances, afford good winter feeding grounds. Caribou Mountain in this region is the wintering ground for thousands of caribou. The snowfall is light, and the bunch grass flourishes in early spring. With hay from the meadow lands there is reason to believe that stock raising could be made as productive and successful an industry as in the Chilcotin valley, where its success is demonstrated.

Conditions are also favorable for agriculture in the vicinity of Dawson, Whitehorse, and other local markets of Yukon Territory. In British Columbia, ranching and farming have brought rich returns wherever roads have been built. The principal obstacles to further expansion of agriculture in British Columbia, Yukon Territory, and Alaska, are lack of roads and lack of markets. A new road such as this Pacific-Yukon project should overcome both of these obstacles. The industrial and mining development, stimulated by the road, should tend to increase the local markets and the road itself would provide access to suitable lands. Furthermore, by making the whole country more accessible, the new route should acquaint a large number of people with the agricultural possibilities of the region and thus tend to draw desirable settlers.

Water power.—The market for power has alone prevented development of the major and minor sites that abound through the region as far north as Yukon Territory. All rivers are capable of development to some extent, at least for localized purposes. No surveys have been made, but the rivers have usually plenty of fall and the numerous lakes furnish natural reservoir sites. The Stikine and Tuya Lake offer great possibilities for power development.

Assistance to Airplane Travel

Western Canada and Alaska occupy a most significant position with respect to possible air travel between the old and new worlds. There is no land bridge across the Atlantic Ocean that does not include jumps of hundreds of miles over open water, constituting a threat against airplanes that may not be overcome for many years, but Asia and America are separated by only 56 miles at Bering Strait, and even this short distance is cut in two by the Diomede Islands which lie midway between East Cape, Siberia, and Cape Prince of Wales, Alaska. Nor does the fact that this strait is in the far north result in a long detour from the direct routes between many American and European or Asian points, as might be supposed by those who have not studied the relation between various places in the northern hemisphere as they actually are on the globe.

From New York or Montreal to Europe, the shortest distances are, of course, by way of the Atlantic Ocean, but to Asia the distances are less by way of Alaska and Siberia. For example, the shortest line between New York and Tokio passes through midwestern and western Canada and through Alaska, just a few miles north of Fairbanks. From all Pacific Coast American ports, the shortest airline routes to Asia, as far west as India or Persia, lie close to Alaska. Alaska, therefore, owing to its favorable strategic location, is the most suitable jump-off point for air travel to Asia.

The best air route from western United States to the interior of Alaska is approximately over the same valleys in which this proposed Pacific-Yukon Highway is to be built. The advantages of this route over a route directly along the coast are: Less fog and rain, less rugged country and, consequently, less danger of striking mountains in the fog, and better terrain for landing and take-off fields. The aviation business has increased very greatly in recent years in western Canada and Alaska, and seems destined for an even greater increase when the industry expands to inter-continental service between America and Asia.

Whatever advances may occur in the design and operation of airplanes, we know that they must always be based on and supplied from the ground. They will need many airfields for this purpose, and the airfields must be properly equipped and supplied. The advantage of flying over a traveled highway rather than over a trackless wilderness is obvious.

The necessity for meeting the requirements of this new and most modern form of transportation, which is probably due for an expansion beyond our present comprehension, needs no discussion. One of the best services that can be rendered to the aviation industry is to make all parts of their routes accessible by roads so that aviators may be assured of adequate supplies and services *en route* and be accessible to help in case of forced landings.

The Pacific-Yukon Highway is properly located to serve aviation and the completion of the project will probably greatly stimulate aviation in the area affected and thereby further develop the country. Indeed it would not be surprising if the increase in aviation activities were to force the construction of the project from that viewpoint alone, irrespective of other advantages.

Landing Fields

The route of the highway as surveyed, taking advantage of open valleys, timber-free lands, low passes and proximity to lakes, affords an excellent route for air service between Vancouver and Dawson, and thence to Fairbanks. Some landing fields exist already along

the line and have been in use for a short period. Other locations are available where, with a moderate amount of work, additional landing facilities may be provided.

Burns Lake, about 164 miles west of Prince George and 141 miles from Hazelton, has a landing place about 1,400 feet in length and varying in width from 100 to 600 feet. It is situated on the shore of the lake, which is protected water for a distance of 2 miles eastward and 1 mile westward. It is on the main highway, about one quarter of a mile from the railroad station of the Canadian National. Considerable grading and leveling was done on the field in 1930 and 1931, and flights in northern British Columbia and Yukon Territory have been based on this point.

At Dawson, Yukon Territory, a landing field is situated in the valley of the Klondike River, above the mouth of the Bonanza Creek and just below Jackson Gulch, about 2½ miles from Dawson. The field is about 1,600 feet long, and has a runway of about 300 feet in width. The field itself is considerably wider than the runway. During the winter, a sand bar in the river immediately in front of Dawson is used as a landing place.

Hazelton, British Columbia, near the end of the present improved section of highway, has a suitable airplane landing field, which has been used on numerous occasions.

At Prince George, British Columbia, which is a point on the highway and a station on the Canadian National Railroad, there is a landing field one-half mile west of the city which has been used on several occasions. It is 1,800 feet in length and 500 feet in width; and, in addition to the field, the Fraser River at Prince George and Tabor Lake, about 9 miles from the town, offer satisfactory landing facilities for hydroplanes.

Smithers, British Columbia, 50 miles southeast of Hazelton, offers several facilities for landing. About 2 miles east of the town, near the Bulkley River, is a landing field which the aviation bureau of the Smithers Board of Trade is slowly improving, with the idea of developing a local airport. Two miles southeast of Smithers is Lake Seymour, one mile long by one quarter of a mile wide, with deep water but with timbered approaches; and 2 miles west is Lake Kathlyn, which is about 1½ miles square. This lake may be approached easily from all angles, has a fairly deep center, but is shallow along the shore.

At Vanderhoof, about midway between Prince George and Burns Lake, on the Canadian National Railroad, there are numerous fields in the vicinity of the town available for landing places, but not especially built for the purpose. The Nechako River at this point is sufficiently wide for hydroplane landings; and at distances of 5

and 7 miles, respectively, there are two lakes, Tachick and Nulki, each 6 or 7 miles long and a mile wide, which afford excellent hydroplane landings. These lakes are connected by motor roads with Vanderhoof.

Whitehorse, Yukon Territory, is the site of a large area of land which has been set aside by the Dominion Government for aviation purposes. It is at present being used by several planes operating between Whitehorse and interior points, such as Mayo, Dawson, etc. A portion of the field sufficient for present use has been surfaced, and a permanent hangar has been erected. Further work on this field will be done as conditions require.

In addition to the landing places described above, all of which are directly on the line of the reconnoitered route, numerous other available landing areas exist throughout the region tributary to the highway. These are situated at Anyox, Ocean Falls, Prince Rupert, Stewart, and Terrace, British Columbia, and at Mayo, Yukon Territory. Scattered throughout the region are lakes, such as Dease, Tagish, Atlin and Laberge, all of which are suitable for hydroplane landings.

In Alaska, Fairbanks is a center for commercial aviation as it is conveniently situated to serve a large part of the interior. The operating companies use modern planes, inspected and approved by the United States Department of Commerce, and employ licensed aviators.

Tourist Features

Undoubtedly one of the greatest direct returns from the construction of a road to Alaska must be found in the increased business due to tourist travel. This business will flow directly from the expenditures of visitors for living expenses, gas, oil, garage charges, and miscellaneous purchases of articles or services.

Some effort has been made to determine on a rational basis the potential flow of tourists into the northland as a result of the opening of the highway, but no adequate basis appears to exist for any very definite conclusions.

Some counts are available of travel on connecting roads and at points along the proposed highway. Other records of tourist travel are available for other points in Canada and elsewhere that are indicative of what may be expected under favorable conditions. One of the most significant conditions is the percent of foreign (non-British Columbian) cars crossing the Alexandra Bridge in the Fraser Canyon, about 30 miles north of Hope. With a daily annual average based on a count from April first to November 15, 1931, of 90 cars, 18 cars or 20 percent were foreign, principally, of course, from the United States. In 1930, 2,887 cars from the States

crossed the bridge. In 1931, the total traffic as recorded at the toll-gate (Spuzzum) was 19,064, of which about 3,810 were tourists.

Alaska at the north end of the route has about 36,000 tourists annually, which based on conditions of tourist travel elsewhere would require 12,000 cars if all traveled in that way. Very few cars are taken to Alaska by tourists under present conditions, but tourists traveling by other conveyances penetrate to Dawson on the Yukon, which lies on a popular route including Fairbanks, Circle, and Dawson. There is enough of this business to induce Dawson at present to cater to tourists.

It has been the experience in other cases that tourists are promptly attracted by the opening of new highways and provisions for suitable accommodations. The opening of the Mexican National Road to Monterrey, Mexico, 150 miles from Laredo on the Rio Grande, within a year and a half produced an average week-end traffic from the United States of 2,000 cars. Most of these came from points as remote as San Antonio, Texas, a distance of 300 miles, and entered a sparsely settled country having a language foreign to the tourists and provided with only meager facilities for automobile travel.

Traffic Analysis

Within the limits of the United States there are definite studies[8] indicating that over reasonably large areas the amount of foreign (i.e., non-State) travel increased 50 percent in the 5-year period from 1925 to 1930. The same studies reveal that in 1930 the long-distance tourist travel to California included 2 percent from a distance greater than 3,000 miles, 25.2 percent from a distance of more than 1,500 miles.

These travelers were attracted by the well-advertised conditions existing in California and at other western points having notable scenery, climate, or natural features of an unusual character. Whether the same results may be expected to follow so immediately on the opening of a highway into northern British Columbia, the Yukon Territory, and Alaska cannot be definitely stated, but the outstanding fact is that these regions offer new and different conditions. The snow-capped mountain ranges, glaciers, and profusion of mountain lakes occurring along a large part of the proposed highway certainly constitute a set of attractions that cannot be found anywhere else in North America. The contrast with the hundreds of miles of plains and desert that occur on most of the long western routes in the United States stamp these conditions as novel, and they may accordingly be considered correspondingly attractive to the curious touring public.

[8] Western States Traffic Survey and Pennsylvania Transport Survey.

Based on the known conditions affecting tourists, various estimates have been made of the probable number of visitors that may be expected to follow the opening of such a road as that proposed. These estimates range from 3,000 to 6,500 cars the first year; 6,000 cars the second year; 14,000 cars the third year; and 30,000 cars the tenth year.

Examining the data available, which furnish a reasonable basis for an approximate estimate, it appears probable that 3,100 cars may be expected to travel large parts or all of the route the first year, and conservatively 4,000 cars in the fifth year.

In the United States 25 percent of the traffic observed in the study conducted in the Western States traveled 1,500 to 3,000 miles. If we assume that 5 percent of the tourists who go to Alaska annually would return overland for 2,200 miles if a safe, comfortable, and convenient route were provided, we should have 600 cars accounted for. At the Alexandra Bridge, 1931, about 3,500 cars crossed, or approximately 1,750 in each direction. The traffic increased about 6 percent in 1931 over 1930 along the toll section of the Caribou Highway. This gives 2,350 cars in the initial year, and an increase of normal traffic of 6 percent annually. In the total annual traffic a certain increase in the proportion of foreign traffic has been observed over a large area in the United States, which indicates an annual increase of about 10 percent. Therefore, the annual total increment of 6 percent will show 0.6 percent greater tourist fraction, or say, another one-half percent of tourists in the total. On this most conservative basis, present known tourist traffic into the northland may be expected to develop an increase of 6.5 percent annually, giving the following approximate figures for the next five years, assuming the road at once opened: First year, 2,350; second year, 2,502; third year, 2,665; fourth year, 2,838; fifth year, 3,022.

In these figures only the Alaska tourists using the steamer to Alaska have been included, in addition to those now attracted to the Caribou Highway as it exists. The next step is to find some figure representing the probable increase of long distance touring from the United States and eastern Canada that will flow over the new route when opened.

Across the Mexican border, we have evidence of approximately 100,000 cars annually developed within two years of the opening of the road, with a travel season of twelve months. At Banff, Canada, and in the Canadian Rocky Mountain Park, we have records of 32,000 cars in a 5-months' season. These figures indicate that tourist travel up to a conservative figure of 5,000 a month has been developed on a likewise conservative radius of 300 miles—for many of the Banff tourists come from a much greater distance.

From the studies of long distance travel within the United States, we found that 25 percent of the tourists observed in the State came from points approximately 1,500 miles or more distant to California; similarly, 20 percent came from 1,000 miles or more to Colorado; 14 percent came from 1,500 miles or more to Utah; 20 percent came to Wyoming from 1,000 miles or more; 20 percent came to Arizona; and 15 percent to New Mexico from points 1,000 miles or more distant. On the other hand, only 9 percent came to Idaho from points 2,000 miles or more; 5 percent to Oregon; and 7 percent to Washington from points 2,000 miles or more. But 10 percent to Oregon and 14 percent to Washington came from points 1,500 miles or more. It appears, therefore, that a conservative estimate of tourists that will travel 1,000 miles is 15 percent; that will travel 1,500 is 10 percent; and that will travel 2,000 is 5 percent, even to the least exploited areas of the country. If we attribute to the Alaska Highway half the attractiveness developed by our average Western State, this would indicate that 750 would be added to the travel to Dawson and perhaps to Fairbanks in the six open months of the first year of the proposed highway. Fifteen hundred would go as far as Hazelton. The road to Hazelton is already improved and we should expect then that approximately 1,600 tourists, based on 32,000 observed at Banff would pass up the Caribou Highway to Hazelton. The nearest check on this relation is the 1,750 cars actually observed in one direction at the Alexandra Bridge. This appears to support the basis of the estimate made.

Adding the 750 cars to the first year figures already obtained, and allowing for the natural increment to this number each year thereafter for five years, we have: First year, 3,100 cars; second year, 3,300; third year, 3,500; fourth year, 3,750; and fifth year, 3,950. This appears to be a conservative estimate of the number likely to travel the whole distance to Dawson or Fairbanks. Practically all of these would go and return, making totals at the Alexandra Bridge of twice these figures, or 6,200 the first year, and 8,000 the fifth.

The estimate presented is very conservative, and it may properly be assumed that Hazelton will remain just as attractive an independent objective as it is now. In which case, we may add in the first year 1,600 cars as far as Hazelton, and increase this 6.5 percent each year, as follows: First year, 1,600; second year, 1,700; third year, 1,800; fourth year, 1,930; fifth year, 2,050. This would give a total tourist traffic as far as Hazelton of 4,700 cars the first year; 5,000 the second: 5,300 the third; 5,700 the fourth; and 6,000 the fifth.

Earnings in the form of taxation have been estimated at $1.10 per day per car by the British Columbia authorities, and expenditures

by tourists as shown by such data as are available amount to approximately $20 per day per car. There is no way of determining, except in a very approximate manner, how long cars on the Alaskan or Hazelton trip are likely to remain in Canada, but probably the Alaskan round trip of approximately 4,500 miles would consume at least 30 days and the Hazelton half that time. On this basis the following total expenditures and tax earnings are indicated from tourist traffic.

Year	Hazelton Trip			Alaskan Trip		
	No. of cars	Expenditures by tourists	Earnings through taxes	No. of cars	Expenditures by tourists	Earnings through taxes
1	1, 600	$480, 000	$26, 400	3, 100	$1, 860, 000	$102, 300
2	1, 700	510, 000	28, 050	3, 300	1, 980, 000	108, 900
3	1, 800	540, 000	29, 700	3, 500	2, 100, 000	115, 500
4	1, 950	585, 000	32, 200	3, 750	2, 250, 000	123, 750
5	2, 050	615, 000	33, 800	3, 950	2, 370, 000	130, 350

These figures show the amount of business each year that may be expected to flow directly from tourist travel only on the proposed route. It is considered to be a very conservative statement, and it takes into account none of the various returns that the route may be expected to produce in other ways.

The resources indicated to lie along the proposed line will invite exploitation; available farming lands now inaccessible because of lack of transportation will come into production as settlement follows the road and a market for produce is opened. It is to be expected that the mineral and other natural resources will be developed and that the permanent business of the region will expand with a greater rapidity than in the past. Such returns cannot be reduced to figures. They would be but estimates limited only by the imagination. But that, in addition to the direct returns, they would be many times the interest and maintenance charges, is beyond question.

Relation to Other Continental Projects

It is pertinent to the scope of the inquiry carried on by this Commission to call attention to the fact that a highway from the United States to Alaska would at once fill an extensive gap in a series of projected highway systems.

At the north end the general scheme of highways for central Alaska would be connected through McCarty with the entire Cana-

dian system by the completion of the line between Hazelton and the Richardson Highway. The Canadian National and Provincial highways are connected at many points with the Federal Aid and State Highway Systems of the United States. The Federal Aid Highway System, comprising as it does all the principal interstate routes of the country, furnishes a number of possible lines from Blaine, Washington, to Laredo, Texas, or to Nogales, New Mexico; and at these border cities connection is made directly with the National Road System of Mexico. At present the Republic of Mexico is concentrating both funds and efforts on the main route from Nuevo Laredo by way of Monterrey, Montemorelos, Ciudad Victoria, Valles and Pachuca to Mexico City, and large parts of this route are completed. It is expected, according to the latest estimates of the Mexican engineers, that the road will be passable to tourists to Mexico City before the end of the calendar year 1933.

Beyond Mexico City the road has long been completed to Puebla, and some construction has been done at several points southward via Oaxaca, the Tehuantepec Isthmus and Suchiate to the Guatemalan border. From this point to the city of Panamá and the Isthmian Canal Zone a reconnaissance has been made as provided by the Congress of the United States to determine a feasible route or routes for a highway through Central America to connect with South America.

The promotion of the Alaska Highway connection has, therefore, an aspect nothing short of continental in its scope and significance. Its effect in promoting international travel among the people of the Western Hemisphere, more especially among those of North America, will be important and no doubt large because it will constitute the initial line of through overland communication. The project will constitute a vital part of the growing movement to cement the solidarity of the Americas, improve communications directly with our neighbor republics by physical connections, and develop the good will of these nations by friendly intercourse and larger acquaintance.

Relation to Other Transportation Systems Serving Alaska

The question of competition with other transportation systems to and within Alaska has arisen in connection with the study of this project. With the exception of a very small amount of airplane passenger and package business, all trade with Alaska is now conducted by ships. Ship service will always be required for through freight even after the completion of this road project because freight cannot be hauled over long highways in competition with ocean carriers. Highway transportation costs over this project would not be less than from 20 cents to 50 cents per ton-mile, while ship freight can be hauled for less than 1 cent per ton-mile. Hence, there is no

possibility of any appreciable water-borne freight from the United States to Alaska being diverted to the new highway.

It is possible, of course, that some passengers going to Alaska would travel over the highway in preference to going by ship, and there might be some loss of passenger traffic in the combined railroad and ship passenger business from this cause. On the other hand, the existence of the road is expected to induce many people to go to Alaska who otherwise would not go at all, and many such would use the other modes of transportation, either northbound or southbound. Furthermore, any increase in the development and population of interior Alaska would cause an increase in passenger and freight traffic with the United States, and consequently benefit the carriers.

In regard to local traffic within Western Canada and Alaska, the new road project would not adversely affect the present river and rail carriers since, except for the stretch between Whitehorse and Dawson, the new sections of the road will traverse country which is not now reached by the existing systems. Between Whitehorse and Dawson it is true that the highway route parallels the river which is now served by steamboats, and while some freight which is now hauled by steamboat from Whitehorse to Dawson might move over the highway instead, nevertheless any increase in development or population that might be attributed to the road should favorably influence the traffic on the river. Freight which would be needed in large volume for opening new mining properties would move by boat as far as possible before being transferred to trucks.

The Alaska Railroad which provides connection from the North Pacific Ocean at Valdez to Fairbanks touches the new project only at Fairbanks. While the railroad would lose the passengers destined for Fairbanks who would go over the highway in preference to the water-and-rail route, it would gain all additional freight created by the highway, as well as passengers who, having made the northward trip by road, desire to return by rail and water, and also all such passengers who desire to visit points on the railroad not accessible by road. Even should possible railroad travelers go to Fairbanks by road, the hauling of supplies for these and other travelers and new industries opened as a result of the new highway should many times offset any such loss. If the project contributes to the prosperity of the territory, the present carriers will benefit tremendously.

Progressive Construction

The integral construction of so large an undertaking as that represented by the unimproved sections along the route herein proposed is probably too great to be attempted, but modern methods of

road building have long since adapted themselves to properly economic methods of procedure and administration. It is pointed out that while the estimate for completion is $12,409,300, grading alone would cost approximately $8,613,800. The grading can be further subdivided and concentrated along those sections that will at once produce a return in greater service to the several communities, improved connection, added attractions for tourists and development of the country. Grading could be extended from Kispiox northward toward the Stikine-Klappan Crossing. The road from Atlin to Whitehorse could be improved and thus open to outside communication the entire Atlin Lake region. The line already partly graded and in use between Whitehorse and Dawson could be undertaken and prosecuted from both ends with assurance that every mile improved would add to the facilities for communication between those most important points in Yukon Territory.

By this method of prosecuting the work, full value in service would be secured from each part of the project as it is advanced, and the immediate financial requirements would be reduced much below those of the complete estimate. Thus financed and constructed over a period of five years, there would be provided an interval in which advertising and promotion could be undertaken so that on opening the through-route a much heavier patronage by tourists could reasonably be expected than the estimates contained in this report.

While the objective should be the ultimate completion of the entire route, the local benefits to be derived from early completion of individual sections should not be ignored. Thus the early completion of the Fairbanks-Dawson road on its own merits for the purpose of developing the intermediate territory and providing a much-needed connection between the two communities, as well as a vital link in the proposed through-highway is considered highly desirable.

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VII. FINANCING

Detailed consideration of possible agreements between the United States and Canada relating to raising the funds to defray the cost of the entire project is not within the scope of the inquiries made by the Commissioners. The preliminary discussions touched but briefly and informally on this subject, as it did not appear to either the American or Canadian side that comprehensive and formal consideration of this problem was authorized.

Financing of road construction and other public works in Alaska has been largely at Federal expense. The report of the Alaska Road Commission for the fiscal year 1932 shows that the funds for such work under that agency have been as follows:

Direct Federal appropriations including increase of compensation and roads and trails in national parks	$12,750,740.47
Federal taxes collected in Alaska and automatically allotted to road work "Alaska Fund"	3,828,612.52
Territorial appropriations and miscellaneous contributions from local sources	1,770,461.30
Total	$18,349,814.29

Thus it is seen that out of a total of about $18,350,000 the local contribution has been about $5,600,000, or, roughly, 30 percent.

Since the proposed international highway is continental in scope it is considered that a liberal proportion of its cost should be defrayed by Federal funds as has been done on the transcontinental and other Federal-aid highways in the sparsely settled States.[4] In view of the preponderating Federal responsibility for the development of Alaska a Federal contribution of 90 percent toward the cost of constructing the Alaska end of the proposed international highway is not considered unreasonable. In fact, the assumption of the entire burden by the Federal Government should be given consideration.

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[4] For example, the current status of Federal-aid road construction in Nevada, as of February 28, 1931, was as follows:

Under construction:	Total estimated cost	$1,005,734.41
	Federal-aid allotted	871,720.23

Thus the Federal proportion is approximately 87 percent of the total.

VIII. PRESENT STATE OF DEVELOPMENT

Population Served

In the absence of other more specific data fixing the economic service of any particular highway, the population living along the road is always an index of the relative value of the location. The Caribou Highway, with its extension as studied in connection with the Alaskan highway project, shows some most unusual conditions with respect to the population in both British Columbia and Yukon Territory.

In British Columbia this single road will connect centers containing 66.6 percent of the classified urban population, according to the last available Canadian Census Report—that of 1931. This urban population lying along the highway is also approximately 38 percent of the entire population of the Province. In Yukon Territory the conditions are even more striking. One hundred percent of the classified urban population would be served by the proposed route, and at least 32 percent of the entire population both rural and urban. While extreme relations of this sort may be expected to apply in greater or less measure to development roads in new territory, they are none the less indicative of the importance of the roads in question. Omitting considerations of Dominion significance or policy, it is probable that in British Columbia there are not more than one or two routes of trans-Provincial proportions having a greater justification than the one under study. In the Yukon Territory, no other one can be located having greater justification from the point of view of the urban population, and for this reason, probably no single route could anywhere be located in the Territory having greater general use or importance than the proposed line.

Alaska's vast area of 590,000 square miles is inhabited by 59,278 people (1930 census) or, roughly, one person for each 10 square miles of area. The population is about evenly divided between whites and natives. During the gold rushes 1898–1910, the population was about 65,000, followed by an abrupt decline as the most spectacular gold production operations were worked out. There was a decided drop in population during the World War, due largely to withdrawal of capital and labor from Alaska enterprises for participation in the war effort. Since 1920, however, there has been a moderate but consistent growth (7 percent in 10 years) in harmony

with the development of the territory by the improvement of transportation facilities.

In addition to the static population reflected in the census figures, there should be considered the large seasonal transient or recurring population amounting to from 30,000 to 40,000 per year. The mines, fisheries, and transportation concerns bring thousands of workers to the territory every year. Many of them consider themselves *bona fide* Alaskans, even though they winter in the States.

Development of Alaska

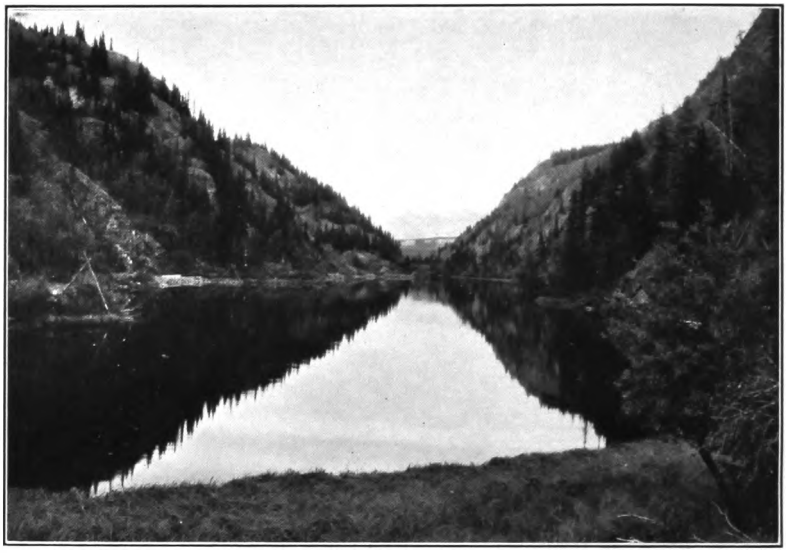
The study of population alone does not give a true picture of the commercial and industrial importance of the Territory, especially during the intensive mechanization that has characterized gold-producing and fishing industries in recent years, resulting in the general use of machines to replace manpower. In normal years the average value of merchandise shipped to Alaska is from $30,000,000 to $40,000,000 and exports, including gold and silver, from $50,000,000 to $80,000,000, giving a substantial balance of trade in favor of the Territory. From these figures, taken from Government reports, it is seen that there are produced each year and exported from Alaska commodities to the value of from $800 to $1,300 for every man, woman, and child permanently residing in the Territory. If the United States as a whole could produce at the same rate per capita, we would have the enormous exportable surplus of over $100,000,000,000 per year.

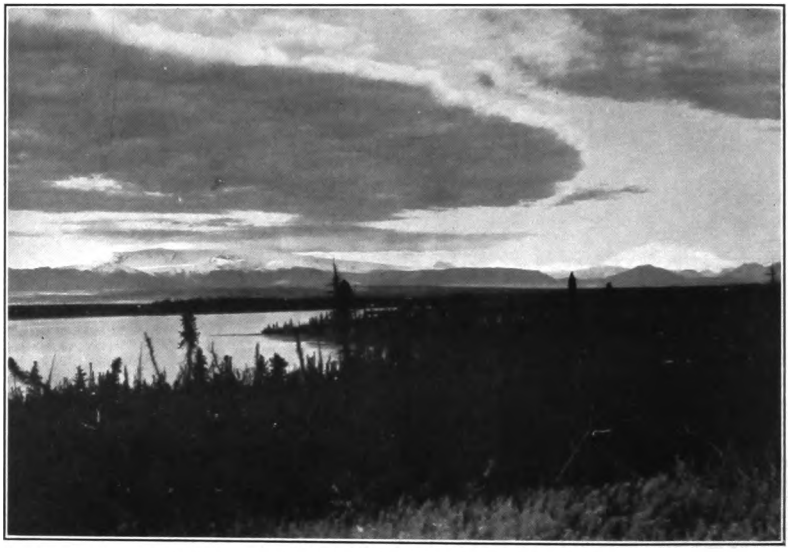
The most important products of Alaska, in the order named, are fish, gold, copper, and furs. Other products of minor importance are whale oil, live foxes, and other animals, silver, lead, tin, reindeer meat, stone, and timber.

Cost of Government

The Territory raises and disburses funds from local taxes. These amount to about $1,250,000 per year, and the expenditures can not exceed the receipts as the Territory is not authorized by Congress to incur any deficit or debt. Only a minor portion of governmental functions is performed at local expense, the bulk of the cost being defrayed by the Federal Government and amounting to about $7,000,000 annually. The Territory might, therefore, be considered a direct drain on the Federal treasury to this extent, but this figure takes no account of returns to the Federal treasury such as payments of taxes to the United States by interests which operate businesses or industries in Alaska but have their domiciles in continental United States. These include the larger mining and fisheries com-

SCENES ALONG THE RICHARDSON HIGHWAY.





SCENES ALONG THE RICHARDSON HIGHWAY.

panies which pay income taxes in Boston, New York, San Francisco, Seattle, and elsewhere, out of the profits from their Alaska businesses. The correct balance, therefore, between governmental costs and revenues is not shown by the figures quoted. The Territory is not costing us that much.

However, the disparity between the costs of government and receipts should be removed if at all possible, and the most promising method of accomplishing this is the further development of the Territory with a view to increasing its population and earnings. Improved roads are the most vital necessity for encouragement of this development.

IX. RÉSUMÉ

Conclusions and recommendations were for convenience placed at the beginning of this report, and to these reference is now made. Regarding the construction of a highway from the northwestern part of the United States to Alaska, the Commission was instructed "to ascertain whether such a highway is feasible and economically practicable", and the Commission's general conclusion is that the project has both these qualifications in view of the facts set forth in this report.

APPENDIX A

EXTRACT FROM A REPORT BY MAJOR MALCOLM ELLIOTT OF THE ALASKA ROAD COMMISSION GIVING DETAILED DESCRIPTION OF A ROUTE FOR THE PACIFIC-YUKON HIGHWAY THROUGH BRITISH COLUMBIA AND YUKON TERRITORY TO ALASKA, WITH HISTORICAL NOTES

This route starts at Vancouver, British Columbia, follows the Caribou Highway to Prince George, turns west to Hazelton, British Columbia, then runs north and northwest to Whitehorse, Yukon Territory, and Dawson, Yukon Territory, and west to Fairbanks, Alaska. Other routes are probably feasible. Liberal use has been made of official information issued by the Governments of British Columbia and Yukon Territory.

Vancouver to Chilliwack (population 2,200), 70 Miles

The road passes through New Westminster (population 18,024), a fresh water seaport, industrial and commercial center.

This is a rich agricultural area, including dairying, mixed farming, hops, tobacco, and fruit. Population of rural municipalities and villages in this valley is about 75,000, and property valuation about $100,000,000. Annual motor-car traffic from the United States is about 150,000 cars carrying 500,000 passengers.

Chilliwack to Hope (population 500), 33 Miles

(103 miles from Vancouver)

Farming country. The road passes through Rosedale and St. Elmo, centers of farming and dairying. Hope was founded as Fort Hope in 1847 by Hudson's Bay Company as a trading post, and was the center of a very notable mining district. Here the road crosses to the west bank of the Fraser River on a double deck bridge. The lower deck carries the Canadian National Railroad.

Hope to Yale, 14 Miles

(117 miles from Vancouver)

The beginning of the Fraser River Canyon. Yale was the head of navigation of the Fraser River, and cargoes debarked here to

be carried through the canyon over the Caribou Trail. Stage coaches, freight wagons drawn by horses, mules and oxen, pack trains of mules and oxen, even camels were used. Steam tractors were tried. Many of the bars of Fraser River were mined with rockers and sluices.

YALE TO LYTTON, 59 MILES

(176 miles from Vancouver)

The road is carved in the side of the canyon and overlooks the tumbling rushing river below. It crosses to the east side of the canyon at Alexandra Bridge. A few miles north it passes through a tunnel. The road is surfaced with gravel, well maintained, of ample width, easy curves and grades, and is protected on the outer edge by a stone rampart. The old Caribou Trail is still to be seen crossing and recrossing the modern road in many places.

LYTTON TO CLINTON, VIA ASHCROFT, 86 MILES

(262 miles from Vancouver)

Lytton is at the confluence of the Fraser and Thompson Rivers. It is a historic town. Here the road splits, one branch going up each of the rivers and the two branches uniting again at Clinton. The road runs up Thompson River through Ashcroft, Cache Creek, and Hat Creek. This is an area of farming, cattle raising, and fruit growing, famed for its potatoes, vegetables, and tomatoes. Lignite coal occurs in large deposits on Hat Creek. The highway passes bright-hued green lakes coated with brine from which epsomite is extracted. Near Hat Creek are the "Pillars of Paradise", serried cliffs vivid with all the colors of the spectrum, chrome predominating. The formation is largely serpentine, and chromite deposits have been found.

At Spences Bridge and Ashcroft there are roads leading to the southeast connecting with the continental system offering other routes to the Caribou. A branch road west from Hat Creek goes through Marble Canyon to the Lytton-Lillooet-Clinton road.

Clinton is a picturesque town of age-worn log structures side by side with modern buildings. The surrounding lands are rich in mineral and agricultural possibilities.

LYTTON TO CLINTON, VIA LILLOOET, 94 MILES

(270 miles from Vancouver)

This road runs up the Fraser River and passes through country of great mineral, agricultural, and power possibilities. Gold occurs in lodes and placers, particularly in the Bridge River region west

of Lillooet where prospecting is going on and production is under way. A 60,000 horsepower development of Bridge River, out of an available 300,000 horsepower, is under way for furnishing power to Vancouver.

This is an attractive area for tourists and sportsmen. Bear—black and grizzly—mountain goat and sheep, and other game are available. Scenic attractions are most enticing. Tourist accommodations are available.

Clinton to Prince George, 263 Miles

(525 miles from Vancouver)

From Clinton the highway climbs to a great rolling far-flung plateau whose grassy uplands furnish thousands and thousands of acres of cattle ranges. There are also wide stretches of jackpine forests and many valleys where farming settlements are found. There are many ranches—large and small—contributing each autumn to the big drive east and south by which millions of pounds of beef are moved to the railroads and the world's markets.

Fourteen miles north of Clinton is the head of the chasm—a replica of the Grand Canyon of the Colorado—walled with many bright colors, a scene of awe-inspiring grandeur and beauty.

Williams Lake, 114 miles north of Clinton, is a supply point for this vast cattle country—a modern well-equipped town.

Quesnel, 70 miles north of Williams Lake, an old town with a prosperous and romantic past, is now becoming modern. It is a supply center for mining developments, farms and ranches. In the open air museum in front of town there is displayed a great Indian canoe, 51 feet long, 4½ feet beam, cargo capacity 6,000 pounds, carved from a massive cottonwood.

Barkerville, 60 miles east of Quesnel, was once a rich camp but has now dwindled to about 200 people. It is the view of some, supported by investigations by the British Columbia Bureau of Mines, that modern mining methods will bring in another era of development. The town has many interesting relics of its past prosperity.

Northward from Quesnel, the road goes through prosperous ranching and farming areas and reaches Prince George, a well-equipped city of 3,000 people. Its taxable property is valued at $4,500,000. It is the center of a considerable farming, lumbering, and mining development. Numerous roads radiate in all directions. The Canadian National Railroad has a division point in this city.

A road north from Prince George, 32 miles, leads to Summit Lake, the Arctic Divide, where drainage to the Arctic Ocean begins.

Prince George to Hazelton, 305 Miles

(830 miles from Vancouver)

The road swings west from Prince George and then northwest following the Canadian National Railroad to Hazelton. The route goes up the Nechako River, an upper tributary of the Fraser, through a table land dotted with many upland lakes. At Burns Lake, 164 miles west of Prince George, the road surmounts the crest of the Fraser watershed and descends into the valley of the Bulkley River, a tributary of the Skeena River, which discharges into the Pacific at Prince Rupert, just south of the southwestern tip of Alaska.

The country served by this road is well supplied with natural resources—mineral and agricultural. Gold, silver, lead, zinc, and copper are present in sufficient quantities to warrant further prospecting and development. While there are many ranches and farms, only a very small fraction of the agricultural and ranching possibilities have been exploited. This is an area which will support thousands and thousands of the type of people who desire to establish homes in a new and favored region.

The telegraph project of the sixties followed the Bulkley River on its proposed route to the north and to Siberia and Europe. Colonel Bulkley, an officer of the United States Army on leave, was the engineer in charge and the river was named for him. The successful laying of the Atlantic cable in 1866 resulted in the abandonment of this project.

Sportsmen have found and will find this part of British Columbia a great field for their activities. Game and fish abound.

The towns traversed on the run from Prince George to Hazelton include Vanderhoof, Burns Lake, Houston, Telkwa and Smithers. At Vanderhoof a branch road leads to Fort St. James on Stuart Lake, 43 miles, where, for over 100 years, a trading post has been maintained by the Hudson's Bay Company. Douglas Lodge is now a comfortable stopping place for vacationists and the locality has many attractions.

Hazelton

This town had its start as a supply point for early mining and fur-trading operations. Before there was any road to Hazelton, considerable travel came up the Skeena River, which connects the Hazelton area with the Pacific Coast in the vicinity of Prince Rupert. Navigation of the Skeena was very difficult, on account of the rapids, and was discontinued for the supply of Hazelton in 1913, when the transcontinental railroad completed its connection with Prince Rupert.

Hazelton is still the outpost supply point for a vast area to the north and northwest. The mining industry based on Hazelton promises much. There is a great deposit of anthracite coal lying dormant in the Groundhog district, 140 miles to the north, gold in the streams to the northeast, and silver and lead, copper and zinc in the nearer encircling hills, also tungsten, molybdenum, cobalt, and other minerals.

There is no lack of good farm land for the support of future mining activities and also there are vast areas suitable for cattle raising.

APPENDIX B

EXTRACT FROM A REPORT BY COLONEL J. M. ROLSTON ON AERIAL AND GROUND RECONNAISSANCE IN BRITISH COLUMBIA ON THREE ALTERNATIVE ROUTES NORTHERLY TO STIKINE RIVER CROSSING, AND THENCE OF ONE ROUTE TO ATLIN VIA DEASE LAKE

Pursuant to instructions received on July 8, 1930, in regard to ground reconnaissance, and to verbal instructions as to use of airplanes, I arranged with Hazelton for a packtrain, and with the Western Canada Airways for a Junkers plane, the latter to meet me at Burns Lake on August 6.

In going carefully over the best maps available, I found that the Telegraph Trail from Cabin No. 9 (225 miles north of Hazelton) to Telegraph Creek had been surveyed carefully by the Lands Department, and that considerable information was available for purposes of estimates. That portion of the Telegraph Trail from Kispiox to Cabin No. 9, I could find no maps covering, and it was therefore necessary to go over this portion, and get data for grades, cost, etc.

Considerable delay was encountered in getting a packtrain at Hazelton; but on August 14 a train of sixteen horses was obtained, and I started my assistant, Mr. E. H. Barclay, north up to Telegraph Trail from Hazelton.

Aerial Reconnaissance

While waiting for a packtrain I used the planes with Burns Lake as a base to fly north via the Telegraph Trial to Damdochax Lake, and finding it possible to land and get off this lake. I sent supplies in by air from Burns Lake, and established a cache for Barclay's party. In doing this I was able to get a knowledge of the following country:

> Burns Lake to Babine; down Babine River to junction with the Skeena; up the Skeena to junction with the Bear; the Summit between the Skeena and the Nass River (Damdochax Lake); Bear River, Bear Lake, Driftwood River to Takla Lake, and over to Babine Lake.

By reference to the map it will be seen that the Skeena, the Babine, and the Bear Rivers are the only three passes leading to the north from the region of Hazelton, with the exception of the Finlay River, which is too far east to be taken in on this reconnaissance.

Having completed the above and having received instructions to fly to Atlin, I left Burns Lake on August 14, and to avoid going over the same territory, flew by way of Hazelton, Kitwanga, Nass River, Meziadin Lake to Stewart, to reload with gasoline for the flight north. This route via Kitwanga to Meziadin Lake presents no great difficulties in the way of summits or rock work, and I decided to fly up the Nass above Meziadin Lake, and follow it up till I got into the Skeena-Nass divide, so as to be able to compare the different routes.

On August 15 I left Stewart, and flying the Nass River, followed it to the summit of its East Fork. I was able to pick out the Telegraph Trail when we crossed it, and orient myself. The maps of this area are very vague, having a scale of 32 miles to the inch, and are not easy to follow when traveling 100 miles an hour.

The upper valley of the East Fork of the Nass looked so promising, being a wide valley with meadows and benches, that I decided to follow it straight north, and see what the summit is like. The summit of the Nass and Klappan—elevation about 4,500 feet—is hard to determine from the air, because of its flatness, and the difficulty of determining from the air which way the streams flow.

The Klappan Valley, leading almost straight north, is wide with a lot of open meadows and bunch-grass mountain slopes. The heavier growth of spruce, common to the Nass and its branches, ceases at the summit, and the country becomes more open. We flew on down the Klappan River to the junction with the Stikine River.

The Stikine, flowing from east to west, cuts the plateau in a deep valley, and a few miles below the junction turns into deep canyons extending almost to Telegraph Creek. This condition is important.

From the above junction I followed Ptarmigan Creek to its summit—elevation about 5,000 feet—then down the headwaters of the Tanzilla River to Dease Lake, where I had had gasoline delivered from Telegraph Creek.

The Klappan route looked so much better than I expected that I decided to send Barclay instructions by wire to follow the East Fork of the Nass to its divide with the Klappan, and I would go up the Klappan Valley by packtrain, and get a thorough knowledge of it by closer inspection.

At Dease Lake I heard from trappers that Thibert Creek was the best route north, and accordingly I flew via Thibert Creek over a low divide to Tuya River. The Tuya River rises in Tuya Lake in a big open mountain plateau with low divides leading north to Jen-

nings River, and west to the Teslin country. I flew up the Jennings River divide, making the elevation about 5,000 feet; then went south again, and straight west over a plateau very sparsely timbered to Nahlin; thence north, following the White Swan River to Teslin Lake.

Teslin Lake, with its tributary rivers, and emptying northwest, forms a natural divide through this country, and any route to Atlin must follow this divide in order to avoid the high mountains on each side of the valley.

I flew to the north end of Teslin and dropped down on the Teslin Trading Post situated on the east shore of the lake. This small settlement, consisting of a trading store, police headquarters, and a few Indians, is a forwarding point for trading posts down the Liard River. I was considerably surprised to find a new Chevrolet car being driven down the 50 yards of road to the beach to meet us. No sign of a road had been seen from the air, and on inquiry I found that the Indians intended making a road to Atlin themselves.

From Teslin we flew west up a creek leading to Gladys Lake, then over a divide to Surprise Lake which empties into Atlin Lake.

This route from Teslin to Atlin, I think would have to be followed, as there is a high range cut only by one or two passes, and the Surprise Lake route would appear to be the lowest. The valley between Surprise Lake and Atlin is a busy placer field, hydraulic flumes leading into Discovery Creek being visible at various places. We followed the course of Discovery Creek into Atlin.

The town of Atlin, situated just 30 miles south of the Yukon boundary on Atlin Lake, is the supply center for all mining, trading, and trapping carried on in the interior of British Columbia, including Teslin Lake and the upper Liard.

Having reached the northern point of my work, I flew back to Dease Lake, covering a slightly more southern route. After reaching Gladys Lake we followed over a low divide and came down Goodwin Creek to the south end of Teslin Lake; thence following the White Swan to Gun Lake over a high divide to Tuya River which we followed down stream and over a low divide into a small lake at the head of Dease Creek; thence to Dease Lake.

Great activity in the way of flumes for placer operations was noticed on Thibert and Dease Creeks.

After carefully considering the different routes over which I had flown, I decided to have oblique aerial photographs taken over the following route:

> From Hazelton via Kitwanga, Nass River, East Fork of the Nass River, Klappan River, Ptarmigan Creek, Tanzilla River, Tuya River, White Swan River, Goodwin Creek, Atlin.

In addition to the above, I had photographs taken from the junction of the Klappan and Stikine, following the Stikine River to Telegraph Creek in order to show the terrifically heavy work which would be encountered should a more westerly route towards Telegraph Creek be considered.

The results of the flying reconnaissance were that the following points appeared to me to be objective points for any route through this area:

(*a*) The south end of Teslin Lake;
(*b*) The junction of the Klappan and Stikine Rivers;
(*c*) The upper Skeena from Bear River junction to Kilankis Creek.

Ground Reconnaissance

On August 25 with a packtrain I left Telegraph Creek, heading for the Klappan valley via Buckley Lake and Klappan Crossing. Owing to the fact that the last boat from Telegraph Creek was scheduled to leave on October 3, I was forced to make a very fast trip up the Klappan River to the summit, and out again in time to catch this boat.

There is a fair packtrail leading from Telegraph Creek easterly over a high divide into the Klappan River valley, and on to the Spatsizi River, where Mr. Hyland, a merchant of Telegraph Creek, has established a trading post.

Route No. 1

Klappan River

From the crossing of the Klappan River up the Klappan valley is a very old trail, which is practically impossible to follow, but as it was low water in the river we made good time by following sand bars, etc., and reached the summit of the Klappan on September 11.

I found this valley a first class route. The cost of construction would be comparatively light as the valley consists of jack-pine benches or many open meadows very similar in character to the Chilcotin country.

It is interesting to note that all horses used by the big packtrains pulling out of Telegraph Creek are wintered in the Spatsizi River, as the Spatsizi and Klappan areas produce bunch grass which the horses winter on very well.

The general elevation of the Klappan valley runs from 2,600 feet at its junction with the Stikine to 4,500 feet at the summit, a rise or about 2,000 feet in some 80 miles. In fact the river is navigable for canoes for about 40 miles above the crossing.

In the meantime, my assistant, Mr. E. H. Barclay, was proceeding up the Telegraph Trail to Cabin No. 6, and thence following the East Fork of the Nass to the Klappan summit. I waited a few days for him, but as my time was very limited I had to pull out for Telegraph Creek and catch the boat on October 5.

East Fork of the Nass River

The East Fork of the Nass River, rising in a lake at the summit fed by glaciers, is a small stream about 40 feet wide falling in a southeasterly direction. The summit and for about 5 miles each side consists of large open swampy meadows with high open-top mountains on each side, these mountains forming the western boundary of the celebrated Groundhog Range.

Following down the Nass River the country gradually changes from a jack pine to a spruce valley, and for that reason will be a more expensive valley to build through, as the spruce valleys invariably are full of muskegs with generally soft bottom. Some 40 miles from the summit the junction with the West Fork of the Nass River takes place, and from this point on the main Nass River is followed to the junction with the Blackwater or Damdochax Creek.

The Yukon telegraph line follows over this latter portion, but proceeds westerly up the West Fork of the Nass to its headwaters in a high mountain between Cabins No. 8 and No. 9. The West Fork of the Nass gives no hope of a route.

From the junction with Blackwater Creek over the summit to Kilankis Creek is a low flat summit with elevation of about 2,200 feet. The Kilankis Creek forms an acute angle with the Skeena which it would be impossible to cut out, on account of a high mountain which separates the two.

Skeena River

From the junction of the Kilankis and Skeena Rivers any route to Hazleton would of necessity be forced to follow down the Skeena River through a deep narrow valley for approximately 50 miles. The Skeena valley will be expensive construction, as the river is in canyons a great deal of the time, and a route would have grades up the side of the hills over these canyons.

From Cabin No. 2, which is on the Skeena River and about 60 miles north of Hazelton on the Kispiox River at the end of the present motor road, the packtrail follows over a fairly high rolling summit, and a route may be obtained this way but will require considerable hill work in getting into the Skeena.

The above description completes Route No. 1 from Hazelton via the Skeena, East Fork of the Nass, Klappan Rivers to Stikine River.

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ROUTE No. 2

In addition to the above route, the route from Kitwanga, lower Nass River, Bell-Irving River, upper Iskut River, Kinaskan Lake, Ealue Lake, Klappan River, and Stikine was looked into.

I saw this route from the air up to and past Bowser Lake. From topographical surveys the portion between Bowser Lake and Kinaskan Lake is known. I was at the summit of this route situated a few miles north of Ealue Lake and found it to be about 3,100 feet. This summit is the lowest by about 1,500 feet of any which can be found leading north. The summit between the Bell-Irving and Iskut is only 2,000 feet; therefore, from the point of view of low elevation, this route recommends itself. The cost of grading construction would apparently be not very much higher than on any other route, but from information obtained from reliable sources, such as telegraph operators who live in the country the year round, I have found out that the snowfall along the Bell-Irving, Echo Lake, and Iskut River is very heavy. I was told that in crossing the summit from Echo Lake to Telegraph Creek snowshoes had often to be used in July, and although this summit is considerably higher than any which will be crossed on this route, it indicates that this route follows a snow valley. I am also informed that through the Iskut valley snow slides are very prevalent at times, causing serious hold-ups on the telegraph line.

As described in the forepart of this report the Bear Lake, Driftwood River, and Babine Post areas were fairly well covered in flying. I was able to get very extensive views across country and up river valleys while on the various flights, and from later observations from the tops of mountains while on ground reconnaissance.

I consider that the following route should be given further consideration and be thoroughly explored before any definite route is accepted:

ROUTE No. 3

From Topley on the C.N.R. straight north to Babine Lake, thence following the west shore of the lake to Babine Post, thence north by the Nilkitkwa River through a divide to the head waters of the Driftwood River, thence by Bear Lake, Bear River, to the junction of the Skeena, thence following the main Skeena River past Courier Creek and Beirnes Creek to the summit between the Skeena and the Spatsizi, thence north to either the Klappan valley via the Little Klappan or more northeasterly via the Spatsizi River to Cold Fish Lake and into the Klappan over a low divide.

The advantages of this route appear to me to be:

(*a*) The country between Topley and Bear Lake appears from the air to be of far greater value from any standpoint than from, say, Cabin No. 2 up the Skeena to the Blackwater;

(*b*) The Bear Lake and upper Skeena appear to be more or less open bench country with jack pine and open meadows. The Bear Lake Indians trap all this country and winter their horses around Bear Lake proving this is a fairly good country.

The upper Skeena, from information received from Indians, is a better valley than the East Fork of the Nass. It may be noted here that we had to cut trail some 40 miles up the East Fork of the Nass in order to get our horses through. This shows the heavy nature of the country and indicates that it is not popular with the Indians.

The snowfall in this area which is further to the east is less than on Routes No. 1 and No. 2, and I consider this fact important in considering any route to the north.

The disadvantages of this route would appear to me to be more or less the paralleling of the present road which is built 20 miles north of Hazelton, but I understand that a considerable amount of road work has also been done north of Topley towards Babine Lake.

Big-game parties, leaving Hazelton and proceeding by packtrail, invariably go into the area which would be touched by this route, i.e., the head of the Skeena and the Groundhog Mountains. This is a marvelous game country, absolutely abounding in caribou, moose, etc., and a big game-hunter's paradise.

The mileage covered by air on this work was some 2,000 miles in addition to the mileage covered in taking photographs. The ground reconnaissance covered 800 miles by packhorses.

Owing to the lateness of the season the field work had to be rushed through in order to get the horses out at all; and, as it was, some eight horses had to be shot, on account of shortage of feed, exposure, etc.

Alternate Route No. 1

On the accompanying map, Route No. 1 is shown in red, commencing at Hazelton and ending at the junction of the Klappan and Stikine Rivers. The total length between these points on this route is 283 miles.

The following description of the route reconnoitered will aid in making a detailed location on the ground whenever necessary.

Mile 0–30

There is at present a second-class road extending northward from Hazelton, elevation 750 feet, which crosses the Skeena River about

three miles and the Kispiox River at nine miles from Hazelton, and follows the east bank of the Kispiox River to Cabin No. 1, at mile 30 on the Yukon telegraph line. This section of 30 miles will require straightening.

Mile 30–45

From mile 30 to mile 45 the location would follow along a jack-pine ridge and up Trout Creek to Trout Lake, elevation 1,400 feet. On this section side-hill work would be incurred, with occasional outcropping of solid rock.

Mile 45–56

From mile 45 the location would gradually approach the Skeena River through rough rolling country with occasional deep-creek crossings, such as Canoe Creek at mile 47. The location then follows along the Skeena River to mile 56, the elevation dropping at Cabin No. 2 to 1,100 feet.

Mile 56–103

From mile 56 to mile 103 the location follows the west side of the Skeena River. It is practically impossible to cross the Skeena, as throughout this section it is almost entirely in deep canyon. The country consists of a series of gravel benches dropping sharply into numerous creek valleys, many of which are also in canyon. There are fourteen such creeks in this section which will require 50-foot spans with approaches through heavy banks. There is very little solid rock, the formation throughout being principally gravel. The elevation at mile 103 is 1,700 feet.

Mile 103–142

From mile 103 to mile 142, the divide between the Skeena River and the Nass River is crossed at an elevation at the summit of 2,400 feet. This section offers no great difficulties and work would be fairly light except bridge requirements of one 100-foot span and a few 50-foot spans on smaller creeks. The section between mile 117 and mile 142 is a little heavier, owing to occasional heavy side-hill work. Elevation at mile 142 is 2,150 feet.

Mile 142–154

This 12-mile section follows the north bank of the main Nass River along benches and river flats. This section will not require heavy work.

Mile 154–205

The line then follows the East Fork, keeping to the east bank. At mile 154 the Nass divides into its East and West Forks. The West

Fork rises in the mountains and offers no chance of a route. In this stretch of 51 miles along the East Fork the elevation rises very gradually from 2,250 feet at the junction of the Forks to 4,400 feet. The valley is about two miles wide and consists of rather heavily timbered flats interspersed with muskegs and meadows. The road would in many places have to follow the side hill to avoid the muskegs, and such location will require a certain amount of heavy side-hill work. Bridges along this section will be required at Panarama Creek, mile 165, and Anthony Creek, mile 165½. In addition, there are five or six large creeks which will require spans up to 50 feet.

At mile 205, the divide is reached between the East Fork of the Nass River, which flows south, and the Klappan River flowing to the north. This is a meadow summit consisting of open flat meadows with poor drainage for a distance of five or six miles having a width of about one mile. The East Fork of the Nass rises in Summit Lake on this divide.

Mile 205–283

From mile 205 to mile 283 the road follows down the Klappan valley to its junction with the Stikine River. The Klappan River rises in a glacier very close to Summit Lake, and for some distance is a small creek only about ten feet wide. The Klappan valley, however, is about one mile wide and consists of gravel benches and rocky side-hill slopes. It is much drier than the Nass valley and of a much more open nature. Jack pine replaces the spruce of the upper Nass valley, and the side hills are in many cases open ground covered with bunch grass. The best route follows the east bank of the Klappan throughout the section and should generally be kept at a considerable height above the river to take advantage of bench locations and to avoid bad crossings of creeks tributary to the Klappan. At mile 246 the Little Klappan River is crossed. The Little Klappan River rising in the Groundhog Mountains to the east is a stream some 200 feet wide, fordable at low water, but carrying a heavy discharge of high water. It has a wide valley of its own, and the old Ashcroft Trail follows this valley up to the Groundhog Mountains. At mile 248, Eagle Nest Creek is crossed, which next to the Little Klappan is the principal tributary. This creek rises in high mountains rather close to the main stream and will require a major span at a canyon site, as it is subject to extreme high water and rapid rises. From mile 248 to the end of the section, mile 283, the route follows jack-pine ridges, affording very cheap construction. This last section represents the cheapest portion of the route to construct, as the Klappan valley widens to about 2 miles and falls gradually to the Stikine River at elevation of 2,600 feet.

Estimate of Quantities

Route No. 1: Hazelton to Stikine River (Mile 30 to Mile 283)

In getting out an estimate of the quantities for this road the following basis has been used:

(*a*) Road bed: 16 feet wide
(*b*) Classification: Earth, loose rock, solid rock
(*c*) Culverts: Pipe
(*d*) Structures: Spans 50 feet and over. Less than 50 feet included in small bridges
(*e*) Clearing: 6 acres per mile
(*f*) Grubbing: 1 acre per mile
(*g*) Graveling: $2,500 per mile

Summary

Estimate of Quantities

Mileage	Acres	Miles	Earth	Loose Rock	Rock	Culverts	Small Bridges	Bridges
			cu.yds.	*cu.yds.*	*cu.yds.*	*lin.ft.*		
30–154	744	124	1, 194, 000	297, 000	110, 000	24, 800	372	2 100-ft.
154–205	306	51	500, 000	180, 000	60, 000	10, 200	153	19 50-ft.
205–283	468	78	681, 000	231, 000	62, 000	15, 600	234	1 100-ft.
								9 50-ft.
Total	1, 518	253	2, 375, 000	708, 000	232, 000	50, 600	759	31 50-ft. 3 100-ft.
253 miles								

Estimate of Costs

Clearing: 1,518 acres at $100 per acre	$151, 800
Grubbing: 253 acres at $250 per acre	63, 250
Earth: 2,375,000 cubic yards at 50¢ per cubic yard	1, 187, 500
Loose rock: 708,000 cubic yards at 80¢ per cubic yard	566, 400
Solid rock: 232,000 cubic yards at $1.50 per cubic yard	348, 000
Culverts: 50,600 lineal feet at $5 per lineal foot	253, 000
Small bridges: 759 at $300 each	227, 700
Gravel surface: 253 miles at $2,500 per mile	632, 500
Spans: 34 50-foot spans at $2,500 each	85, 000
Spans: 3 100-foot spans at $10,000 each	30, 000
Total	$3, 545, 150

Average per mile: $14,000.

Alternate Route No. 2

Route No. 2 crosses the Skeena at Kitwanga, a station on the Canadian National Railway a few miles southwesterly from Hazelton, and extends northwesterly up the valley on the Kitwanga River to the lake of the same name, then crosses a low divide to the headwaters on the Cranberry River, a branch of the Nass, and continues down that river, approximately 35 miles, at which point it leaves the Cranberry and crosses to the main valley of the Nass.

The line then proceeds up the Nass to the big bend where the river changes its general direction. Here the divide is crossed to the Bell-Irving River which is followed to Kinaskan, Edoontenas, and Ealue Lakes. Here it turns sharply to the east to the valley of the Klappan, which is followed to its junction with the Stikine River near the end of Route No. 1. The total length is 283 miles.

Although Route No. 2 is approximately the same length as Route No. 1, from Kitwanga to mile 270 it lies to the west of an outlying ridge of the Coast Range, and for this reason is subject to a totally different climate from that encountered on Route No. 1. Route No. 2 enters the wet belt at about mile 20 and does not leave it again until Ealue Lake is reached, very close to the northern end of the route.

The valleys of the Lower Nass River, Bell-Irving River, and Iskut River, which is the principal eastern tributary of the Stikine, are subject to a very heavy snowfall, and it is believed that a road built through this area would be difficult to keep open for more than four months in the year. Owing to the fact that the route lies west of the Coast Range the rivers are subject to violent floods following heavy rains, as well as to the regular floods due to melting snow, and this fact would greatly add to the cost of maintenance.

In the vicinity of the Iskut River, this route is forced to swing towards the east to avoid a bad crossing of the Stikine at a section between Telegraph Creek and the Klappan River where the country is badly intersected with canyons. This easterly bearing is forced past Ealue Lake until the Klappan River is reached. If the route were projected northward along the line of the present telegraph line to Telegraph Creek in an effort to pass to the west of the canyon area, a high summit would have to be crossed at the head of the Iskut River at an elevation of about 5,000 feet. The line would then have to drop down to an elevation of 500 feet at Telegraph Creek in order to cross the Stikine River, and this long descent through particularly rough country would involve very heavy work. Finally, it would be necessary to follow upstream along the Stikine River to a point in the vicinity of the Klappan junction, the terminus at present suggested for this section.

Estimate

The estimate of quantities of Route No. 2 for grading would probably not exceed that for Route No. 1, but more and heavier bridges would be required.

The following major bridges would have to be constructed:

(*a*) The Skeena River at Kitwanga
(*b*) The Nass River near the Bell-Irving divide
(*c*) The Bell-Irving River
(*d*) Ten large tributaries of the Iskut River

ALTERNATE ROUTE No. 3

It is suggested that further examination be made of what appears from the air survey to be a feasible route lying to the east of Route No. 1. This route (No. 3) would leave a point on the Canadian National Railway near Topley across a low divide to Babine Lake, follow the west shore of the lake to Fort Babine, thence up the valley of the Nilkitkwa River. From the headwaters of this stream the divide would be crossed to the Driftwood River and Bear Lake, and the route would follow along the eastern side of Bear Lake and down the Bear River to its junction with the Skeena. The line would then continue on the east side of the Skeena River upstream to the divide which would be crossed to the headwaters of the Little Klappan River. The line would follow down the Little Klappan to its junction with the Klappan, at which point Route No. 3 would join Route No. 1.

The length of this route would be approximately 318 miles, as compared with 248 miles to the same point on Route No. 1, but this route would in effect parallel the Caribou Highway from Topley to Hazelton.

The summit between the Nilkitkwa and Driftwood Rivers lying between mile 76 and mile 133 does not appear from the air to be very high, and this is the only point on the route which might offer difficulties.

The advantages of this route lie in the fact that being further east and further from the Coast Range, the snowfall is correspondingly lighter and the country drier in summer. There is no such heavy construction encountered as that along the Skeena River on Route No. 1. An additional advantage is that this route touching Babine Lake opens by water communication a very large area of the country. Further, at the point where this route reaches the Driftwood River, it is only about 40 miles from the north end of Takla Lake, and were this connection built an additional large area by water communication would be benefited by the route. Takla Lake also affords large possibilities as a general tourist resort.

Estimate

It is estimated that Route No. 3 would not be more expensive to build than Route No. 1, inasmuch as transportation facilities are better along this route than along either Routes No. 1 or No. 2, and as construction would not be so heavy as that along the Skeena River on Route No. 1.

Stikine River to Atlin

The problem confronted in this area is to join the Klappan-Stikine junction with the south end of Teslin Lake.

It appears from aerial reconnaissance that any route between these points would have to cross a high plateau lying between Tuya Lake and Jennings River to the north or White Swan River to the west. There are two main routes available.

1. Ptarmigan Creek, Gnat Creek, Tanzilla River to Dease Lake following the west side of Dease Lake to Thibert Creek, thence up Thibert Creek over a low divide into Tuya River, and following Tuya River northerly to Tuya Lake, and over a divide above timber line to the headwaters of Jennings River; thence following Jennings River to the south end of Teslin Lake.
2. Following down the Stikine River on its northern bank gradually gaining height until a low pass will allow of a route to Tanzilla River; thence north to the Tuya River which will be followed for about 30 miles. A high plateau would then have to be crossed to the headwaters of the Nahlin River; thence north to the White Swan River, which could be followed to the south end of Teslin Lake.

In order to get to Atlin a divide must be crossed and the most feasible route seen was from the south end of Teslin Lake, thence westerly up a creek which has its head near Gladys Lake, then following the west side of Gladys Lake over a divide into Surprise Lake, and joining the present road from Atlin at Discovery.

Photographs taken over this route from Stikine to Atlin are shown in this report.

NATURAL RESOURCES

The area covered on the three routes shown in this report is bounded on the north by the Yukon boundary; on the south by the Canadian National Railways; on the west by the Nass and Bell-Irving Rivers, and on the east by the 126th meridian.

This area is cut in half by the valley of the Stikine River flowing in an east and west direction.

Southern Portion

The southern portion of this area, consisting of almost continuous mountain ranges, is intersected by three parallel valleys leading through the area from the southeast to the northwest, being respectively:

1. The Kitwanga, Nass, Bell-Irving, and Iskut Rivers described in Route No. 2;
2. The Skeena, the upper Nass, and Klappan Rivers described in Route No. 1;
3. The Nilkitkwa, Driftwood, Bear, upper Skeena, and Little Klappan Rivers described in Route No. 3.

The space between each of these main valleys is occupied by mountain ranges.

The natural resources of the area can best be described by following the routes examined.

Route No. 2

This route following the lower Nass, Bell-Irving, and Iskut Rivers is situated west of the main Coast Range and has a much wetter climate than experienced by either Route No. 1 or Route No. 3.

Timber

In the lower Nass valley, between the Cranberry and Bell-Irving Rivers, a fair pulp stand consisting of a good percentage of Engleman spruce was seen. The Government Forestry Reports of this stand show some two billion feet, which would form a good reserve stand of pulp for a mill situated in the north. From the junction of the Bell-Irving and Nass Rivers northerly the valley narrows and the stand of timber is of a poor quality, and from the Iskut River north is negligible.

Agriculture

The valley of the Kitwanga is sparsely settled and there are no settlers from that point north. The valley of the lower Nass has been surveyed and good land reported. It is possible that with the clearing of the timber the upper Nass valley as far as the Bell-Irving River would prove to be a considerable amount of agricultural land.

Water power

All the rivers on this route are capable of development, but at present information is not available as to the amount of power which could be developed. Meziadin Lake it is understood is now under development. However, all the power that could possibly be desired could be developed through this area.

Minerals

The area between Kitwanga and Bowser Lake has been fairly well prospected and many claims staked. The lack of transportation, however, has held in check any development. The northern portion of this route covering the Unuk River, Iskut (Kinaskan) Lake, etc., has received a great deal of attention this past season by mining engineers of large companies, and it is understood that this is a very promising area.

Route No. 1: Hazelton, Skeena River, etc.

Timber

One of the principal industries observed at Hazelton was the production of cedar poles. Large quantities are obtained in the upper waters of the rivers tributary to the Skeena and floated down stream to the Canadian National Railway.

On the Skeena River up to No. 3 Cabin on the Telegraph Trail is a fair stand of pulpwood containing Engleman spruce. The valley of the lower Babine River is also well timbered with the smaller type suitable for pulp. This area is quite undeveloped due to lack of transportation.

Tie-making is also another paying industry for the settlers in this area, jack-pine ties being plentiful.

On the divide between the Skeena and the Nass northwards the timber gradually deteriorates towards the summit, and there is no timber of a merchantable character north of this point. Small benches of spruce are found along the rivers which would probably support small local mills.

Agriculture

The Kispiox valley is a fair agricultural valley, and is developed for the first 20 miles. The large meadows and open nature of the timber give good feed for stock, and mixed farming is being carried on quite extensively. From the Nass north it is not considered that agriculture could be made to pay, the season being too short with early frost prevailing in the mountain passes.

The Klappan valley with its large meadows and bunch-grass hillsides, which extend easterly to the Spatsizi River affords good winter feed for all the packponies of this region.

Caribou Mountain in this area is the wintering ground for thousands of caribou. The snowfall is light, and the bunch-grass hillsides afford very early feed in the spring. Where large meadows could be cut for hay there is no reason to suppose that stock would

not do well in this area. The climate is not very severe, and the country is very similar to the upper Chilcotin, where stock raising is a paying industry.

Route No. 3: Topley via Babine, Groundhog Mountains, etc.

Timber

Tie-making for the Canadian National Railway forms the principal industry of the settlers through this area. It enables them to clear the land profitably and gives immediate cash return for the work done. The land when cleared has proved suitable for mixed farming, which is carried on extensively.

The tie timber extends northerly along the route to the Babine, and from aerial reconnaissance as far north as Bear River, but north of this point, as in Route No. 1, the timber rapidly disappears and when passing over the Groundhog there is practically no timber.

Agriculture

There is no reason to suppose that when transportation is provided the country to the north surrounding Babine and Takla Lakes suitable for agriculture would not be settled up. Large areas of undulating flat country were noticed along this route, which should prove suitable for such farming as is carried on in the Bulkley valley. A good road touching Babine and Takla Lakes would immediately make a very large area available for settlement. Gas boats could connect with the terminus of the road as in the case of Francois and Ootsa Lakes, and it is considered that this route (3) offers more chances for settlement than either of the other two routes.

Minerals

The Topley and Smithers district on the Canadian National Railways has some very promising mines under development. The Babine Mountains to the north are responsible for several promising properties awaiting development.

During the past season several large mining companies have been prospecting extensively from Takla Lake west and north on the Driftwood, Bear, and Omineca Rivers, using Takla Lake as a base for their airplane.

On entering the upper Skeena valley the formation changes to coal measures, and for some 60 miles the route passes through the center of the well-known Groundhog Coal Fields. From reports obtainable very little work has been done on these anthracite coal fields other than extensive prospecting and reports by mining engi-

neers. These reports can be seen in the Annual Reports of the Minister of Mines of the Province of British Columbia.

The coal measures change to a mineral zone on approaching the Stikine River.

During the past season several claims were staked on the lower Klappan River showing high values, and it is understood from mining engineers that all of the upper Stikine and tributary rivers offer a good field for the prospector.

The ordinary prospector is quite unable to enter this country as the cost of getting in packtrains, etc., is beyond the average prospector's means, but the larger companies are using planes to fly their men in and later on picking them up again and bringing them out.

Fishing

At Burns Lake a mild curing white fish industry is flourishing. White fish are plentiful in many of the smaller lakes and some of the larger ones, such as Babine Lake. Fish are brought in by truck and mild-cured for shipment over the Canadian National Railway. This industry would receive a tremendous impetus if proper transportation was provided.

Scenery

All three of the routes reported on traverse rivers leading through the Coast Range and the scenery is unsurpassed. The photos attached to this report give some idea in regard to this feature.

Big-game hunting

Practically all the area offers first-class shooting and fishing, but the open mountains of the upper Skeena, Klappan, etc., provide a wonderful area for big game. Moose, caribou, mountain sheep, and goat are very plentiful in this area and attract a large number of hunters from all over the world. At present, owing to the high cost of guides, packers, etc., a 30-day hunting trip costs about $3,000, which gives some idea of the payroll provided by the big-game hunters.

Northern Portion—Stikine River to Atlin

From the Stikine River north the natural features of the country change entirely. There are no large rivers such as in the southern portion of this area, and the rivers leading north are shorter and nearly all rise in a high level plateau whose elevation is between 5,000 feet and 6,000 feet and which occupies the area between Dease Lake and the Coast Range. This plateau is very sparsely timbered and is dotted with lakes and muskegs over its entire area.

Mining

This country has been well known since first prospected in 1869. Dease Lake, the upper Stikine River, and Liard River have been more or less continuously worked by placer miners ever since, with varying results. At present the creeks tributary to Dease Lake are being worked by hydraulic companies, but the freight rates, being $160 per ton from Wrangell, take most of the profits.

Teslin Lake emptying north forms a water route for the northern portion of this area from the towns of the Yukon, and a great deal of freight destined for the upper Liard, etc., comes in this way. The upper Liard has been receiving a great deal of attention from prospectors, and it is understood that some valuable finds have been made recently by the ill-fated Burke expedition. Flying has helped tremendously towards prospecting this area; but commercial air companies have had a hard time to get by, on account of the large expense and risk involved in northern flying.

Water power

The Stikine River offers great chances of extensive water power. The Tuya River draining from Tuya Lake is another potential water power. The remaining streams being small do not offer very many chances of development.

Scenery

The northern portion of this area consisting of Teslin, Surprise, and Atlin Lakes offers wonderful scenery. Atlin has taken advantage of this and provided a first-class tourist hotel with every convenience, including guides, motor launches, etc.

Big-game hunting

Both Telegraph Creek and Atlin depend a great deal on the big-game hunter for a yearly pay roll. A number of parties go in from both these points each year to enjoy the hunting provided on a high plateau.

Climate

The climate on the proposed route from Topley to Atlin via Route No. 3, being situated east of the Coast Range, is dry, which will prove a direct asset to the road as it will draw tourists, prospectors, etc., and in addition will give cheap maintenance cost to the upkeep of the highway.

APPENDIX C

EXTRACT FROM A REPORT BY MR. J. H. GRAY OF EXAMINATION FROM TELEGRAPH CREEK BY TRAIL TO NAHLIN RIVER; THENCE RECONNAISSANCE VIA NAHLIN-TUYA RIVER DIVIDE TO SOUTH END OF DEASE LAKE; AND THENCE TO STIKINE RIVER CROSSING IN VICINITY OF KLAPPAN-STIKINE JUNCTION

In carrying out the instructions contained in letter of July 9, 1930, I refer to my letter of May 25 last to the Honorable N. S. Lougheed, Minister of Public Works, enclosing map and pointing out: (*a*) That the south end of Dease Lake might be considered a fixed point on the route of any Arctic highway; (*b*) that the Dease-Tuya Lake-Jennings River to Teslin Lake seemed to be the most direct and favorable line of route; and (*c*) examination of the Tuya-Nahlin Rivers divide was desirable as a contingent factor in my plans for the work.

Victoria was left on July 11, Vancouver on July 12, and Telegraph Creek reached on evening of July 17. Owing to Frank Calbreath's death, the ownership of his horses—from which band I expected to obtain animals—delayed getting away until morning of July 23. Our small outfit consisted of self; John Ensor, general assistant (white); Billy Fann (Indian packer); 5 horses (1 saddle); and 2 dogs. This was increased at Nahlin by another Indian, Ned Tato, cook and packer, and 2 dogs, thus leaving Ensor's services available at all times without interfering with the camp routine of packing, meals, and packtrain transit. This arrangement was continued through the season.

Route examination along the Telegraph Trail from Telegraph Creek to Nahlin was confined to observation, short personal detours, and 29 kodaks. An exception to this was at Egnell, where a stop of over one day was made to examine the situation, where a rise of 2,100 feet occurs in a few miles.

From Telegraph Creek (600 feet above sea level) the trail rises to a summit of 3,600 feet 10 miles out; thence continues 20 miles northwesterly to a heavy crossing of Tahltan River, and thence to Little Tahltan Flats at 1,960 feet, about 5 miles further on and 35 miles from Telegraph Creek.

Only by a line up the Tahltan and Little Tahltan Rivers from a Stikine River crossing near Tahltan mouth (800 feet above sea level) via Klastine River, or some such route, from Klappan valley, would consideration be given to a route via this portion of Telegraph Trail.

The Little Tahltan River, 10 miles from the flats, turns abruptly northerly into the mountains. The summit or divide between this stream and Salmon or Hackett River is scarcely noticeable, the maximum height booked being 2,240 feet.

At Camp 3 on Hackett or Salmon River 15 miles from Tahltan Flats, elevation 1,980 feet, the first kodaks were taken. Views 1 and 2 [1] show, respectively, the camp and class of country passed through on the flats for 15 miles between Tahltan Flats and 3 miles back of Egnell. View 2 also shows the nature of side hill, from a point at extreme right of view and some 3 miles east of Egnell, that must be utilized along Egnell Creek (faintly shown on extreme left of view) in order to reach the plateau level some 2,100 feet above Egnell.

Stream crossings and drainage generally would be light over this stretch, in fact more favorable conditions could not be expected.

The snowfall is from 2 to 2½ feet (Indian report).

At Egnell, 1,890 feet above sea level, I took a day for the examination of Sheslay River and Egnell Creek.

Sheslay River, 1,820 feet at this point and poorly shown in view 3 bearing N.53°W., could be easily descended for about 15 miles, whence a mountain pass bearing northeasterly could be utilized back to the Telegraph Creek country about Dudidontu River, some 22 miles north of Egnell.

The examination of Egnell Creek was satisfactory. A 150-foot span in canyon would cross at an elevation of 2,900 feet followed by fair side hill for another 3½ miles to plateau level. The work on this 6½ miles would be heavy, but in my opinion more favorable than on the Sheslay River detour.

View 4 is taken 2 miles north of Egnell, looking S.30°W. (magnetic) down valley of Egnell Creek from an elevation of 3,600 feet.

View 5, taken 2½ miles north of Egnell and at an elevation of 3,800 feet, looks easterly across Egnell Creek to Level Mountain.

View 6 is taken from a point 2½ miles north and nearly 2,000 feet above Egnell, looking easterly across Egnell Creek to Level Mountain, 5,000 feet.

View 7 is a small lake 3½ miles north of Egnell (3,900 feet), and view 8 is another plateau lake (3,750 feet) 8 miles north from Egnell.

[1] Views not printed—not incorporated in this extract.

This stretch of 10 miles, excluding the 6 miles of side hill ascent to reach plateau elevation, is along undulating plateau gradually falling to the north. At least 60 percent of this ground would call for corduroy, and timber is not always to hand. No major stream crossings occur, but four culverts to the mile would be reasonable with a limited amount of catch waters. The depth of snow would not exceed 3 feet.

Camp 5 (3,510 feet) on headwaters of Dudidontu River, is shown in view 9 at 6:00 a.m., just before putting up loads.

View 10 is about 2 miles out from Camp 5, looking back.

Views 11, 12 and 13 show, respectively, Camp 6 on small lake half a mile south of Cache Creek and up and down Cache Creek, the last towards Dudidontu River.

The stretch of 12 miles between Camps 5 and 6 is similar to that preceding and would require 50 percent corduroy, one small stream crossing, and same proportion of culverts. Elevation here is 3,610 feet.

The change from wet ground to dry and solid as Cache Creek is reached is remarkable and continues uninterrupted to Nahlin River. Four major stream crossings occur in this 12 miles from Cache Creek crossing to that of Matsatu River, calling for 40-foot spans and 5-foot abutments. Timber is available 2 miles distant. Other conditions are most favorable. Solid ground exists, requiring neither clearing nor grubbing.

Leaving Matsatu River good ground continues on flat for 12 miles beyond the crossing of Kaha Creek or Koshin River, at which point (12 miles from Koshin River) the trail turns sharply to the north and ascends over rough ground to a ridge divide (3,400 feet) and thence falls to 3,160 feet at Camp 7, 72 miles from Tahltan Flats.

View 14, down Matsatu River valley towards its junction with Dudidontu River, is taken from a point one-half mile west of Matsatu Crossing. From the same point extended view 15 takes in an arc contained between S.12°W. and N.8°E. (magnetic), that is, from a direction looking down the Matsatu to one directed practically up that stream. Evidently, the ground in Dudidontu valley is soft or has some other route deterrent for the telegraph line, after making a detour to Nahlin station, joins the same waterway system 30 miles west of it.

View 16 (the last portion of 15) shows a break at A, the lake shown in view 17. This was taken from top of ridge and shows, on right, the valley running through to A.

Nahlin River (2,390 feet) was reached on August 2. The intervening stretch, some 27 miles from Matsatu River, is favorable, the ground for the most part being solid. It would call for one mile of

corduroy; 3 major stream crossings, requiring 500 feet of 10-foot trestle having 30-foot spans, and 10-foot abutments; six 10-foot openings on small streams, and a proportion of small culverts. Timber would be available from clumps of scorched jack pine, but is not plentiful.

However, the crossings of Lost Creek and Nahlin River, which occur a mile apart on line of Telegraph Trail, would necessitate some other line of approach, probably by Dudidontu River; but as time was short for what appeared more important matters, no time was further spent on this line.

View 18 depicts Nahlin River Trail crossing a hole 350 to 400 feet deep and 1,000 feet across. Lost Creek is a similar proposition. Nakina River crossing, over 30 miles further west, is said to present greater difficulties than Nahlin. The Telegraph Trail was examined beyond Nahlin for 4 miles, thus completing information along this line.

Reconnaissance from Nahlin to Stikine Crossing

My reconnaissance was made in an easterly direction, but, for the sake of symmetry and the placing of zero mileage at a single point on the routes examined, the plans and sections have been prepared westerly from Stikine Crossing. I, however, propose going over the ground in direction examined in a semi-narrative manner with the kodaks, but shall come back with the mileage when providing more technical data.

It might be said here that the camps are the only records of our passage left on the ground. These are consecutively numbered and dated and a traverse table of the bearings between provided. Our line of travel is in some cases shown, but no record beyond original field book attempted of the enforced deflections, which in all cases exceeded (in some cases to a great extent) the distance between camps.

The work was begun at Nahlin station, by running a rough traverse with prismatic and range finder up and along the high banks on north or right hand side of Nahlin River. This was continued for 6 miles to Camp 9, at which point the Nahlin makes a decided bend in its course from northeast to east and the banks on the north side flatten out perceptibly.

A choice was presented whether to follow the river easterly around the south end of a big mountain (Horn Mountain) or carry on about N.50°E. to its north end. The latter was chosen, prompted by the desire to strike the Tuya River above its gulch and in the belief that it would provide more information, and it did.

From Camps 9 to 11, 7.3 miles, conditions continue similarly and extend also to the 6 miles of Nahlin River traverse taken on the

plateau along the north side. These conditions are diversified surface, fairly smooth, covered with brush and spruce timber rising gradually over low ridges and alternately solid and marshy ground. An extreme depth of 3 feet through vegetable mush to boulders and solid ground is generally found.

In view 19, elevation 2,910 feet, Camp 9 is seen and also the southerly point of Horn Mountain. Attention is called to the flat ridge on extreme left of view, which would interrupt any route in this region.

View 20 from half-way between Nahlin and Camp 9, elevation 3,010 feet, looks through Camp 9 in same southerly direction to the pass traveled. View 21 from one mile east of Camp 9, elevation 3,170 feet, is towards pass and intervening low spruce ridges. View 22 is still closer to pass, elevation 3,860 feet, looking northeast through it. This last view (22) is taken from about half-way between Camps 10 and 11.

View 23 is looking back from Camp 11 (elevation 4,211 feet). Spruce Mountain shows up on right of view; the distant mountains, possibly 40 miles west, have unfortunately not come out. However, two bearings (magnetic) west and S.75°W. are shown on plan and the contours of these distant mountains figured from field book sketch.

It is thought that the difficulty at Nakina River might be relieved or dissipated by what shows up in this view. I never saw Gun Lake or that system of drainage into Teslin Lake. In fact, when crossing Little Teslin River, I accepted the Indian's statement that it was called "Little Teslin River" and emptied into Teslin Lake, without especial effort to prove his correctness, since it did not appear to me of great consequence to the matter in hand. Gun Lake, however, has been placed on the map from other sources, because it has significance as an obstacle to direction.

At Camp 11, camp 13.3 miles from Nahlin, at elevation of 4,260 feet, surface conditions change, timber growth practically disappears unless in sheltered nooks, and the ground generally becomes firmer, that is to say, areas of superficial marsh are infrequent. The same conditions are to be found up to Tuya Crossing, being 36 miles from Nahlin.

View 24, one showing conditions at Nahlin-Tuya Rivers divide, 4,640 feet elevation, is taken from A, N.25°E. 2 miles from Camp 11 and covers an arc from S.20°W. to N.65°E. (magnetic), as is shown on plan.

View 25 is taken from a point in pass S.70°E. 3 miles from A, elevation 4,600 feet, and depicts an arc, from west to S.70°E. The many apparent ponds in both these views (24 and 25) are really of

no depth, simply surface water, the result of four days constant storm and downpour.

Camp 12, elevation 4,790 feet, was placed in stunted spruce grove some 150 feet above general flat level. From here was taken view 26 showing the rim out from pass towards Tuya River, between the two mountains marked D and C. B (on view just below C) is a fixed point for best ground (S.20°E.). From Camp 12 can be seen the old trail to Jimtown, on Telegraph Creek-Dease Lake wagon road.

At a point S.40°E. from Camp 12 and 2 good miles distant, view 27 is taken showing the way to Tuya River with the flanking mountains D and C and fixed point B shown on view 26.

View 28 is taken from same point as last, looking back N.40°W. to Camp 12, and shows at right of view the southwesterly bend around northerly limit of Horn Mountain.

Camp 13 is placed about half-way up the ridge, timbered with small spruce, and is 7.8 miles from Camp 12 at an elevation of 4,390 feet.

View 29 is taken looking back to Horn Mountain from Camp 13, showing on right the pass traveled and on left unvisited divide or pass on south side of Horn Mountain into upper Nahlin River.

At 7 miles from Camp 13, after traversing fairly good ground for most part bare of timber, which in no case has reached construction sizes, a large stream is crossed (west branch of Tuya River) flowing about S.70°E. from the pass just traversed. This stream is 75 feet wide, in a trough 40 feet deep and 200 feet across, and joins the Tuya River about 4 miles S.70°E. from where we crossed at an elevation of 4,150 feet.

View 30 is taken from Camp 14 looking back to Horn Mountain. The line on map swings to right and follows either bank of Tuya West Fork, as may be found the more suitable.

Camp 14 was placed half a mile easterly from this stream and is 6.5 miles from Camp 13 and placed at a break in the ridge, at an elevation of 4,260 feet. A fall of 320 feet on mountain slopes of 4 feet and 8 feet to 1 foot, timbered with spruce 6 to 10 inches diameter, along firm ground for a distance of 2 miles, reaches a small lake shown in view 31. On left appears the timbered ridge projection of mountain slope. The distant hills in right-hand half are on far side of Tuya River.

For this lake, view 31, there is good going to bare bank of Tuya River, elevation 3,480 feet, for a distance of 4 miles. View 32 is taken from this bank. Camp 15 was placed early, about half a mile down stream and quarter mile back from this point at an elevation of 3,500 feet at foot of hill, on 75-foot stream coming thereout.

I ascended this creek for 1½ miles through a rocky canyon rising on 2 degree grade, or 185 feet to the mile.

There not being any attraction up, I went down Tuya River in search of a bridge crossing. At a half-mile south from camp, view 33 depicts the bridge site found, a much more favorable and secure location than was anticipated. The span would be 400 feet between bridge seats on rock and 32 feet above flood. This could be reduced to 330-foot span by placing a 15-foot abutment upon a lower ledge on east bank at 17 feet above flood, and 25-foot abutment at 7 feet above flood, moved 50 feet back or easterly on west bank. From easterly bridge seat (3,480 feet) a steep grade is called for 2,200 feet to level of gap in flanking ridge. Distance can be developed between these points resulting in an 8 percent grade. The courses S.82°E. to N.80°E., generally in an extremely circuitous line of travel for six hours required for distance development, reach Camp 16 at an elevation of 4,360 feet and 3.8 miles from Camp 15.

This 4 miles between Camps 15 and 16 is favorable ground but extremely circuitous, being among small isolated hills. Steep pitches rising easterly would be called for. The area is covered more or less with dense buck brush, and spruce timber to 8 inches diameter is available. Ground is good and dry.

From Camp 16 was taken view 34 looking back, southwest, across the Tuya River to Level Mountain, to the east of which meadows and ponds were observed, rimmed from drainage to the Tuya River by a low ridge, which I took to be the headwaters of the Nahlin River. Some 40 degrees to the right, or S.75°W. (a gap in the ridge) appeared an advantageous point to get through to Nahlin River around north end of a large lake in Tuya Valley to south of mountain C and Horn Mountain.

On August 21, traveling from Camp 16 about S.80°E. in 3 miles, we reached the definite limit of timber and were still going up, so we determined to make Camp 17 (4,790 feet) in a small clump of balsam sufficient for cooking and spent remainder of day in saddle to find a way out.

It was evident that the Indians were altogether astray and dry of suggestions. I determined that we were in the French Mountains. Before returning to camp in the evening I located a large valley, seemingly in direction desired and some 4 miles to south which had an easier approach from Tuya Crossing than the way we came. The ground southward from Camp 17, being favorably undulating, from an elevation of 4,890 feet, we took that line.

Since the ground passed over between Tuya Bridge and mile 83 was of a favorable character, I have preferred to utilize the greater mileage in making up section and estimating cost.

Taken from top of mountain 5,500 feet bearing S.55°E. two miles from Camp 17, view 35 takes in an arc from N.30°E. to east (magnetic).

Turning easterly up valley (named Deception Valley) Camp 18, elevation 4,240 feet, was made on north side of valley about 8 miles from Camp 17, over favorable ground and direction.

From Camp 18 Deception Valley was followed east for 3½ miles from which point the valley turns northerly. At this point also a 35-foot stream flows in from the south, flowing easterly and northerly down this valley to a gap in the spruce cornered flanking ridge on south side about 4 miles distant, through which it passes—very likely, in my opinion, to Little Dease Lake. This stream was ascended from an elevation of 4,160 feet, where it enters Deception Valley over favorable ground through dense buck brush to Camp 19 at an elevation of 4,670 feet, where we made camp a third of a mile east and some 400 feet above stream, which had gone into a deep gulch of 400 feet. It continues heading south to its basin. Having made up my mind to follow a good rising lead to a skyline ridge S.70°E. and learning that the Indians had said I was going away from Tatsho Creek, I looked into the matter and found they wanted to continue south along the stream we had been following. I carried on as determined.

In doing this and after leaving Camp 19, at about 4 miles S.70°E. we reached a divide, 4,870 feet elevation, and looked down into Tatsho Creek. At least the Indians said so, and so it proved to be.

View 37, taken from A-2 on plan, looking towards Mount McLeod showns the slopes descended from divide at mile 68 easterly towards mile 62.

Tatsho (Eightmile Creek) rises at the foot of two snow peaks, 6,300 and 5,963 feet from a basin elevation of 4,900 feet, and flows for about 17 miles of stream, before emptying into Tanzilla River at 2,360 feet. From its basin it flows northerly 4 miles, at which point mile 67 of line of route is close at hand; hence, line of route swings easterly and east for 5 miles along bare slopes of Tatsho, between heights of 4,500 and 3,500 feet. At this point (62 miles) spruce timber up to 10-inch diameter is found. The general contour of 3,500 feet is followed through timbered and diversified ground for 10 miles to mile 52.

Being desirous of renewing supplies at Dease, the packtrain went out down stream by line of camps shown. This fitted examination of northerly slopes to mile 60, from which point easterly to mile 47 operations were carried on from Camp 23.

The course of Tatsho Creek was followed to its wagon road bridge (Telegraph Creek-Dease Lake wagon road). The lateral slopes are

easy, not exceeding 8 to 1. Structures crossing Tatsho would require to span at least 80 feet with 10-foot trestle approaches. The lower valley is densely timbered, and bridge material would be obtained close to hand. Its great objection as a route would seem to be the fact that this stream possesses a local zone of precipitation. The dense character of all growth in the valley is remarkable for this locality. Snow indications have been put at a maximum of 6 feet, but little information could be traced to actual experience, beyond the fact that constant users of the wagon road will say "that a dry road at and in vicinity of Tatsho Creek is unusual".

Camp 20, although about 15 miles by trail followed from Camp 19, is not more than 8 in a direct line and is to be noted because the small stream camped on—a short mile west of Tatsho Creek, of which it is a feeder—furnishes a good lead westerly in case the alternative E (in better direction) should not be followed through.

We got out to wagon road at Camp 22 at about 2:30 p.m. on August 28. MacDonald's truck passed shortly after our arrival, and I shipped our packer into Telegraph Creek to bring out 3 saddle and 2 additional pack horses, with the idea of speeding things up. Up to this time all hands had been afoot; but on the later Dease Lake-Stikine Crossing trip, it was proved to my satisfaction that mounting all hands paid.

From Camp 23, elevation 2,615 feet, reached on August 29, we examined and adjusted all work within about 5 miles radius. A settlement in this matter entailed very much greater time than anticipated, the examination at one time including the valley of Fourmile Creek as a possible lead into Tatsho Creek.

On August 30 met Coulter and Little, with whom Colonel Rolston had been flying, visited airplane, which shortly after took off for Burns Lake. Barometer read 27.55—2,450 feet—on Dease Lake. Official height is 2,425 feet, indicating error. Elevation at Camp 23 was adjusted using official lake elevation, which was carried east and west.

View 38 is taken from Dease Post looking north up the Lake, the first dark point on left is where the Fourmile comes in.

View 39 is taken from top of hill, south of Dease Lake. Route line ascends this hill after crossing wagon road and affords another view of the Lake from about mile 50 of route line.

On September 5 the additional horses from Telegraph Creek and our old mob, which had been collected after three days' search from 16 miles down the wagon road, with renewed supplies, made an early start for Stikine Crossing via Tanzilla River, Gnat and Ptarmigan Creeks and made Camp 24 on Tanzilla River near a small canyon after a march of about 7½ miles. My examination out was along the benches to 300 feet above river flats, and the distance traveled

(double what was booked) was in bad ground, soft and heavy with underbrush.

View 40 taken from hill, N.65°E. of Camp 24 looking up Tanzilla River, shows jack-pine brule. Either line of route shown on plan would occupy the higher benches to right and left of river.

View 41 taken from a point one third of a mile N.40°W. of Camp 24 is down the Tanzilla. The distant mountains are on far side of wagon road.

View 42, from practically the same point, shows Tanzilla River at Camp 24 (removed when view was taken) and line of route at about mile 41.5 to 42.5 where it is falling to river flat after passing small canyon (not seen).

From A, some 6 miles of extremely soft indifferent going from Camp 24, view 43 was taken, about opposite where Tanzilla River turns to the east and Gnat Creek joins from the south. The route line via Gnat Creek-Ptarmigan Creek Summit is on opposite side of Tanzilla River, having come down east bank of Gnat Creek. The alternative by Stikine River is behind or south of camera, half a mile.

Camp 33 was an out camp, that is, made when returning from Stikine Crossing, and is about 8½ miles from Camp 24. From this point view 44 is up the valley of Gnat Creek for 6½ miles southeasterly to an unnamed lake about a mile long, at the south end of which occurs a pass to the northerly slopes of the Stikine River, around which Stikine Valley Projection was examined to this pass over the slopes shown on right in view. Gnat Creek upstream, after passing through a smaller lake, takes a local bend to the east before reaching Mile Long Lake through a short feeder.

View 45 is looking up gulch of Gnat Creek from station 2 just above falls and a mile north of Camp 33.

View 46, taken from same point (station 2), is looking down Gnat Creek gulch below falls and depicts side hill on right traversed for about 2 miles along Ptarmigan Creek route line. This line goes through an opening between main bench and an isolated hill in center of view, to the Tanzilla River flats, shown in left quarter.

View 47 is same view practically as no. 44, but is taken when going in from Camp 25 some 4½ miles nearer the Mile Long Lake (mentioned above) near the pass to the Stikine, which is that in center of view.

Taken from a point at summit of Stikine Pass about one third of a mile beyond Mile Long Lake, view 48 looks S.26°E. (magnetic) into Stikine valley. The mountains showing are on the north side of Stikine, the mile-wide valley evidently making a turn more to the east at a point below any position visited.

From Camp 25, about 12 miles from Camp 24, we continued up valley of Gnat Creek, passing between Mile Long Lake and the creek. Examination indicated that better ground was along the right hand or northeasterly bank of creek. Good and economical ground was found to canyon, elevation 4,440 feet, about 8 miles from Camp 25.

View 49 is taken from a point in Gnat Creek valley about 2 miles from canyon entrance and looks down Gnat Creek.

View 50 looks up Gnat Creek, from same point as previous view, into canyon mouth.

The canyon is tortuous, with rock walls and earth-covered broken slopes, the former predominating. These are of varying heights, one to 250 feet, and extend a short 3 miles along the creek.

The cost of putting a road through here would not be excessive, and with a liberal use of powder, a satisfactory result should be attained within reasonable cost, amounting roughly to double that on timbered slopes. Excessive but short lengths of grade would be required in interest of economy at three points, the grades in no case exceeding an 8 percent.

View 51 is an unfavorable point in canyon.

View 52 is a favorable stretch just below a point where forks in the canyon occur 2¾ miles above. The 20-foot stream continues S.80°E. while a branch, dry at this time, comes in at S.40°E. We took the latter or right-hand turn and within a short distance came out on a bare and easy slope, at elevation 5,010 feet, showing a rise through the canyon of 570 feet. From this point we descended to timber level and made Camp 26 among some stunted spruce on slope of stream basin, which begins forming where we came out of canyon and thence flows into Stikine River. Camp 26 was about 12 miles from Camp 25.

This Monday, September 8, made a Sunday, as horses' feet required going over, with several replacements necessary. Spent the day on Gnat-Ptarmigan Creek summits and on leaving Camp 26 next morning, went through the more southerly pass into Ptarmigan Creek.

View 53, taken from A-2, 2 miles from Camp 26, gives an idea of the situation. Elevation 5,405 feet is practically that of the divide. On extreme left of view is seen a mountain top, the foot of which lies at the forks of the canyon. The summit of left-hand canyon's divide is seen in view 55. The cone-shaped top (left of view) is on far side of Ptarmigan Creek. In middle view is pass no. 2, which was traveled. On right-hand side is mountain top, at the foot of which is a shallow gully which drains water from within

a few feet of pass no. 2, to the Stikine River. This drainage was the largest creek passed in running out Stikine Valley Projection.

View 54 is taken from Cone Hill, elevation 5,570 feet in pass no. 1 in the direction of pass no. 2, and looks S.68°E. down Ptarmigan Creek.

View 55 is taken from same point looking up Ptarmigan Creek to a skyline summit, estimated at over 6,000 feet. This same summit may be seen in view 60 from Junction.

Looking towards Skeena from A-2, view 56 covers from S.26°E. (extreme right) to S.35°W. on left. On far side of pointed hill (on left) is the Stikine drainage mentioned as rising close to pass no. 2. In center left are the distant Stikine flats, and farther right is the nose of ridge around which Stikine Valley Projection finds its way through a Stikine pass into Gnat Creek.

View 58 (no. 57 not listed) shows pond about third of way through pass no. 1.

View 59, taken at Junction with main pass and Ptarmigan Creek, nearly 2½ miles east of A-2, and at an elevation of 4,720 feet, depicts a view back up pass no. 2. The last half mile from lip of pass would require grading down Ptarmigan valley south slope.

View 60, from same point (Junction), is taken looking up main pass and Ptarmigan Creek for over 3 miles, to same summit shown in view 55.

The descent down pass no. 2 is from pass elevation of 5,405 feet to 4,720 feet at Junction, a fall of 685 feet in a minimum distance of 2 miles. Unfortunately the natural pass grade increases towards its junction with Ptarmigan. The elevation at pond about third way through pass was 5,275 feet, leaving between 550 and 650 feet before reaching Ptarmigan Creek level. This is easily obtained with reasonable grade along 2-1 slopes entailing heavy work among huge boulders.

From Junction we proceeded to Camp 27 on Ptarmigan Creek a mile below where creek takes a decided bend southerly at a point 8 miles from Junction and 12 from Camp 26. The going was diversified throughout this 8 miles on south or right-hand creek bank. Five streams are crossed, two 25 feet wide and three smaller.

Ptarmigan Creek was crossed about a mile above where camp was made. Just below the camp flows in the stream from Moose valley, a waterway equal in volume to Ptarmigan itself.

This stream (Moose Creek) was crossed, and our travel was continued down east or left bank, since it looked more favorable than opposite side which showed swamps. The bench was ascended at

intervals to better ground, but for 4 miles below Camp 27, rough ground prevailed. From this point good conditions are found on creek flats to Camp 28, which was placed at junction of Stikine River and Ptarmigan Creek, 6 miles from Camp 27, on September 10, elevation 2,841 feet.

There will be seen on plan submitted,[1] two dotted lines in the vicinity of Camp 28, joining northerly with the lines of route up Ptarmigan valley and Stikine Valley Projection, respectively, and extending southerly after crossing the Stikine River. These show the location of low- and high-bridge crossings of this stream.

View 61 shows a low crossing, calling for a 250-foot span, with north abutment on rock and south abutment 20 feet high. Span would be 40 feet above ordinary water level.

View 62 is taken along the line of a 300-foot span, which would be 260 feet above water surface, in small canyon.

Neither of these bridge sites would be available from the vicinity of Klappan River mouth; but a large opening was observed breaking through from the south bank of the Stikine River in the direction of Klappan valley, through which, if considered desirable, the route line might be brought to either of these naturally secure crossings. The difference between water levels when visited and flood indications was 18 to 20 feet.

In the foregoing pages I have endeavored, with the assistance of photographs, and I fear prolixity, to bring before you, irrespective of personal opinion, the conditions existing at the various elevations passed through.

Adverse construction conditions occur at high elevations where soft ground prevails and no timber grows. In this matter I am impressed with the idea that small drainage ditches would be successfully effective; that is, this class of ground will be usually found on slopes where natural drainage, if helped, would produce good results.

In the case of those plateau areas, from 3,500 feet upward, where bog rests upon solid and most frequently (apparently) boulder floors, to a maximum depth of 3 feet, modern road machinery should provide some means of meeting the difficulty. No rock would be encountered except at Stikine bridge crossings, entering lower end of Ptarmigan-Gnat pass, Gnat Creek canyon and Tuya River crossing.

For purposes of estimation I have figured a 2-foot embankment throughout the total distance. Unquestionably this form of construction, wherever possible, lends itself to early snow clearance. Clearing, grubbing, corduroy, and ditching have been noted wher-

[1] Plan not printed—not incorporated in this extract.

ever, and to the extent, required. Structures are indicated to meet requirements. Two feet is minimum embankment, which is to be increased to meet circumstances. Gravel seemed to be plentiful in vicinity of Nahlin River. Hillocks of gravel were noted 3 miles from river bank. The cut bank of West Fork of Tuya River also showed this material along the foot of mountain C at mile 100. The slopes of Tanzilla River should supply gravel, although none was observed. None was seen on Stikine slopes nor along Ptarmigan or Gnat Creeks. A search, to the end of establishing gravel pits, would doubtless follow general route location.

Snowfall would not seem to vary much; natural indications were in no ways definite. Information results are these: Stikine Crossing (report of one man) 4 to 5 feet, which would include the valley generally; Ptarmigan Creek, half-way to divide, 5 feet; Gnat Creek about Mile Long Lake, 4 feet; Tanzilla River to Dease Lake, 3 to 4 feet; westerly slopes of Dease Lake, 3 to 4 feet; Tatsho Creek, 6 feet; Tatsho Creek-Tuya River divide, unknown; Tuya River, unknown. On the Tuya-Nahlin River divide and surrounding plateau, the Indians thought about 4 feet could be expected with snow gone early in June.

View 63 shows continuation down Stikine Canyon, from 50 feet down stream from high-bridge crossing.

View 64 is taken from Camp 30, looking up Klappan valley. Ridge blocking view is a continuation of Stikine Canyon on south side of river.

Taken from a point half a mile north of Camp 30, view 65 shows Stikine valley within an arc from south to N.40°W. (magnetic) and the slopes at elevation of 4,800. These slopes continue into valley of river but are timbered more heavily as a rule. In fact, elevation is by no means a gauge as to tree growth. For instance, in view 66 some 300 feet higher at Camp 31, timber predominates, showing a view of the Stikine below.

View 67 finishes my kodaks. This is also a view of Stikine vallay from Camp 32 at an elevation of 4,200 feet, the proposed maximum elevation of the Stikine Valley Projection, and more like the character of country the route would traverse.

Owing to the uncertainty of any crossing of Stikine River hereabouts, except probably at mouth of Klappan valley, I have adopted a point opposite thereto as zero for my mileage westerly; and since the Stikine Valley Projection runs through for about one third the entire way, I have determined to carry the mileage that way.

Stikine Valley Projection

The Stikine valley route line has been projected to invite comparison with that following up Ptarmigan Creek over divide (5,405 feet) into Gnat Creek.

In making any such comparison it should be borne in mind that: (*a*) The position of zero at lower crossing increases the Ptarmigan route by 2 miles and decreases the Stikine by an equal amount, whereas development easterly may demonstrate the distance to be materially lessened by way of Ptarmigan; and (*b*) that the scenic advantages pertaining to the line through pass no. 2, on the Ptarmigan-Gnat Creek divide and Gnat Creek canyon, are markedly superlative to anything seen on the Stikine route. There would be an advantage in elevation of 1,200 feet, as between Ptarmigan-Gnat Creek, 5,400, and Stikine-Gnat divide, 4,200 feet.

Starting at zero, level of Stikine 2,800 feet, an immediate rise therefrom proved an error. A projection on the line of alternative A would have been more satisfactory, but I feel justified in basing the profile and my estimate of cost upon the results of the examination of the higher line, where the ground surface and material are the same. On profile submitted, alternative A is approximately shown.

The best line out of the Stikine valley uses, preferably, gradually ascending grades, as the character of the ground or obstacles may dictate, from an elevation of 2,800 feet at the river to 4,200 feet, or 1,400 feet in a distance of some 22 miles.

The cost of grading, including gravel surfacing, varies and has been divided into six sections, resulting as follows:

Section 1.	21.0	miles,	cost per M,	$10,768,	Total cost		$226,134
2.	2.0	do	do	6,846,	do		13,691
3.	8.0	do	do	9,133,	do		73,065
4.	3.5	do	do	10,570,	do		36,996
5.	2.5	do	do	9,506,	do		23,766
6.	5.0	do	do	11,894,	do		59,470
	42.0	miles, at net total cost					$433,122
	Engineering, etc., 10 percent						43,312
	Contingent, 10 percent						43,312
	Total cost for 42 miles						$519,746
	or at rate per mile of $12,375						

The junction of the two lines occurs at the 48th mile of Ptarmigan route, counting from same zero. Alternative B (3 miles long) is shown starting from 24½ miles on Stikine Projection, crossing Gnat Creek and joining Ptarmigan line at 31½ miles, in order to

cut out 4 miles of bad swamp on other line. A 60-foot bridge crossing Gnat Creek hereabouts would substitute for that of Tanzilla River between 40th and 41st miles, where a 100-foot span is indicated. I shall now return to zero and take up cost on Ptarmigan line to Nahlin River, noting alternatives.

Ptarmigan-Gnat Creek Divide to Nahlin

This 130 miles has been divided into 22 cost sections, and a brief description of each follows.

The 400-foot span at Tuya River (which is open to modification) has been put at $150,000 and is not included in following table or cost for section 18, which covers the grading and gravel surfacing only.

From zero on bank of Stikine River at my aneroid elevation of 2,800 feet, the line of route rises some 300 feet to a pass leading to the southwest slope of Ptarmigan Creek and at practically that height above it. This line is made on broken timbered slopes averaging 3 feet and 4 feet to 1 foot. Turning northerly when through this pass, the line continues along side-hill ground for the 8 miles from zero, covered by section 1. The slopes improve as you go upstream. The creek flats, after reaching some 3 miles above its mouth, are composed of heavy swamp which continues more or less as such until the 8th mile is reached.

Section 1, 8 miles. The earth embankment throughout this first 8 miles has been computed as being 3 feet in height.

Section 2, 6 miles. The country improves on section 2, having firm flats, and the slopes are generally drier after you turn the corner to nearly west course.

Section 3, 2 miles. At the 14th mile the grade would steepen for lift into Ptarmigan pass no. 2. The cost of this short section 3 has been made the same as no. 1, viz, $12,800 per mile.

Section 4 covers 3½ miles, from 16th mile to entrance of Gnat Creek canyon at 19.5 miles. Similar conditions exist throughout, with bare solid ground composed of glacial drift, over which stretch the drainage would be amply cared for by the ditching and few culverts noted. This is the first of the light sections characteristic of the higher altitudes and summits.

Section 5, from 19.5 to 22.5, covers 3 miles through the Gnat Creek canyon. Excepting cost section 8, with the Tuya River crossing, this is the heaviest piece of work encountered, viz, $15,000 per mile. The only rock work on this route occurs here.

Section 6, 3½ miles. Coming out of canyon on north bank of Gnat Creek, the line traverses the open or bare creek flats for 3½ miles, with light work and grades.

Section 7, 9 miles, follows the benches of Gnat Creek to the 35th mile, where the flats of Tanzilla River are entered. This stretch of 9 miles is fairly good ground, somewhat rough at lower end.

Section 8, 2 miles, consists of 1 mile of river flat, Tanzilla bridge of 100-foot span, and a mile of easy side-hill work, 200 feet above river.

Section 9 covers 2 miles of bare flat bench. A light section.

Section 10, 2 miles of bare bench falling to river flat past small canyon, on side hill.

Section 11 covers 6 miles of lower flats of Tanzilla through pine brule and some soft ground.

Section 12, 3 miles, is all good ground through small jack pine. After crossing wagon road some heavy side-hill work is encountered in last half mile.

Section 13 extends for 13 miles through heavy timbered country, leading to Tatsho Creek, portions of which are soft.

Section 14, 12 miles along the bare slopes of Tatsho Creek through divide to Deception Valley, is along easy slopes for half the distance, with no other growth than buck brush.

Section 15 is 6 miles of dry and flat ground through Deception Valley.

Section 16 is bare dry ground for 10 miles across a false summit from Deception Valley to within 3 miles of Tuya River.

Section 17 comprises 3 miles of sparsely timbered and circuitous route from about Camp 16 to Tuya River.

Section 18 does not include Tuya River crossing but reaches 2 miles beyond. Some heavy side-hill work on west side has been figured. The matter of bridge cost has not been included in these figures, but $150,000 noted for this purpose.

Section 19 includes 3½ miles of timbered country, portions of which are soft, rising to Camp 14.

Section 20 is a light section of 8½ miles of bare ground, for most part dry and flat.

Section 21, 14 miles, covers the open and dry stretch of country encountered in the passage of the Tuya-Nahlin divide.

Section 22, being 8 miles from 122d to 130th mile, is lightly timbered with spruce, with a part of the surface consisting of boggy areas overlying small boulders.

A cost summary of the above divisions follows:

RÉSUMÉ: STIKINE CROSSING TO NAHLIN RIVER VIA PTARMIGAN CREEK

Cost section	Mileage		Distance (miles)	Cost	
	From—	To—		Per mile	Total
1	zero	8	8	$12, 794	$102, 350
2	8	14	6	10, 972	65, 835
3	14	16	2	12, 800	25, 600
4	16	19. 5	3. 5	8, 526	29, 841
5	19. 5	22. 5	3	21, 330	64, 000
6	22. 5	26	3. 5	6, 682	23, 386
7	26	35	9	8, 542	76, 877
8	35	37	2	15, 429	30, 859
9	37	39	2	7, 134	14, 263
10	39	41	2	9, 983	19, 966
11	41	47	6	10, 118	60, 110
12	47	50	3	10, 615	31, 846
13	50	63	13	11, 243	146, 160
14	63	75	12	8, 292	99, 509
15	75	81	6	7, 548	45, 289
16	81	91	10	7, 804	78, 045
17	91	94	3	9, 749	29, 246
18	94	96	2	8, 707	17, 414
19	96	99. 5	3. 5	11, 246	39, 362
20	99. 5	108	8. 5	7, 493	63, 687
21	108	122	14	8, 091	113, 273
22	122	130	8	10, 225	81, 781
		130. 0			$1, 258, 699

Net cost: $1, 258, 699, equals $9,682 per mile
Add 20 percent 251, 740 for engineering and contingent

Total cost $1, 510, 439, equals $11,619 per mile, or $12,773 including Tuya span.

NOTE.—The cost of Tuya River bridge is placed at $150,000, or $1,154 per mile for 130 miles.

ALTERNATIVES

Alternatives A and B have been already mentioned in connection with Stikine Valley Projection, of which they are a part.

Alternative C is an extension of the Stikine Valley Projection down the south bank of Tanzilla River to a favorable crossing point, and utilizes the present Telegraph Creek-Dease Lake wagon road for some 8 miles, to within 1½ miles of Sixteen Mile Creek at an elevation of 2,500 feet, where it joins alternative E at mile 70, having a rise of some 1,500 feet in 5 miles. It either passes inside Caribou

Mountain, or goes around Caribou into the Tuya valley, utilizing an old road for 16 miles to 26-mile point at an elevation of 2,000 feet.

In showing grade lines of what might be expected along alternatives E and E-1, it has been thought well to include with the information acquired by examination, probable possibilities of route improvement as observed at a distance. These opportunities unfolded themselves as we traveled easterly and are submitted for what they are worth.

The short alternative D is questionable. The Saturday evening of October 4 I walked through a gap between miles 51 and 49, noticed for first time when returning over divide from Tatsho Creek, and I find that mile 49 to mile 51, as shown, could be replaced by a straight line between these points. I left next day (Sunday) by last stage out.

Alternative F between miles 69 and 83 is conjectural and requires further information concerning Little Dease Creek crossing, but from miles 84 to 94 it would undoubtedly be found an improvement over the route traveled.

SUMMARY

There was examined 172 miles of route line between Stikine River crossing and the Nahlin, consisting of 130 miles along Ptarmigan and Gnat Creeks and 42 miles of Stikine Valley Projection.

In this 130 miles I met with nothing prohibitive to the construction within reasonable cost of a wagon road conforming to the specifications of your instructions; on the contrary, natural conditions facilitated an undertaking of this character. Quite aside from its favorable topographical features, however, there are two important items, viz, gravel and the general character of the material at the higher elevations, between say 3,500 and 5,000 feet above sea level, which are in doubt.

Gravel has been alluded to previously, and its absence from the higher levels may be expected. There are, however, flanking ridges on the divides and stream banks that might disclose this necessary material.

Referring to the light sediment found on the divides and ascents thereto, I had hoped to be assisted to a conclusion by information as to experience in Alaska, but my inquiries in that direction have not met with success.

I would not hesitate to use the sediment under railway ties, but how it reacts under gravel surfacing and whether affected by the extreme cold of long winters, I am without knowledge.

It was remarked that where boggy areas of small dimensions occur (water holes, in fact) at a general maximum depth of 3 feet, the

underlying stratum consisted of a firm floor of variously sized boulders. Is this light surface material a shallow covering? There are certainly no boulders visible on top. In views 24 and 25 the result of heavy rain storms may be seen in the many small ponds, which undoubtedly disappear through evaporation. No mud results from heavy wetting.

Estimates of cost are submitted with plan and profile of route actually traversed, and this line would be equally advantageous both as to conditions and cost over the shorter alternatives D and F.

The general inaccessibility of this undertaking renders the question of costs open to many contingencies, but I believe the figures submitted may be accepted with safety. The prices utilized in this connection, you are aware, were supplied me from experienced sources.

The plan conforms in general direction and distances with the district map. Profiles have been prepared from aneroid elevations and are subject to the variations or inaccuracies this practice engenders, but should give a fairly correct idea of what may be expected and will serve to fix maximum grades.

Barometrical readings, using two instruments, were satisfactory during July and August, that is from Telegraph Creek to Dease Lake, and the elevations in spite of weather fluctuation (which did not seem to affect the instruments) should be closely approximate; but those from Dease Lake to Stikine Crossing were most unsatisfactory. Early in September the aneroids went all to pieces. Changes of 600 feet in stationary barometer between night and morning were quite usual. Dease Lake official height (2,425 feet) was utilized from that point easterly; and, by applying Belleville's rule to interval readings, results were obtained which seemed to fit.

It was not unusual to note jumps of 200 feet during the lunch half-hour.

The season was inauspicious for the work in hand. July was fine; August over 60 percent wet with some heavy and continuous storms (fully 50 percent of kodaks were taken in rain), and much fog prevailed; September was better, about 40 percent wet.

Game was plentiful in the form of caribou and moose. We had three heavy meat eaters and five dogs so that our consumption along that line was heavy. The fifteen animals killed, about 50 percent from tent door, were never hunted but picked up as we traveled. Game was constantly in view. For sport the ptarmigan appealed to us most, as humorous, large, and tame flocks of these birds were noted everywhere.

I was well served. The Indians were excellent. Billy Fann, the packer, while using language to them beyond description, was good to his horses, which is a rather unusual Indian trait. The horses'

backs returning home were unmarked and clean, which tells its story. Ned Tato, second packer and cook, was first class, clean in his kitchen, and ready to help out. John Ensor, my white assistant, was a treasure and all that goes to make a man, with no end to his endeavor to push things along. This was his last job. We parted at Dease Lake early Sunday morning, October 5—he going down the lake to join his partner and new boat at Porter, bound for McDame Creek; I bound for Telegraph Creek. Five days later they were both drowned in Cottonwood Rapids, Dease River, losing with their lives their little all and the hopes and preparations for a good winter. Ensor's loyalty to the work calls for these few regretful words.

Concerning my examination between Stikine Crossing and Nahlin, it would appear to me that the only important item left unsettled is the passage between Cairn and Caribou after crossing Tatsho Creek on alternative E, or between about miles 62 and 80 thereof. Nothing more of importance requires to be known throughout this distance, but is ready at any time for survey.

Before concluding, I wish to say a few words regarding the Teslin Lake route via west slope of Dease Lake, and in this connection am submitting a smaller-scale map (5 miles to inch)[1] upon which is red solid line last year's reconnaissance and an extension from Nahlin, by the most direct route via Atlin to the Yukon boundary.

From about the 50th mile of reconnaisance there is a possible route ascending the westerly slopes of Dease Lake to head of Thibert Creek, and thence to Teslin Lake and Yukon line.

A comparative table of distances between these two routes would be approximately as follows:

1. Stikine Crossing to Yukon boundary via Atlin	
Stikine Crossing to Nahlin	130 miles
Nahlin to Atlin (as shown)	91 miles
Atlin to Yukon Boundary	30 miles
Stikine Crossing to Yukon boundary	251 miles
Wagon road built	23 miles
Stikine Crossing to Yukon boundary, new road	228 miles
2. Stikine Crossing to Yukon boundary via Teslin Lake	
Stikine Crossing to Dease Lake	50 miles
Along west slope of Dease Lake	34 miles
Head of Thibert Creek to Teslin Lake	82 miles
Along west shore of Teslin Lake	30 miles
Stikine Crossing to Yukon boundary—	
via Teslin Lake	196 miles
via Atlin	228 miles
Difference in favor of Teslin Lake route	32 miles

[1] Maps not printed—not incorporated in this extract.

The Dease Lake slopes are timbered and broken up, but no more costly to negotiate than the country through some 68 miles lying between Nahlin and the southerly end of Atlin wagon road.

From head of Thibert Creek to head of Jennings River for some 45 miles, a plateau similar to the Tuya-Nahlin divide may be expected; and the passage along these northern rivers is usually a simple matter.

Colonel Rolston, who flew over this route to Atlin, spoke favorably of what he then saw.

Upon the small-scale map submitted [1] will be seen two Tuya Lakes, shown on black- and red-dotted lines, respectively. That in black is by G. M. Dawson, and since it is dotted in his original return, I should opine the lake was not visited but observed from a distance.

The lake shown in dotted red is from information obtained from a man who claimed to know the lake well as being "not more than 10 miles (magnetic) west of Frying Pan Creek to its south end, nor more than 6 miles long".

This would seem a probable chance to obviate a crossing of Tuya River without making too great a detour to the east.

I have to regret my inability to carry out the expedition that we had been outfitted for—that is, to go through the inside passage between Caribou and Cairn Mountains and up Tuya River to locate the lake and out by Jimtown trail to wagon road, but as winter came down in earnest on September 30, I was forced to send horses to Telegraph Creek and was unable to take advantage of your permission to carry on.

[1] Maps not printed—not incorporated in this extract.

APPENDIX D

EXTRACT FROM A REPORT OF MR. J. H. McNEIL ON THE INTERNATIONAL HIGHWAY ROUTE THROUGH THE YUKON TERRITORY FROM THE BRITISH COLUMBIA BOUNDARY TO THE INTERNATIONAL BOUNDARY

The location of a highway route through the Yukon Territory will depend on where the British Columbia line reaches the boundary. It may be at the head of the Pelly or further south and in line with Atlin. Down the Pelly will be the most direct line from the Frances Lake country; on the other hand, the construction cost will likely be greater than if following a line towards Whitehorse and close to our present winter mail route to Dawson. The following notes will give an approximate idea of the country from Atlin northward via Carcross and Whitehorse to Dawson. Information on the Pelly route is not available, except that in a general way the country does not present any serious obstacle to road construction.

From the Yukon's standpoint any line via Atlin, Carcross and Whitehorse to Dawson would be preferred, as this route will fit in during winter communication between Whitehorse and Dawson, as well as being at several points in close connection with the river navigation during the summer season.

The route from Dawson to the Alaskan boundary should be determined along with the line on the Alaskan side. The Alaskan Government may not have much choice of routes and may have to cross the boundary at some particular point, in which case the line from Dawson can be adjusted to make the connection without working any hardship on the Canadian side.

The distance from the British Columbia boundary via Atlin to the international boundary has been set down as being about 530 miles. I have not attempted to give any details of cost of constructing or for maintaining the road, as such figures can only be approximate. Much depends on the class of road that will be required and the thoroughness of construction details. In order to give a rough idea on the costs, I would consider that the road would be formed by grading in from both sides wherever feasible to a width of not less than 60 feet which would build the roadbed well above the frost action and afford drainage, and at the same time

eliminate the use of corduroy except at special locations. This would allow a good surface for graveling; this would have to be spread liberally except in spots where the natural formation would be sufficiently dry to allow of a lighter spread. Side-hill grades would need a 20-foot roadway as a minimum, increasing in accordance with the amount of moisture in the ground and the straightness of the road.

Crossing of the small streams would not require much special consideration. The main crossings would be the Sixmile River, Tahkini, Nordenskiöld, Yukon, Pelly, and McQuesten. Some could be crossed by ferry at first and ultimately bridged. Rock work would not amount to much as the only rock section would be from Allgold Creek to Dawson. Apart from the crossing of the Yukon, Pelly, and McQuesten Rivers, I should expect that a well-formed graveled-surface road would cost about $7,500 per mile, with maintenance ranging from $300 to $500 per mile. Some sections would have to be completed at a less cost than above per mile, in order to allow for a greater expenditure at other less favored places. The construction of the large bridges is something that will require close attention in order to get any idea on costs.

Section from British Columbia Boundary at Lake Atlin to the West Bank of Tagish Crossing

Leave Atlin Lake near the north end and follow the east side of the Lubbock River until a crossing is made before arriving at Little Atlin Lake. The course continues along the west side of Little Atlin until opposite the north end of the lake, at which point the route turns more directly westward towards Tagish Crossing, which is also referred to as the Sixmile River, connecting Lakes Marsh and Tagish. To Tagish Crossing is approximately 45 miles, and the present condition is that of a trail passable for packhorses and dog teams.

Jack pine and spruce, suitable for corduroying, or construction of small bridges and culverts, are available in this section, which consists of low-lying ground with maximum elevation about 100 feet above the level of Lake Atlin. There are a few wet spots in this section, but the balance is dry and hard ground. Gravel deposits for surfacing are readily obtained throughout.

The principal river crossings are at the Lubbock and the Tagish. The former is of minor consideration, as a bridge 20 feet wide will suffice. The latter is a large stream with two locations suitable for bridge sites. The present telegraph line at Tagish crosses where the stream is about 900 feet, with a solid rock island about 300 feet

from the east bank. The west bank is composed of clay, sand, and gravel to a height of 30 feet. The east bank is much of the same material as the west, but lower.

Opposite Tagish settlement is the other bridge site, which is about 750 feet wide with a 15-foot high clay bank on the east side and a 10-foot bank of clay, sand, and gravel on the west.

In both cases the river is between 15 and 20 feet deep with a maximum current of 3 miles per hour. It rarely freezes over to allow safe crossing on the ice. The location can be easily piled for bridge foundations. Navigation requirements are nominal and can be easily confined to a short-span drawbridge. Moderate precautions will safeguard the bridge structure from damage from floods or ice jams.

Section West Bank Tagish Crossing to Carcross

Leave the lower crossing at Tagish and go about southwest to Carcross, and to some extent paralleling Lake Tagish. A small settlement exists at Tagish, and the residents are interested in raising fur and farm products. Carcross is situated at the lower end of Lake Bennett and ranks as the most important station along the White Pass and Yukon Railway, being the shipping point from the railway to Atlin and other places of interest along the numerous arms and waterways which compose a very interesting group of lakes. Carcross has excellent hotel accommodation, and its background of forest, lakes, and mountains allows of recreation fields varied and picturesque enough to satisfy anyone.

Through this section the trail has been constructed to a standard passable for small trucks and auto-cars throughout the entire distance of approximately 22 miles.

There is fair-sized spruce timber, suitable and in sufficient quantity for ordinary requirements throughout this section. The maximum elevation does not exceed 300 feet above Lake Tagish levels. Mostly dry hard soil prevails, with several gravel deposits and about one mile of very sandy ground immediately out of Carcross. The latter will require special attention, otherwise the ground conditions are very favorable for highway construction with moderate cost maintenance. There are no large waterways and large and small culverts will suffice for the drainage required.

Section from Carcross to Whitehorse

The present road from Carcross to Whitehorse occupies generally the best location for a highway between these points. Portions of this road can be embodied in the new construction, and all of

it will be of more or less use in transporting equipment and supplies to advanced construction camps. However, reconstruction of the present road will not reduce the working costs to any appreciable extent. The direction from Carcross is slightly west of north, and generally parallels the White Pass and Yukon Railway. The town of Whitehorse is the terminal for the White Pass and Yukon Railway and also the distributing center for the Kluane, upper White, Teslin, and upper Pelly districts, as well as the shipping point to Dawson, Mayo, and lower Yukon ports. During the period of closed navigation mails are dispatched weekly from Whitehorse over the Overland Trail to Dawson and Mayo and thence by distributing routes to Eagle and other Yukon River points.

The distance from Carcross to Whitehorse is about 43.5 miles.

The north half of this section is quite passable for automobiles and other half has not received much attention, consequently is rougher. Cars use it at times but have experienced some difficulty in passing over the sandy stretch near Carcross. At Robinson, a road branches off up the Wheaton and Watson valleys to serve the mining interests in that neighborhood.

The elevation at Carcross is about 2,171 feet and at Whitehorse about 2,081 feet above sea level. Maximum elevation is 2,516 feet above sea level. The rise and fall are sufficiently uniform to allow of a light grade. Mostly spruce and jack pine, rather too small and scattered to be of value, prevail. Larger timber is available a few miles back. British Columbia fir can be landed for $70 per thousand feet, and in this case would be most suitable for structures.

Several small streams emptying into the Watson and Lewes Rivers are crossed on this route, none of which exceed a span of 25 feet. General soil conditions are very favorable with practically only one wet spot about one-fourth mile long, which if not entirely avoided can be easily overcome. Gravel can be readily obtained throughout.

Section Whitehorse to Kluane Junction

This section is locally important, as it serves the Alsek and Kluane Lake country as well as being a part of the overland winter mail route. This piece is quite passable for tractors, trucks, or cars for most of the year. During spring when the frost is receding and after rain storms in the summer the surface of the road becomes very sticky until it drys up again, which occurs in a few hours when there is any wind. The Takhini is crossed about 22 miles out from Whitehorse. Generally the road swings away from the Yukon River in order to follow the valley of the Nordenskiöld, which is the best route available. Length of this section is approximately 31 miles.

Whitehorse is 2,081.36 feet above sea level, and Kluane Junction, 2,144.96 feet above sea level. Maximum elevation is 2,512.80 feet. Jack pine and spruce of a size suitable for construction of small bridges and culverts can be obtained at several places throughout if desired instead of the imported British Columbia fir. About 25 small bridges from 6- to 12-foot spans, and about the same number of culverts will be required. The Takhini River is at the present time crossed by a ferry scow. The stream is rather sluggish, about 500 feet wide and about 10 to 12 feet deep during midsummer. It has a mud and small gravel bottom and low bank approaches. The shock and pressure from running or jammed ice is nominal, compared to most of our northern streams.

The ground is fairly good, the worst feature being the gumbo nature of the surface. This, however, can be remedied by a covering of gravel which can be readily obtained along the roadside on adjoining benches. The present road is mostly located along gentle sloping hillsides, with a few exceptions of short steep side hills on the north side of the Takhini. Parts further north are comparatively level.

Section Kluane Junction to Carmacks

The route follows the Nordenskiöld valley down to junction with the Yukon River. This section has not been improved to the standard of the previous one out of Whitehorse. It is used in connection with winter mail service, and is passable for trucks, cars, and tractors during the year, except for a portion of the winter when the snow is too deep for the lighter machines, which then give way to tractors. The distance is about 102 miles.

Kluane Junction is 2,144 feet and Carmacks 1,718 feet above sea level. Maximum elevation is 2,843 feet above sea level. Fairly useful timber occurs in places especially along the Nordenskiöld. Corduroy and small bridge and culvert timbers are available along most of the route. Larger timbers suitable for bridges can be had along the Nordenskiöld on a longer haul.

About seven bridges ranging from 30 to 80 feet exist along this run; however, there is no occasion to exceed a span of 35 feet at any of the crossings. Many small streams are crossed and this, combined with the flatness of the route, generally creates necessity for numerous small bridges and culverts. Most of the section is through comparatively flat country with light grades or hillsides. The more abrupt portions can be practically eliminated. With the exception of some of the flat country, the balance is fairly dry. Gravel exists along the road in many places, and the nature of the ground and the contour is very favorable for grader work for forming the roadbed. This section is practically free from winter flowing glaciers.

Section Carmacks to Yukon Crossing

This section is more hilly than any of the previous ones. The road is good during the summer but at times during the winter the snow drifts along the side hills. It connects again with the Yukon River and is the last section on the southwest side. Its length is only about 20 miles.

At Carmacks, the elevation is 1,718 feet and at Yukon Crossing 1,597 feet above sea level. Maximum elevation is not over 1,958 feet. Timber here is too small for use in construction. It is mostly spruce and much scattered owing to the dryness of the benches. Some comparatively large spruce trees can be had by going to some distant points.

Apart from the crossing of the Nordenskiöld, there are not required very many bridges, and none of more than 12-foot span. The present bridge across the Nordenskiöld is composed of three streams spans and two abutments, having a length overall of 218 feet. The length can be reduced by changing the location to a little further upstream, where a bridge of two spans would suffice. The present wooden structure has been in use for fifteen or more years and is still serviceable, thus it can be readily seen that the bridge has not been bothered very much by ice jams or drift ice.

This section has considerable rise and fall, although the elevation at any point is not high. The ground is dry and hard, with gravel available in many places. The present location can be easily improved as this matter did not receive proper consideration when the road was first laid out, besides funds were not available for more extensive and longer grading of the side hills.

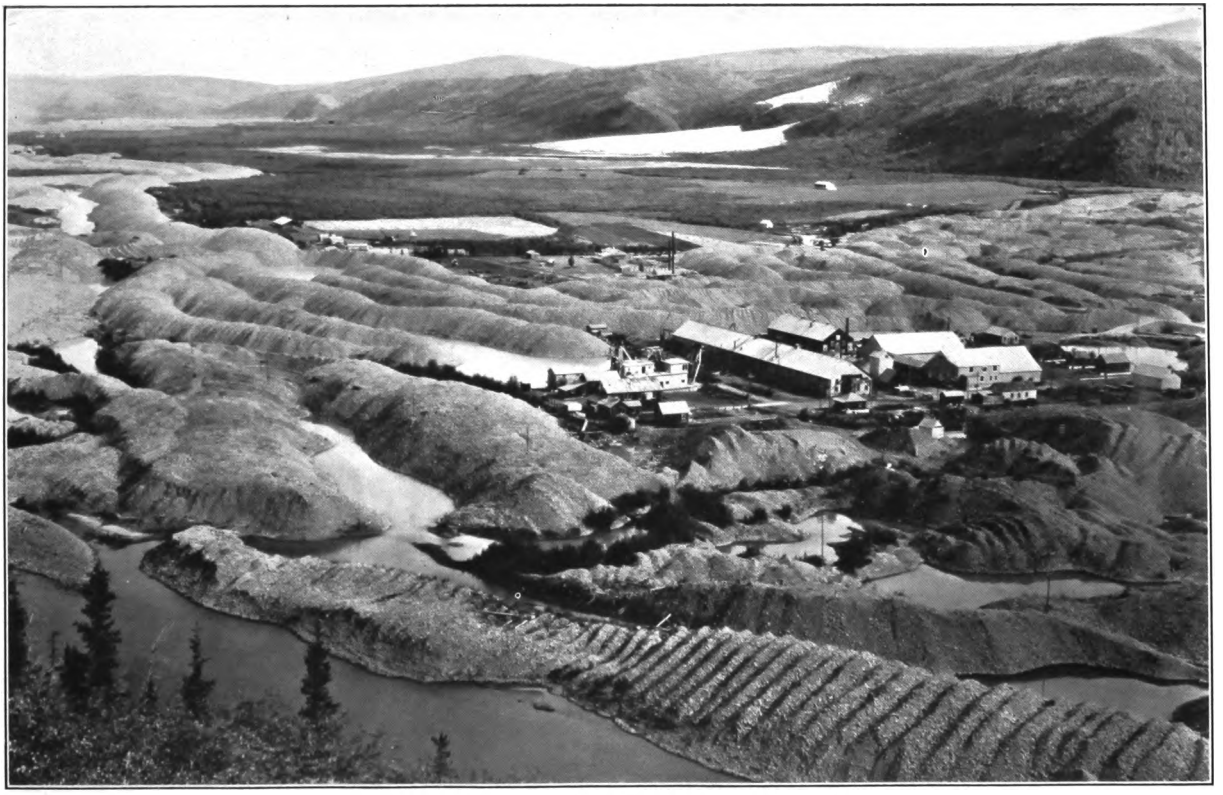
Section from Yukon Crossing to Minto

Having crossed the Yukon, the route follows the western side of the valley to Minto. The country is very favorable for a road, which accounts for the fact that the road is passable and has been so since built, for any rig, notwithstanding that this section has received the least attention in maintenance of any section along the overland. The length is approximately 23 miles.

Elevation at Yukon Crossing is 1,597.4 feet above sea level, and Minto roadhouse 1,520.7 feet. Maximum elevation is 1,838.9 feet. Jack pine and spruce occur, but both are rather scarce and small for construction work, except at the creek bottoms where spruce can be had large enough for culverts and small bridges.

The Yukon River at the crossing is about 800 feet wide. During earlier years the Yukon Government maintained a cable ferry at this point suitable for passing over wagons, auto-cars, etc. This of late

FIVE-FINGER RAPIDS, YUKON RIVER.



MINING OPERATIONS IN THE KLONDIKE VALLEY.

has been discontinued as the service is not as important as other trail matters. It would require a large expenditure to bridge the Yukon except at a few favorable locations such as the Five-finger Rapid, which are about 12 miles above the present crossing. Other streams on this section are small, two of the largest being less than 30 feet in span, whilst the necessity of having culverts is not as important as on the other sections.

The ground is very good, owing to the gravel deposits that exist at the surface or at a slight depth. The present road extends along the benches on comparatively level ground. The few steep grades in use at present are due to a rather abrupt connection between the lower and higher benches.

Section Minto to the Pelly

This section follows an old water channel through to the Pelly and the road, or, rather, the trail now in use has not been constructed other than to cut out the brush and timber and grade the few sideling places. It is estimated to be about 20 miles long. The general elevation is slightly above the levels of the Yukon and the Pelly Rivers. The timber is sparse and of small size throughout.

Structures will be practically confined to culverts except at the crossing of the Pelly, which is about 500 to 600 feet wide. The site is suitable for operation of a ferry. The ground is generally dry throughout with the exception of short lengths. Gravel can be obtained at various places throughout.

A few miles beyond Carmacks, the line could branch off direct for the Five-finger Rapid, cross on a bridge and pass through the Taltmain Lake country over fair ground with comparative light grades. This would allow of a junction with the other route now in use at the crossing of the Pelly and would be slightly shorter and pass through much more pleasant country than via Minto.

Section Pelly Crossing to Crooked Creek Junction

The route follows up Willow Creek into a branch creek flowing into Crooked Creek, which in turn flows into the Stewart River. The country traversed is not difficult although not as dry as the sections already referred to above. The present trail is fairly well laid out, and after the snow levels up the holes the going is passable for tractors with large loads. The estimated length is about 42 miles.

The rise to the summit is very gradual on both sides, the summit being a few hundred feet above the Pelly and the Stewart Rivers.

Rather scrubby and mostly spruce timber, with odd patches of small jack pine, occur. In spots some fair-sized trees can be had sufficient for most of the bridge members required, except stringers or main chords. Not more than three bridges will be required with from 30- to 40-foot spans. A large number of culverts will be needed and a few small bridges.

The formation has been laid by water. As water-worn gravel can be obtained generally throughout, the country is favorable for road construction after the drainage is assured. This is a matter of raising the road bed and providing channels to carry the water away. Large graders would accomplish a great deal in this kind of ground, and it is important that the bed be well built up in order to get away from any settling action due to frost. This latter danger is remote, as there are no indications of glaciers at any place on this section.

At Crooked Creek junction, a branch road extends up to Mayo and on the Stewart and serves the entire mining section of the Mayo district. Considerable supplies are hauled during the winter over this trail, and as the mining expands so will the importance of this branch connection with the outside. The distance from the junction to Mayo is about 31½ miles. The Stewart River is crossed directly opposite Mayo by boat during the summer and over the ice when the latter has formed strong enough.

Section from Crooked Creek Junction to Clear Creek

Following the left or south side of the Stewart River for about 22 miles, the route then crosses the Stewart to the north side and continues for 10 miles to the crossing of the McQuesten River. Thence it goes down the valley to Clear Creek roadhouse, which is located about one and one-half miles north of the Stewart River and the last close connection with this stream. This section is used during the winter by the traffic between Mayo and Dawson, as well as being a part of the overland mail route. It is estimated at about 41 miles in length.

Practically a water grade exists throughout, as the trail follows the low river benches on approximately constant level. The timber is mostly spruce, with a sprinkling of jack pines large enough for the creek bridges ranging from 6- to 40-foot spans.

The creek crossings are already bridged sufficiently well for heavy tractors. The Stewart is crossed over the ice during the winter or by steamboat or rowboat during the time the river is open. To bridge the Stewart would entail a large expenditure, although not involving any construction problems. It is about 800 feet across during medium height of water. At a point about 8

miles downstream a much easier crossing is available. In fact, this is the best crossing on the Stewart River below Frazer Falls, owing to a rock shore on one side, which bears the brunt of the ice shock, and narrow width of the river. At the upper crossing and at places above the McQuesten, gravel and mud banks exist on both sides of the stream, making it more difficult to get permanent foundations.

The McQuesten River is one of the large tributaries that flow into the Stewart. At the crossing it would require a bridge about 225 feet long with the longest span about 100 feet to give the necessary clearance for drift timber and ice floes. The banks of this stream are comparatively low and would require some raising to be above the spring flood levels. The ground formation is of a medium large run of gravel, not frozen except at the surface of the ground above the water level. At a midsummer stage the water is not more than 6 feet deep except in spots. The current is about 4 miles per hour. Ground conditions are very good and gravel can be obtained on a short haul throughout as most of the section is on gravel formation, outcropping or at a depth of a few feet.

Section Clear Creek to the Klondike at Allgold Roadhouse

This section leaves the Stewart waters and runs directly over to the Klondike River. For the first 9 miles the trail climbs gradually, then runs practically level for 13 miles. It then climbs again to a plateau which drops abruptly to the Klondike flats near Allgold Creek. The length is estimated at about 42 miles.

The present trail attains an elevation of about 500 feet above the Klondike River flats. This can be reduced one half, if so desired, by changing the trail more to the sides of the plateau. Practically all timber is spruce, with scrubby cottonwood on the dry benches. The spruce is not of large size and is handy to the road. Fortunately there is not much need for timber larger than required for small bridges and culverts.

Generally the ground is dry with some wet spots at the crossing of the small draws, which will need corduroy for foundations. Gravel can be obtained at many places throughout. Similar to other sections, the grader will be the principal unit of equipment on this run. A good view of the Ogilvie Range can be had at several places along the trail.

Section Allgold to Dawson

At present a rough road exists from Allgold to Hollenbeck's roadhouse, a distance of 8 miles. For the rest of the way a rough auto road extends to within 15 miles from Dawson. The Klondike

River runs close to the present trail all the way. From Allgold the distance is approximately 34 miles along practically a water grade. All timber has been cut except small spruce and cottonwood.

The ground is not good for the first 8 miles out of Allgold. However, lack of drainage is the present worst feature. A good road should be made over this stretch by corduroying some places, grading up high in other places and a general widening of the road around the four rocky bluffs that exist. From Hollenbeck's to Dawson the present road will need to be changed to avoid the wash from the Klondike River. The ground is level and gravel can be had on a short haul over most of the way, and the exceptions are not in long stretches. The last 15 miles into Dawson is at present good enough for any heavy or light traffic.

Section from Dawson to the International Boundary

The country to the west of Dawson may be described as an elevated plateau deeply intersected by water courses descending more or less abruptly towards the main streams and valley bottoms of the Yukon, Sixtymile, and Fortymile Rivers. The present road follows the watershed between the Yukon and above-mentioned rivers for about 65 miles, the grades are very abrupt in many places, the elevation ranges from 3,000 to 4,000 feet, and the winter storms shut off traffic in November or early December. Ground conditions are generally good, as the trail has continued in use for over 25 years with very small expenditure for repairs.

The new route would have to follow lower levels either along the Yukon hillsides or further back in the Sixtymile or Swede Creek valleys, its direction depending on where the Alaskan line would meet the boundary.

Several comparatively small bridges and numerous culverts would have to be figured on, but the crossing of the Fortymile main stream represents the only crossing of any size and this would likely be on the Alaskan side.

APPENDIX E

EXTRACT FROM A REPORT BY MR. DONALD MACDONALD, LOCATING ENGINEER OF THE ALASKA ROAD COMMISSION, OF A RECONNAISSANCE FOR A PACIFIC-YUKON HIGHWAY IN ALASKA

AUTHORITY

Instruction of Major Atkins, January 8, 1931, to investigate the area lying between McCarty (Grundler), mile 90 Richardson Highway, and the international boundary, proceeding by the Goodpaster-Fortymile drainages and returning by the Tanana River, utilizing the subdrainage of Healy River and Mosquito Fork.

PROCEDURE

Engaged packtrain of six horses, packer, cook, and one man, and assembled outfit at Fairbanks June 10. Ascended the Goodpaster to the head and followed the Fortymile drainage to the boundary. Investigated the possibility of connecting with the Sixtymile road on the Canadian side. Returned by way of Chicken, Kechumstuk and the Tanana Ridge to the point of beginning where the pack outfit and two men were released August 12, 1931. Then accepted the public-spirited offer of John Hajdukovich of Tanana Crossing, who proffered passage on his motorboat to Tanana Crossing, charging only for the use of the gasoline and the wages of a man for a few days, and arranged trip by outboard motor to the head of the Tanana. During this trip, having observed the dangers and the cost of transportation up the river, investigated a possible alternate by connecting the Chisana road with Lake Tetlin where distribution of materials direct from Valdez could be effected with downstream haul. This trip was made by back-packing with two Indians to Slana, a total distance of 70 miles. Returned to Fairbanks via the Chisana road and the Richardson Highway, arriving there September 12, 1931. The itinerary and route of these reconnaissances is indicated on map entitled "General Situation", which accompanies this report.[1] Disregarding side trips, a mileage of 550 miles by packtrain, 400 miles by gasboat, 204 miles afoot without packtrain, and 70 miles back-packing a total of 1,224 miles, were traversed.

[1] Map not printed—not incorporated in this extract.

Possible Routes of Access to Alaska

There exist three general routes for the Pacific-Yukon project.

(1) The McCarty-Dawson route, the investigation of which was the primary purpose of this reconnaissance;

(2) The McCarty-Whitehorse route via the right limit of the Tanana;

(3) The Gulkana-Whitehorse route, utilizing the Chisana project.

Information pertaining to all these routes was obtained and will be found in the body of this report.

The McCarty-Dawson Route

The objective of this route, viz, the head of the Sixtymile River near the boundary, which will connect with the existing Dawson-Sixtymile road, may be reached by three routes:

(1) The Goodpaster-Fortymile route, 235 miles;

(2) The Tanana River to Tanana Crossing and thence by the old Abercrombie Trail to Kechumstuk, Mosquito Fork and Walker Fork to the boundary, 240 miles;

(3) A route approximating a due east and west line between mile 90 at McCarty and the actual head of the Sixtymile, 183 miles.

The Goodpaster route, because of its indirection, heavy rock work, long stretches of swamp, and frozen ground, is in the opinion of the locating engineer impracticable. While it apparently offers a line of low gradient, even this condition is deceptive as, in order to partially avoid the adverse conditions above cited, recourse must be had to the high ridges with long ascending and descending grades of difficult development.

Route 2 via Tanana Crossing and the Tanana River is also indirect, being at least 60 miles longer than the shortest route, with no compensating advantages, either economic or structural.

Route 3 from McCarty to the Sixtymile, approximating a due east and west line, is indicated in considerable detail on an accompanying map and condensed profile. Probable grades, ground conditions, and bridge lengths are indicated. Further detailed description is deemed unnecessary. With the exception of miles 60 to 82

and miles 131 to 143, the line will be average construction throughout and will approximate $8,000 a mile for a graveled road 16 feet wide. The crossing of the Goodpaster and the Dennison, the two largest streams, presents no unusual difficulties. The west bank of the Goodpaster affords a natural solid rock abutment. Both the Goodpaster and the Dennison are clear-water streams of confined channel, somewhat resembling the second crossing of Birch Creek on the Steese Highway 14 miles from Circle, and the same treatment is suggested here. Because of forest fires in the Goodpaster region, timber is somewhat scattered, but no difficulty is expected in securing timber for the structure. There is a wonderful stand of timber on the left limit of the Healy at the mouth of one of its largest tributaries, about 12 miles above the mouth and about 3 miles from the projected location. Piling and timbers 60 feet long could be obtained there. It appears, however, that such a long haul for the structural members of the standard design of the Alaska Road Commission for fir Howe truss would indicate steel spans as the most economical structure. Gravel is easily obtainable at convenient points throughout the route, but particularly from the Richardson Highway to the Healy. Assuming three standard wooden Howe truss spans with 100-foot approach, the Goodpaster crossing would cost about $60,000. The Dennison, because of its remoteness, would run to about $70,000. (Unfortunately, a fake mining company has denuded the Dennison of a large part of its available timber. This timber was yarded in and then, with the failure of the project, allowed to rot or float away.)

Then assuming a cost of $8,000 a mile for 149 miles and a cost of $12,000 a mile for 34 miles, this to include all minor structures, the cost of this project would be:

COST ESTIMATE DAWSON-FAIRBANKS ROUTE 3

149 miles at $8,000 per mile	$1,192,000
34 miles at $12,000 per mile	408,000
Goodpaster Crossing	60,000
Dennison Crossing	70,000
Healy Crossing	20,000
Total	$1,750,000

An alternate location from mile 120 and by way of the Mosquito Fork, Chicken Creek, Jack Wade, and Walker Fork would involve at least 10 miles of additional distance, 40 miles of heavier construction by at least $1,500 a mile, and the crossing of the Fortymile below the junction of the Dennison and Mosquito Creek. This would involve about $160,000 total excess.

Disadvantages of Route 3

The apparent objections to route 3 are:

(1) Excessive rise and fall. It is believed that as long as the grades are kept within a reasonable maximum, the directness of the route offsets this condition. The only alternative appears to be the Goodpaster route, and there the possibilities of low gradient are more apparent than real.

(2) The second objection is that from mile 120 the location is away from the existing development in the Fortymile area. The construction of a branch down the Dennison or Liberty Fork would solve this condition to some extent without lengthening the main line. This branch would not be more than 12 miles long and in very good country.

(3) The line passes through a country of no particular scenic interest. This is true of the other routes Fairbanks to Dawson.

It is pointed out that while the Fortymile area is missed, still in the opinion of geologists and prospectors there exists in the vicinity of Mount Fairplay and a lower unnamed mountain at the head of the Sixtymile and Dennison drainages and indicated as unsurveyed on the geological maps, areas that are very promising both in quartz and placer. This country lies dormant because of inaccessibility.

Economic Conditions McCarty-Dawson Route

The economic situation on any of the approaches to the Sixtymile is not particularly encouraging. In the whole Goodpaster-Fortymile area from McCarty to the mouth of the North Fork—a distance of 190 miles—only three men were encountered, and they lived on the lower reaches of the Goodpaster. Two of these men were trappers who did a little prospecting. In 20 years they had sunk about 100 holes without uncovering "pay". The other man was a trapper only. Indications of recent prospecting were found in only one place on the Fortymile, and this was very meager.

In the Fortymile district, comprising Chicken, Jack Wade, Steele Creek, and Walker Fork, there are not more than 50 men engaged in mining. The only large operation is that of H. D. Cowden at Walker Fork, where there are 20 men employed and where equipment and ditching involved in hydraulic operation represents a total investment of a quarter of a million. The work is apparently ably planned, is on good ground, and has ample financial backing. It was stated that a dredge was to be installed next year. Ten miles of proven ground exist below the present workings.

There is some talk of installing a dredge on Jack Wade, depending on a thorough prospecting of the ground this winter. Also a sketchy outfit was making an attempt to secure enough ground in the Chicken Creek camp for large operations. But on the whole the Fortymile has the appearance of a dying camp and there are only half as many people in the camp as there were when the camp was visited 6 years ago.

The McCarty-Whitehorse Route via the Right Limit of the Tanana

(260 miles)

This route, while involving more mileage in Alaska than any of the other routes, is the natural entrance to Alaska from the south and would reduce the total length of the highway from the States about 100 miles. Bisecting Alaska between the Yukon and the Pacific Ocean, it is economically located for the Alaska trunk highway.

Because of construction conditions prevailing throughout the area, costs would probably be lower per mile than on any other project. These conditions are cited as follows:

(1) With the possible exception of the area between Healy and Tanana Crossing and the point where the projected location descends from the ridge below Gardiner Creek and the boundary, soil conditions are very favorable. The country has been burned off by the Indians in their caribou hunts for many years and for over 100 miles is apparently ideal grader ground.

(2) No stream in excess of 50 feet in width exists from Healy River to the boundary, 200 miles.

(3) The Tanana-Chisana River parallels the route and would furnish a fair transportation medium for construction materials.

(4) Low altitudes and light snowfall guarantee a long construction season.

It is assumed that the 260 miles that would be required for this route would cost about $7,500 a mile plus the Goodpaster-Healy bridges, or $2,050,000. While timber is not conspicuously abundant, there would be no difficulty in securing enough for construction purposes and gravel can be secured throughout the length of the route.

Economic Conditions

There are no mining operations at present being conducted in this area. Gold has been found in a number of places, but thus far has not resulted in development. The country is characteristically

a game and fur country. There is a population of 300 natives and a dozen white men, all dependent on fur and game for a livelihood. An Indian reservation has recently been established in the vicinity of Tetlin and the Indian Bureau maintains a school there. These Indians, with the disinterested advice of John Hajdukovich, hunting guide and trader, are rapidly developing into a self-respecting and civilized community. The Episcopal Church has recently revived its mission at Tanana Crossing and does what it can to relieve disease, ignorance, and poverty. Four white traders with posts at Healy, Tanana Crossing, Tetlin, Lake Tetlin, Nabesna, and Scottie Creek supply these Indians with simple essentials. Supplies are brought up by gasboat. The costs, when the dangers of glacial-stream navigation are considered, are indeterminate, but supplies have been landed by contract, Fairbanks to Tanana Crossing, for 5 cents a pound and to Tetlin for 7 cents.

The trip up the river is a very hazardous one. Shallow swift water, constantly shifting channels, rushing glacial river tributaries, all combine to make the transportation of commodities a gamble. Ordinarily 6 days are consumed from McCarty to Tanana Crossing. Above the crossing, transportation is comparatively easier to the Chisana where stumps and sweepers and rapids bar the way. The river channels are very tortuous, being from 2 to 5 miles longer than a straight line.

The scenic values of the route are not what are considered as typically Alaskan. The ridge would afford long views of the Tanana valley and the rolling Dennison drainage, with the peaks of the Alaskan and Nutzotin Mountains from 20 to 40 miles distant on the southern horizon. The upper Tanana or the Chisana is a weird country of immense swampy flats broken by birch ridges, on top of which views stretch into infinity along the drainage. The native population, primitive in the extreme, affords a good deal of color.

Alternate Location

A superficial examination from the gasboat of the left limit of the Tanana between McCarty and Tetlin indicated that the probabilities of an economic location are remote. The glacial rivers and long stretches of swamp land are not promising, and as Tanana Crossing is approached the foothills of the Alaska Range close in to the river, creating for 25 miles a terrain which resembles the Rapids-Paxsons country on the Richardson Highway, only much more confined and rugged. The same torrential stream beds with moving alluvial fans exist and are more numerous.

The Gulkana-Whitehorse Route

The advantages of this route are:

(1) It would be the shortest line from an existing constructed road to the boundary. From the crossing of the Slana River, the present end of construction to the boundary would be approximately 147 miles. Inasmuch as this project extends to Chisana, the gap from that point to the boundary would only be 50 miles.

(2) The location passes through a country of probably the greatest scenic attraction in Alaska, not excepting McKinley Park. It is also full of historic and archeological interest.

(3) It appears that with the great success attending the development of the Whitham properties in the Nabesna, the country is entering upon a development era. This, if further sustained by the investigations of the Geological Survey. The conclusions of the geologists, always marked for their conservatism, are encouraging in the extreme.

(4) As far as the present location from Gulkana to the Nabesna extends, the line is of light gradients and very direct alignment with easy curves. The country will afford a continuance of these conditions for at least 25 miles. Beyond that very little is known. Snow conditions are very favorable, particularly in the highest pass which, although it reaches an elevation of 3,620 feet, is, even in midwinter, almost clear of snow. This snow passes away a month earlier than in lower altitudes.

Supplementary Investigations

A rapid investigation of conditions prevailing on the Canadian side of the line, in order to establish the possibility of tying up the Alaskan project with the Canadian road, was made. It was found that a very rough road terminates some 12 miles from the boundary at the head of Walker Fork. The entire length of this road was traversed afoot. It was found to be 57 miles long (to Dawson). Only the skimpiest of grading has been done; and while the road, following a high ridge throughout its length, is in very excellent material, it is little more than a wagon trail—a pair of ruts. Alignment is good, but gradients must reach 12 to 14 percent in the pitches. The road must reach an altitude of nearly 4,500 feet, and in July snowdrifts were still markedly in evidence. Mr. Cowden, operating at Walker Fork, stated that in transporting his family from his location to Dawson last year, on September 10, was forced to return and get snow track for his caterpillar.

Returning from Dawson, Mr. Holbrook, formerly of Fairbanks, who is now operating a dredge on the Sixtymile, took us in his

car to the end of the road. This was stated to be the first time a car went that far. Twelve hours were required to drive the 57 miles; and the car, because of the naturally good material of which the road is composed, was never stuck.

Because of these conditions, this road would be of little use as a link in the Pacific-Yukon project. A better location at a lower elevation is indicated.

While at Cowden's camp, he suggested the possibility of cooperative action between the Yukon Territory and Alaska to improve, or rather build, a road between his camp and the end of the Sixty-mile road. The distance is about 12 to 14 miles. Only 4 miles of this distance is in Alaskan territory. It appears that a road in good material can be built with a ruling 7 percent grade. Mr. Cowden suggested that equipment could be leased from the Canadians or the construction of the Alaskan end could be contracted by them. The subject was informally discussed with the Gold Commissioner, Mr. MacLean, and he seemed to be favorable towards it.

Batzulnetas-Lake Tetlin Connection

An investigation of the possibilities of constructing a rough road or winter trail from Lake Tetlin to the Chisana road near Batzulnetas was made. This was suggested by the hazards and consequent cost of landing goods from McCarty. From Lake Tetlin, which is located above any bad water, commodities could be shipped for the most part with a downstream haul, and the freight rates from Valdez to Seward and Seward to Fairbanks would be eliminated. I have been informed that freight is now being handled to Slana for four cents a pound from Valdez. Slana is about 10 miles from Batzulnetas, and this point is, by pacing, about 65 miles from Lake Tetlin. Stream crossings are of no consequence and could be negotiated by a tractor, a car, or team, except during heavy storms. About 20 miles of rough grading would make a fair tractor road for winter travel and 30 miles for summer travel. There would be 45 miles of medium clearing. An automobile road would present some difficulties, as there are about 20 miles of frozen ground.

The Goodpaster-Fortymile Route

The Goodpaster is a clear-water stream about 100 miles long and maintaining an average width of 300 to 400 feet for 80 miles of that length. The lower 35 miles is in a valley 2 to 4 miles wide which merges into the wide flats of the Tanana. This valley is completely occupied by the tortuous loops of the river. The sides of the valley consist of irregular ridges penetrating far into the flats. From a point 35 miles upstream to a point 65 miles upstream, the valley narrows down, being only one-quarter to one-half mile in width.

The side-hill slopes are steep and reach an elevation 2,000 feet above the river. They are in large part composed of loose slabby granite ranging from 2 to 10 feet square.

The conditions would necessitate a ridge location from Indian Creek to a point 2 miles above Central Creek. In this distance such bottom land as there is is too low and too wet for road construction. The steep side hill and narrow valley prevent the sun from penetrating and, as a result, glacier ice 2 feet thick was found in the middle of June in many spots. The whole valley is very crooked, much more so than the map contours indicate. Timber is plentiful on the river bars, with spruce predominating. On the side-hill slopes birch is the characteristic growth.

On the upper reaches, the valley widens again and from mile 65 to the summit at mile 99, construction conditions are relatively fair. The approaches to the Goodpaster-Joseph Creek summit, which reaches an elevation of 3,600 feet, are very good. The summit could be crossed from the west with 4 miles of supported 4 percent grade and an increase due to development of one half a mile. On the Joseph Creek side, the drop is somewhat steeper, but a 6 percent grade would be sufficient.

Joseph Creek

The Joseph Creek country is a slight improvement over the Goodpaster. Alignment is much more direct, but other conditions are far from favorable. The creek is about 40 feet wide and shallow for 15 miles, then gains a width of 60 feet and is 3 feet deep at the average stage of water. The right limit contains the most promising country for location, as it is low and rolling and the left limit is lined with cliffs. The country is almost devoid of timber except a light fringe along the river and niggerheads are the predominating vegetation. The only dry ground is a narrow strip along the creek bank and this, from ice marks on the trees, is subject to spring overflow.

Middle Fork

From the junction of Joseph Creek with the Middle Fork at Joseph village (mile 116) the river becomes a stream of much greater volume than the Goodpaster. There is fair going for 3 or 4 miles below Joseph village, and then the country narrows down and from there on a practicable location becomes increasingly impossible. The best ground is wet and with niggerheads and no gravel showing. The river wash is slabby and heavy. Extract from diary pertaining to miles 147 to 162:

Tough day all day. Twelve hours and 6 miles. Canyon most of the way which meant 12 fords in deep water. At mile 151.5 bluff 1,500 feet long and 600

feet high, then heavy slide rock. At mile 153 another bluff 3,000 feet long and about the same height. All this on right limit. Left limit worse. Steep broken ground on either limit too rough and high to support over. River is very crooked and work would all be heavy and hand work throughout. Mile 154 to 162. Traveled 8 miles to go 4. At mile 157 just below the North Fork, there is a canyon which confines the river to a width of 50 feet. Below this are cliffs on both sides 800 feet high. Climbed about 1,500 feet straight up to get over this.

Because of the conditions prevailing in this section and the even more rugged country below Bullion Creek, the only practicable solution is to climb up the ridge some 2,500 feet with a steep grade from the North Fork, crossing the river at the canyon crossing and follow the route taken by the pack outfit to the mouth of the North Fork at the Fortymile River. This line is comparatively direct, for the most part in timber, but reaches an elevation approximately 4,000 feet. A good crossing of the main Fortymile exists below the mouth of the North Fork. It is only 150 feet wide and has rock abutments on both sides. However, from here to Uhler Creek, there is nothing but a series of high cliffs, and the support to the ridge leading to Walker Fork would involve very heavy construction.

Distances given are for the most part based on 250 miles of direct pacing, with constant comparison with the geological maps, and establishing a relation between map scaling and pacing. Elevations are derived from interpolation of the geological maps, as the barometer used would not check within several hundred feet. Throughout the area covered, the geological maps were accurate to an astonishing degree, except in the Tanana country, where the data have been compiled in part from sources outside of the geological survey. Cost estimates are based on experience in the Steese Highway in similar country.

APPENDIX F

LANDING FIELDS FOR AIRPLANES IN NORTHERN BRITISH COLUMBIA AND YUKON TERRITORY

(Compiled from data furnished by Mr. G. C. Woodward, American Consul, Prince Rupert, British Columbia)

Anyox, British Columbia (situated about 90 miles north of Prince Rupert):

While Granby Bay, the harbor in front of Anyox, affords a landing place for hydroplanes there is no available land for airplane landings other than a granulated slag pile which has a sloping surface.

Burns Lake, British Columbia (situated about 317 miles east of Prince Rupert on the Canadian National Railway):

There is a landing place about 1,400 feet in length, which varies in width from 100 to 600 feet. It is situated on the shore of Burns Lake, which is protected water for a distance of 2 miles east and 1 mile west, and is about ¼ of a mile from the railway station and on the main highway. Considerable grading and leveling work was done on this field last year in preparation for the landing of a plane en route to the Yukon Territory, and further work is to be done thereon during the present year.

Dawson, Yukon Territory:

The landing field is situated in the valley of the Klondike River, above the mouth of Bonanza Creek, and just below Jackson Gulch, about 2½ miles from Dawson. It is about 1,600 feet long and has a runway of about 300 feet in width. The field itself is considerably wider than the runway. During the winter the sand bar in front of Dawson is used.

Hazelton, British Columbia (situated 179 miles east of Prince Rupert on the Canadian National Railway):

There is a suitable airplane landing field at this place which has been used on numerous occasions for landings. A description is not at present available.

Mayo, Yukon Territory (situated on the Stewart River, a tributary of the Yukon River, about 100 miles from its mouth):

There is a four-way landing field, with a good hard surface, 700 feet wide by 1,900 feet long. In addition, there is a good hard straight stretch of river beach ¾ of a mile in length, which is usable after July 15, after high-water season is over. The Stewart River in front of Mayo and many lakes in that vicinity are suitable for hydroplane landings.

Ocean Falls, British Columbia (situated approximately 200 miles south of Prince Rupert):

There is a harbor about 1 mile long and ¾ of a mile in width which affords an opportunity for landing hydroplanes and has been used thereby on several occasions. There is no level land in the vicinity suitable for airplane landings or which could be made into a landing field.

Prince George, British Columbia (situated about 468 miles east of Prince Rupert on the Canadian National Railway):

There is a landing field ½ mile west of the city 1,800 feet in length and 500 feet in width, which has been used on several occasions by airplanes. In addition hydroplanes can land on the Fraser River at this place and on Tabor Lake about 9 miles from town.

Prince Rupert, British Columbia (situated on Keen Island, near the mouth of the Skeena River, and the terminal of the northern branch of the Canadian National Railway):

There are no prepared landing places available. Planes have landed on the exhibition grounds, which are indicated by a fair-sized building, light yellow in color, and adjacent to the civic reservoir. The surface, however, has not been leveled except to provide for sports such as football, baseball, et cetera. Hydroplane landings are made alongside the several floats or wharves on the water front. In stormy weather landings are usually made either at Cove Bay, at the north end of the city, or at Digby Bay, Digby Island, at the entrance of the harbor, at which place is located the government wireless station. Cove Bay is preferable as it is accessible to the city.

Smithers, British Columbia:

Two miles west of Smithers is Lake Kathlyn, which is about 1½ miles square, may be easily approached from all angles, is fairly deep in the center, but shallows out considerably toward the shore.

Two miles southeast of Smithers is Lake Seymour, 1 mile long, ¼ mile wide, very deep, and with timbered approaches.

About 2 miles northeast by east is a farmer's field, occasionally used for land planes, but it is often under cultivation and unsuitable for landing purposes.

About 2 miles east of Smithers, near the Bulkley River, is a landing field which the Aviation Bureau of the Smithers Board of Trade is trying to improve and develop into an airport.

Stewart, British Columbia (situated at the head of Portland Canal, approximately 125 miles north of Prince Rupert):

The following is extracted from a letter received from the Board of Trade of that place:

Stewart: There is a large natural harbor with width of almost 2 miles assuring large water area for safe landing and can be used with safety at all times of the year, there is also unoccupied fore-shore with a width of 2 miles and length of almost 1½ miles.

Stewart vicinity:

Meziadin Lake, 32 miles north and east of Stewart, length about 20 miles, average width 2 miles. Bowser Lake, 40 miles due north Stewart, length 18 miles, average width about 2 miles. Silver Lake, 20 miles northwest Stewart (Salmon River watershed) length 1 mile, width ½ mile. Tide Lake, 30 miles northwest (Salmon River) length 5 miles, width ½ mile. Summit Lake, about 25 miles northwest Stewart (Salmon River) length 3 miles, width ¼ mile.

Terrace, British Columbia (situated on the Canadian National Railway, about 96 miles east of Prince Rupert):

The following is extracted from a letter received from the board of trade of that place:

1. A pasture situated at the eastern boundary of the municipality nearly ½ a mile in length and from 100 to 300 yards wide, and is situated between the main highway and the Canadian National Railway. Very little expense would be required to extend its length by 300 to 500 yards.
2. An area of about 1,000 acres of flat land located about 2 miles north of Kalum Lake and nearly 30 miles from Terrace. This land is flat and only needs brush clearing.
3. An undetermined though large area of jack-pine flat which has been burnt over and will need stump-clearing, situated some 5 miles from town on the Lakelse side of the Skeena River.
4. Kalum Lake, 7 miles long and about a mile broad. Twenty miles from Terrace.
5. Lakelse Lake, 13 miles south of Terrace and about the same size as Kalum Lake.

Vanderhoof, British Columbia (situated about 400 miles east of Prince Rupert on the Canadian National Railway):

There are numerous fields in the immediate vicinity of the town which are available for landing places but not especially prepared for the purpose. There is also the Nechako River, which is sufficiently wide at this point for hydroplane landings, and, as well, two lakes, Tachio and Noelki, respectively 5 and 7 miles distant and about 6 or 7 miles in length and 1 mile in width. These landing places are on good motor roads.

Whitehorse, Yukon Territory (situated near the head of navigable waters of the Yukon River and at the terminal of the White Pass and Yukon Railway):

The Dominion Government has set aside a large area of land for aviation purposes. This is at present being used by several planes operating between Whitehorse and interior points such as Mayo, Dawson, et cetera. A usable portion of the field has been surfaced for these planes, and the owners of the planes have erected a permanent hangar. Further field work will be done this year.

Draining into the Yukon River, above Whitehorse, are Bennett, Tagish and Atlin Lakes, and 30 miles north of the town is Laberge Lake, all of which are suitable for hydroplane landings.

While it is understood that there is a supply of airplane fuel and oil at Mayo and Whitehorse, Yukon Territory, and Prince George, British Columbia, it is possibly advisable to make arrangements in advance at the other places named. At all places referred to there is a reasonable supply of motor gasoline and oil and usual garage repair facilities.

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MAP SHOWING RELATION OF A PROPOSED ROAD BETWEEN BLAINE, WASHINGTON, AND FAIRBANKS, ALASKA, WITH PRINCIPAL INTERSTATE CONNECTIONS AND THROUGH ROUTES OF THE UNITED STATES FEDERAL-AID HIGHWAY SYSTEM AND WITH THE PRINCIPAL CONNECTIONS NOW BEING CONSTRUCTED IN MEXICO AS A PART OF THE NATIONAL HIGHWAY SYSTEM.

LEGEND

1. SONORA
2. CHIHUAHUA
3. COAHUILA
4. NUEVO LEÓN
5. TAMAULIPAS
6. SINALOA
7. DURANGO
8. ZACATECAS
9. SAN LUIS POTOSÍ
10. VERA CRUZ
11. NAYARIT
12. JALISCO
13. GUANAJUATO
14. QUERÉTARO
15. HIDALGO
16. PUEBLA
17. COLIMA
18. MICHOACÁN
19. MÉXICO
20. MORELOS
21. GUERRERO
22. OAXACA
23. TABASCO
24. CAMPECHE
25. YUCATÁN
26. CHIAPAS
27. TLAXCALA
28. AGUASCALIENTES
29. DISTRITO FEDERAL
30. BAJA CALIFORNIA

Scale 1/10000000

Approximately 158 miles to 1 inch

100 0 100 200 300 400 500 Miles

100 0 100 200 300 400 500 Kilometers

PRINTED BY U. S. GEOLOGICAL SURVEY

MAP

TO ACCOMPANY REPORT OF SPECIAL COMMISSION TO STUDY A HIGHWAY FROM NORTHWESTERN UNITED STATES TO ALASKA

Scale

10 0 20 40 60 80 100 150 200 MILES

Note – Preferred route shown thus ——

1933

177403—33. (Follows p. 115)