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58TH CONGRESS, } HOUSE OF REPRESENTATIVES. { DOCUMENT
3d Session. } No. 192.

WAGON ROAD FROM VALDEZ TO FORT EGBERT, ALASKA, AND MILI-
TARY TRAIL BETWEEN YUKON RIVER AND COLDFOOT, ALASKA.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, A PRELIMI-
NARY REPORT OF SURVEY AND ESTIMATE FOR A WAGON
ROAD FROM VALDEZ TO FORT EGBERT, IN ALASKA, AND OF
A MILITARY TRAIL BETWEEN THE YUKON RIVER AND COLD-
FOOT, ALASKA.

JANUARY 5, 1905.—Referred to the Committee on Appropriations and ordered to
be printed with illustrations.

WAR DEPARTMENT,
Washington, January 3, 1905.

SIR: I have the honor to transmit herewith a letter from the Chief
of Engineers, United States Army, dated December 29, ultimo, sub-
mitting, pursuant to the provisions contained in the army appropri-
ation act approved April 23, 1904, preliminary report of a survey
and estimate for a wagon road from Valdez to Fort Egbert, on the
Yukon River, Alaska; also for a survey for a military trail between
the Yukon River and Coldfoot, Alaska.

Very respectfully,

WM. H. TAFT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 29, 1904.

SIR: The army appropriation act approved April 23, 1904, con-
tained provisions appropriating \$25,000 for a survey and estimate
for a wagon road from Valdez to Fort Egbert, on the Yukon River,

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Alaska, and \$2,500 for a survey for a military trail between the Yukon River and Coldfoot, Alaska, both to be made under the direction of the Secretary of War.

I have the honor to forward herewith, for transmission to Congress, the preliminary reports of both of these surveys, each bearing date of December 15, 1904, submitted by Maj. John Millis, Corps of Engineers. There being but one map with both of these reports, they are submitted together.

Very respectfully,

A. MACKENZIE,

Brig. Gen., Chief of Engineers, U. S. Army.

Hon. Wm. H. T. FT.

Secretary of War.

PRELIMINARY REPORTS, WITH ESTIMATES, FOR WAGON ROAD FROM VALDEZ TO FORT EGBERT, ALASKA, AND FOR A MILITARY TRAIL BETWEEN THE YUKON RIVER AND COLDFOOT, ALASKA.

SURVEY, WITH ESTIMATE, FOR WAGON ROAD FROM VALDEZ TO FORT EGBERT.

UNITED STATES ENGINEER OFFICE,

Seattle, Wash., December 15, 1904.

GENERAL: I have the honor to submit preliminary report of survey and estimate for wagon road from Valdez to Fort Egbert, Alaska, as follows:

I was directed to make the survey, also that for the military trail from the Yukon River to Coldfoot, by telegram from the Chief of Engineers of May 13, 1904, and also by letter of the same date. Provision for the survey was made by the army appropriation act approved April 23, 1904, as follows:

For a survey and estimate of cost of a wagon road from Valdez to Fort Egbert, on the Yukon River, to be made under the direction of the Secretary of War, twenty-five thousand dollars, to be immediately available; said survey and estimate herein provided shall be submitted to Congress at the earliest practicable day.

Upon receipt of the instructions Mr. J. M. Clapp, assistant engineer under this Office, was detailed to have immediate charge of all preparations for both surveys and subsequently to be in immediate charge of the field work of the Valdez-Fort Egbert survey. For the latter work four parties were organized, each to cover approximately 100 miles of the proposed road. Two of these parties and three men for the Coldfoot survey, 25 men in all, sailed from Seattle May 31, 1904, for Skagway. From the latter point they proceeded by way of the White Pass and the upper Yukon to Fort Egbert, and then took the field for the work. The remaining two parties, 26 men with 25 horses, sailed June 1, 1904, for Valdez, and started in on the survey from that end.

Mr. Clapp was directed to traverse the whole line in person, so as to be better able to supervise the operations of all the parties and to correlate the results of their work, and this he did.

Field work was completed about August 14, 1904. A portion of the force returned by way of the upper Yukon and Skagway and the remainder by vessel from Valdez. The last parties to arrive reached Seattle on September 29, 1904.

Mr. Clapp prosecuted the work with great energy, and his success in accomplishing the survey as contemplated by the law and the instructions of the Chief of Engineers is highly commendable. The respective chiefs of party and the various other employees are also entitled to great credit.

Special acknowledgment is also due to the commanding general, Department of the Columbia, his adjutant-general, the officers of the quartermaster's and signal departments on duty in the department, and the commanding officers and post quartermasters at Fort Egbert and Fort Liscum for the assistance rendered. Without their assistance it is very doubtful if the survey could have been completed in one season.

Mr. Clapp makes a preliminary estimate of \$3,500 per mile, or, in round numbers, a million and a half dollars, as the cost of constructing the entire road, 430 miles long. His report is herewith.

Very respectfully, your obedient servant,

JOHN MILLIS,
Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

REPORT OF MR. J. M. CLAPP, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Seattle, Wash., December 10, 1904.

MAJOR: I have the honor to submit the following report of a survey for a military wagon road between Valdez and Eagle, Alaska, made during the past summer:

On May 16, 1904, I was relieved from my duties in local charge of the Lake Washington Ship Canal and orally instructed to immediately begin the preparations for a survey for a wagon road between Valdez and Eagle and for a survey of a trail from the Yukon River to Coldfoot, Alaska.

By your direction Mr. Oscar A. Piper, Mr. Edwin A. Tyler, Mr. C. E. Hansen, and Mr. Walter Barrow were detailed to assist me in the compilation of such information as I might find useful and to assist generally with the work.

Lists of equipment were prepared and made ready for requisition. All available literature, including the reports of Major Abercrombie and his assistants on the exploration in Copper River Valley, 1898-99, and on the construction of a military trail across Alaska, were read. Reports of the Geological Department, extracts from the Congressional Record, and other literature of a varied nature which were supplied from the Office of the Chief of Engineers were read. Maps were studied and some prepared to take along.

To be correctly informed as to the present conditions, telegrams of inquiry were forwarded to the commanding officers at the posts of Fort Liscum and Fort Egbert. Valuable information was obtained from these officers. It was learned that at Fort Egbert the United States maintained suitable pack animals and equipment which if properly authorized could be utilized in transporting the supplies and equipment for three parties from that point. From Fort Liscum it was learned that ten equipped animals could be spared for the season for the assistance of transportation from that point.

The department commander issued orders through the proper channels to the commanding officers at Forts Liscum and Egbert to turn over to the United States Engineer Department certain equipped pack animals and to render all practical assistance to the survey parties.

Having obtained this valuable assistance, the work of completing the prepa-

4 WAGON ROAD FROM VALDEZ TO FORT EGBERT, ALASKA.

rations was undertaken. It was found that there would be required an equipped pack train of 25 animals in addition to those loaned by the department commander.

* * * * *

The general plan of campaign was then submitted and approved by you, as follows:

One small party was to go to Fort Egbert and there obtain 8 equipped pack animals and all supplies needed, except instruments, and from there proceed to a point on Yukon River near its confluence with Dall River and survey and mark a trail from Yukon River to Coldfoot, a point on the Upper Koyukuk River, as contemplated by the law.

The commanding officer at Fort Egbert was to purchase supplies necessary for 6 men for a period of ninety days, he having kindly volunteered to do so.

The Valdez-Eagle road survey was to be divided into two divisions, and each division into two sections.

Division No. 1 was to have its base at Valdez.

Division No. 2 was to have its base at Eagle.

Sections 1 and 2 made up division No. 1.

Sections 3 and 4 made up division No. 2.

Section 1 was to begin at Valdez and survey the coast mountain section to Copper Center, a distance estimated at about 100 miles.

Section 2 was to begin at Copper Center and survey northward and meet section 3 coming from the north, an estimated distance of 100 miles.

Section 3 was to begin at Ketchemstock and survey southward to meet section 2 coming from the south, an estimated distance of 100 miles.

Section 4 was to begin at Eagle and survey south to Ketchemstock, an estimated distance of 100 miles.

Division No. 1 was to leave Seattle and proceed to Valdez, Alaska, with its entire equipment, including 25 pack animals.

Division No. 2 was to leave Seattle and assemble at Eagle, Alaska, with its entire equipment, save the pack animals.

Equipment.—Your instructions were that all Alaska parties were to be ready to leave Seattle promptly by June 1, that economy was to be practiced in the requisitions for equipment, and all expenses kept to the lowest possible limit. The selection of equipment and supplies involved a most studied list, which was finally adjusted, approved, and the articles assembled. A complete set of instruments was of necessity to accompany each section. Two complete sets were available, and the purchase of the additional sets meant the expenditure of approximately \$1,000. This included one spare transit for use in case of accident. The full expenditure was not made necessary, as instruments were rented from some of the engineers who were employed to assist with the survey. Camp equipment for both divisions as well as subsistence stores were obtained at Seattle and freighted to the supply bases.

The undertaking was to be in charge of one engineer, to be designated before the date of sailing. He was to make the trip over the whole route between Valdez and Eagle and to direct the survey work through his assistants in charge of sections, using therefor the military telegraph as might be necessary. The Coldfoot work was to be in charge of one man, who would be with the party.

On May 30 the charge of the Coldfoot survey was given to Mr. Oscar A. Piper, an employee of the engineer department for this district, and the writer was relieved of all further work with this party, the preparations having been completed. About this same date the assistants to have charge of sections were determined upon as follows:

Section 1.—Mr. A. B. Lewis, an engineer of Valdez, Alaska, who furnished a part of the instrumental equipment, was assigned to the charge of this section. Mr. E. A. Tyler, an employee of the engineer department for this district, was his principal assistant.

Section 2.—Mr. W. L. Goodwin, an engineer of Seattle, was assigned to the charge of this section. Mr. R. W. Sweet, of Seattle, who furnished part of the instrumental equipment, was second in charge of this section.

Section 3.—Mr. A. Wold, an engineer of Tacoma, and a former employee of the engineer department, was assigned to the charge of this section. Mr. John Bernard, of Tacoma, was his chief assistant.

Section 4.—Mr. E. G. Hunt, a civil engineer and surveyor of Aberdeen, Wash., was assigned as in charge of this section and designated as the principal assistant of the engineer in charge of the whole work, and whom he would have succeeded in case of necessity. Mr. Hunt was assisted by Mr. R. W. Fulton.

The preparations for the Coldfoot party and division 2 were completed on

May 30 and 31, respectively, and on the latter date they left Seattle on the steamer *Humboldt* for Skagway, en route to Eagle. On June 1 the preparations for division No. 1 were completed and on the evening of this date it left Seattle on the steamer *Excelsior* for Valdez. On June 1 the writer was instructed to take charge of the Valdez-Eagle wagon-road survey, and he accompanied division 1 to Valdez.

After a remarkably smooth voyage division 1 arrived in splendid condition at Valdez on June 11. On the way up Mr. C. E. Hensen, who had charge of the transportation train, had the pack saddles all fitted with pads, sling ropes, cinches, etc., in readiness to fit to the horses. The supplies and equipment were unloaded from the steamer and removed to temporary camp in a vacant hotel at Valdez, where that belonging to each section was separated. The animals were rested from noon June 11 until morning June 14 in a large corral belonging to Mr. James Fish, mail contractor, who kindly placed it at my disposal without charge. In the meantime the saddles were adjusted to the horses' backs, and some minor bruises and rubbings received by the horses on shipboard were dressed and treated by the packers.

A slight change in the plan of campaign was made before I left Valdez in that section 2 was to begin its work at Tonsena instead of at Copper Center, as originally planned. This was thought advisable on account of the coast mountain section being rough and requiring more time to survey.

On June 20 section 2 began its work at Tonsena.

On June 13 section 1 began operations at Valdez. I remained with this section until 10 a. m., June 15, when in company with Mr. Lewis, who was in charge of this section, I took saddle horses and rode over a part of the route to be surveyed by section 1, including that part known as "Keystone Canyon." Mr. Lewis returned to his camp from the upper end of the canyon after receiving my instructions, and I proceeded on to overtake the outfit of section 2.

The winter trail by way of the creek bottom was impassable. Many snow banks were crossed along the summer trail, which follows along the shaded side of the valley of Ptarmigan Creek and Tsina River. Crossing the snow banks was very fatiguing to the animals. Many of them sank deep into the snow, requiring to be unpacked to extricate them, while others slid or rolled down the hills. One unfortunate mule rolled and slid fully 200 feet. The small feet of the mules caused them a great deal of extra labor in snow banks and at soft places. While all this was fatiguing to the animals I must mention that the men waded the cold glacial streams, four in number, soon after leaving Valdez, and bore the unpleasantness uncomplainingly. The trail was wet and muddy most of the distance, and on the sixth day out everybody walked 18 miles to Tonsena.

Section 2 pushed its work rapidly along, the 13 animals with it being barely able to keep the camp advanced. The line was produced to Copper Center on June 28. On July 2 camp was moved across the Tazlena River, 8 miles north of Copper Center. On July 3 Chief Packer Crane reported with the balance of the outfit belonging to section 2, having made a remarkably quick trip to Valdez. On July 7 this section with its entire outfit went into camp at Dry Creek, a point 40 miles north of Tonsena.

On July 8, I, with one packer and Mr. Jasper Wilson, son of the Secretary of Agriculture, started for Eagle, taking with us four horses, two of which carried our camp supplies and blankets. Mr. Wilson, who was making the trip across Alaska in the interest of the Agricultural Department, requested to be allowed to accompany me across to Eagle. He reached my camp on July 3 and was shown every courtesy. Mr. Wilson made himself useful and assisted very materially with the labors incidental to the trip. His assistance allowed me more time to make observations on and away from the trail.

At Chestochena on July 9 I got a saddle horse, which Lieutenant Orchard, U. S. Army, the new quartermaster at Liscum, kindly placed at my disposal, and pushed on with my train of five horses. Here I learned that section 3 had begun operations on July 8; that the pack train had returned to North Fork for the balance of the outfit, and that the section would be delayed some until its return. There were 21 animals in the train. I arrived at Mentasta Indian village the evening of July 12, and at Tanana River crossing the afternoon of July

15. Here I was delayed twenty-four hours by the horses straying. On the 16th the horses were taken across the river by swimming. At this point it is about 500 feet wide and from 5 to 12 feet deep.

* * * * *

On July 22 I camped at Ketchemstock, and on the 24th met Mr. Hunt at North Fork. He reported his camp at the mouth of Hutcheson Creek, 5 miles away, whither he had moved it a few days previously by small boats. He had been making satisfactory progress, and had found a good line with easy grades and one presenting no very great engineering difficulties. His progress had been delayed some by the pack train and the poor trail. Mr. Hunt explained to me at length the route his survey followed, and estimated he would reach Ketchemstock with his line about August 15.

On July 25 I left North Fork and proceeded along the military trail, which, while practically paralleling the survey, follows the ridges and saddles of the Forty Mile Hills, instead of the valleys, to Eagle. The elevations of the valleys crossed average about 2,000 feet above sea level; those of the saddles vary from 3,000 to 4,500 feet above sea level, and those of the ridges vary from 3,200 to 5,500 feet above sea level. The climb from valley to ridge is in many places most steep and dangerous. Apparently the object of the trail following the altitudes was to keep above timber line (about elevation 4,000), where the traveling would be over the barren rocky country, and allow the traveler to find his way with less difficulty than by the way of the valleys.

On July 28 I arrived at Eagle.

* * * * *

After resting the horses for three days I started back over the trail for Valdez. On the night of the 3d of August I camped at North Fork. On the 4th I remained at North Fork on account of the heavy rain which fell all day long. On the 5th the camp of section 4 was passed 15 miles up Hutcheson Creek. Ketchemstock was reached August 7 and Tanana August 11.

The trail from Tanana to North Fork as I proceeded north, while not a good one, was a fair Alaskan trail. On my way south, however, it was about as bad a one, I believe, as it was possible to find in Alaska. The animals mired in places, requiring assistance to extricate them. In other places it was necessary to use care in picking a trail that was firm enough to bear the horses' weight. Frequently that usually traveled was abandoned and the horses led through the timber to avoid trouble in passing the worst places. Fully 50 per cent of the distance was exceedingly bad. At Tanana Crossing I telegraphed the operator at Valdez for the sailing dates of steamers from Valdez for Seattle, and found that it would be impossible to catch a steamer before the 16th of September. Here also I caught up with section 3's pack train, which had come back for the rear of that outfit. I camped with section 3 on the night of August 12, 15 miles south of the Tanana River. On August 13 section 3 moved its camp to Mica Creek, 22 miles south of the Tanana, and on this same date the camp of section 2 was moved to Mica Creek. About 5 p. m. on this date the survey lines of the two interior sections met at a point 2 miles south of Mica Creek, having surveyed 250 of the 430 miles of main line between Valdez and Eagle. Of this length section 2 surveyed 165 miles.

On Sunday, August 14, both sections rested at Mica Creek. The animals were carefully examined and cared for and preparations made for the return journeys. The animals borrowed from Egbert were to return there, and the outfits for sections 2 and 3 were to return to Valdez with our own train. The worn-out and useless articles were abandoned, thereby reducing the equipment by their weight. On August 15 sections 2 and 3 started south for Valdez.

The frost had made its appearance and had virtually taken the nutriment from the grass. This worked a hardship on the animals while going through the mountain passes, and the weaker ones showed its effects.

The outfit reached Chestochena on August 20, with one horse nearly played out and several little better off. Here the animals were rested for three days, the weak ones being fed dry hay and grain, which I obtained from the Government cache at this station. During this time both sections were engaged in running 20 miles of alternate lines to try and eliminate a swampy route taken by the former line. That part of Copper River near Chestochena was abandoned at this time also. The mouth of Tolsona River was reached August 24. Here another halt was made, during which time the horses again rested in good pasture. Both sections were engaged here in running and exploring new routes to improve upon the line already run and which followed closely the swampy military trail. A much drier and better line was found and surveyed. On August 28 camp was moved to a point 6 miles north of the Gokona River, and

the line which started at the Tolsona River was produced southward to the Gokona, where it was tied on to the main line on September 1. Over 30 miles of alternate lines were run between Chestochena and Gokona. On September 1, the horses having been pretty well rested and the two interior sections having completed their duties, the return march was resumed. Copper Center was reached on September 3 and Valdez on September 9.

At Mentasta on August 17 I received telegrams from Mr. Hunt and Mr. Lewis, informing me that each had completed his line and joined that of the adjacent section on August 14; thus the survey of the whole main line was wound up at practically the same time. Section 4 was to return via Eagle. I had instructed Mr. Hunt, in charge, to survey a cut-off line about 15 miles long as he returned to Eagle, provided he could find practical grades. This was done and a saving in distance made of about 12 miles. Mr. Hunt, with his section, reported at Seattle on September 15.

Section 1 had obtained an 8 per cent grade line over Thomson Pass and had reported it practicable to find a 5 per cent grade. I had intrusted Mr. Lewis, in charge, to actually run the 5 per cent grade line over the pass as he returned, to get some additional notes at the canyon, and to run a line to connect Fort Liscom, which would show the eastern end of Valdez Bay. This work was completed on September 9, and on the 10th his outfit came to Valdez and went into camp. The next nine days were spent in awaiting a steamer for the States, settling up the business of the undertaking, and in computing the coordinates for the transit lines for sections 1, 2, and 3. On September 19 the steamship *Santa Clara* sailed from Valdez with sections 1, 2, and 3 on board, and arrived at Seattle on September 29.

The animals taken to Alaska were disposed of as follows: Twenty-one horses were turned over to the quartermaster, Fort Liscom, as directed by telegram of September 9 from Seattle office. One horse was drowned while swimming Tazlena River. Three horses were abandoned, having strayed from the herd. Those turned in to the quartermaster were used in carrying out the President's order to transport 10,000 rations to Copper Center to be used in supporting the Indians there during the winter.

DESCRIPTION OF THE TERMINI, THE COUNTRY INTERVENING, THE MILITARY TRAIL,
AND THE ROUTE OF SURVEY.

The termini.—The terminal points of the survey as authorized by Congress are Valdez, on Prince William Sound, North Pacific Ocean, and Fort Egbert, near Eagle City, on the Yukon River. The route surveyed lies wholly in American territory throughout its full length of 427 miles.

The town of Valdez has a population estimated at about 1,000. It is located on the northeast side of a perfectly landlocked, ice-free harbor, known as Port Valdez, an arm of Prince William Sound. The geographical position of Valdez is: Latitude, 61° 07' north; longitude, 146° 13' west.

Prince William Sound is an immense arm of the North Pacific Ocean, exceeding in area the famous Puget Sound of the State of Washington, and is always accessible from the open sea. Excessive depths of water are found in this sound, but there are numerous roadsteads and harbors within its boundaries. One of these harbors, known as Port Valdez, connects with the sound by an entrance channel about a mile wide and of unknown depth. Vessels can always enter the port, but during snow storms or fog it might be dangerous to navigate it. A system of lights and fog signals would certainly aid navigation here.

After passing through the entrance, known as the Narrows, and which is located at the extreme western end of the port or bay, vessels turn abruptly eastward and enter a bay 12 miles long and whose average width is about 3 miles. This bay is perfectly landlocked and would accommodate many vessels. Its depth varies from 10 to 140 fathoms and might prove troublesome in the matter of anchorage for vessels unprovided with cables of great length. The town of Valdez is located upon the terminal moraine of the receding Valdez glacier. The flood plane of the glacial stream surrounds the town on its north, east, and west sides. The Valdez Bay lies to the south. The shores of the bay are generally bold, and high hills, which might well be termed mountains, rise almost from the water's edge. The scenery is rugged and picturesque.

From the eastward Lowe River enters the bay. This is an unimportant stream, usually fordable anywhere, and has a normal width approximating

100 feet. During the rainy times its flood plane has a width varying from 75 feet at the canyon to a mile and a half at a point 5 miles from salt water. The course of the river is approximately 20 miles in length.

The Valdez glacial stream enters the bay from the north, has a normal width of about 100 feet, and is fordable except during rain storms or during hot weather. Its flood plane varies from one-half to 1 mile wide. These two streams are the only important ones finding outlet into Valdez Bay.

Eagle City has a population of about 500 people. It is located upon the left bank of the Yukon River, about 1,475 miles from its mouth. Its elevation is about 900 feet above mean sea level. The town site is a very pretty one and well drained. Its formation is sandy loam soil, and upon it vegetables and grasses are successfully cultivated. Adjoining the town is the beautiful two-company post, Fort Egbert, which borders on the Yukon River and Mission Creek. The Alaskan headquarters for the Signal Corps is located here. The Yukon has a width at Eagle estimated at 1,000 feet. Lying in front of the town is an island which I was informed was rich in gold. During the last winter prospecting was done, and the dirt taken out averaged 30 cents to the pan. In consequence of this the territory was staked for some distance up and down stream from the island. The business men of Eagle, with whom I talked about it, informed me that it was certainly a good prospect, but I am unable to state that this is so. Beyond the Yukon the flats extend for a long distance. In response to my inquiry I was told that very little was known of the hill country, as prospectors had not penetrated the interior in this vicinity more than 100 miles; that it took one whole season to take a supply of food that far sufficient to prospect only a few months the following season, and the expense incident to it was so great as to make any showing impracticable.

Communications.—Valdez is the northern terminus of the Seattle-Valdez cable, through the medium of which Alaska is brought in telegraphic communication with the States and the world by an all-American line.

A military telegraph line connects Valdez with Eagle, where connections are made over the Canadian government's line via Ashcroft with the outside. Branch telegraph lines lead from the Valdez-Eagle line to Fairbanks, Fort Gibbon, and St. Michael.

The deepest draft merchant and war vessels can enter Valdez Bay and anchor. A fortnightly steamer service is maintained with Seattle. Eagle City is reached during the summer months by river steamers from St. Michael at the mouth of the Yukon River and by the river steamers from the upper Yukon ports as far as White Horse, the inland terminus of the White Pass and Yukon Railway, which leaves salt water at Skagway. There is a military trail between Valdez and Eagle, over the greater part of which the Government maintains a mail route throughout the year. The mail leaves both Valdez and Eagle on the 1st and 16th of each month. The contractor can refuse all over 200 pounds mail per trip. In summer the mail is carried on a pack horse and is relayed five times. In winter it is carried on sleds hauled by dogs, and sometimes it is hauled by men. There is also a winter mail route between Valdez and Fairbanks, which follows along this trail as far as the Gulkana River. The distance between Valdez and Eagle by the military trail is 412 miles; by the mail route it is longer.

The country between Valdez and Eagle.—Valdez to Tonsena: Leaving Valdez for the interior, a traveler first encounters a glacial stream lying close to the town of Valdez. To cross this stream one must wade its several branches—there are from two to five—or wait till some friendly disposed person on horseback comes along and asks you to ride behind his saddle. Leaving this stream behind, one enters the Lowe River Valley and follows a rather extensive bottom land for about 5 miles. This bottom land is partly covered with timber and partly native meadow. The alder and cottonwood trees grow to a fairly large size, and the native red top grass (*Calamagrostis langsdorffii*) grows luxuriantly. Leaving the bottom land, the trail crosses one channel of the Lowe River and follows along the flood plane of this river for about 4 miles to a point where it recrosses the river channel and enters another bottom well covered with spruce trees. Here a road house is maintained, known as Camp Comfort, 10 miles from Valdez. Above Camp Comfort the flood plane of Lowe River is followed to the gorge known as Keystone Canyon, 13 miles from Valdez. The canyon has a length of about $3\frac{1}{2}$ miles, is flanked on its southeastern side by a wall nearly vertical and rising to a great height for a part of its length. On its western side the walls are of varying slopes and heights, and benches occur frequently, along which a trail or road would be located. Good alignment can be

obtained. There are several points where the work will be heavy, but they are short. At one or more points slide rock would be removed from the south side of the canyon and the road constructed with it along the wall on the north side of the canyon. Through the canyon the work will all be rock, mostly slate formation, either solid or slide. That in place can be easily drilled.

At the upper end of the canyon the flood plane of the Lowe River again widens into what is known as Dutch Flat. This plane occupies the principal part of the flat for some distance above the canyon. A ravine joins the river just at the head of the canyon. Here snowslides occur each winter, which pile up to great heights and would undoubtedly make the cost of maintaining any road crossing it excessive. To obviate this it will be necessary to cross the river at the head of the canyon by a bridge approximately 150 feet long and then cross back to the north side of the valley on trestle bents a short way above the canyon, where the benches and bars make any construction cheaper than the rock sidehill on the south side. As the upper end of Dutch Flat is approached the valley widens some and the flood plane narrows, the river eventually being confined between banks separated by about 60 feet. At the upper end of Dutch Flat there are two routes into the Copper River Valley. One of these leads over the divide known as Marshall Pass, the elevation of which is about 1,700 feet above sea level. The other leads over the divide known as Thomson Pass, the elevation of which is 2,750 feet above the sea. Following over Marshall Pass, the traveler would find himself soon in the immediate valley of Copper River, about 100 miles from its mouth and above the obstructions to navigation known as The Cataract, Miles Glacier, Childs Glacier, etc.

Following over the higher pass, however, and the one at present followed by the military trail and the survey, one finds himself traveling over a very broken country, rocky, and in places precipitous, down the narrow valley of Ptarmigan Creek to its junction with the Tsina River; thence down this narrow broken valley to its junction with the Kanata River, where the two last-named rivers form the Teikhell River. From this point, distant from the summit of Thomson Pass 21 miles and 1,650 feet below it, one follows up the valley of the Kanata to its headwaters, crosses a low divide at Ernestine into the valley of Mosquito Creek, a tributary of the Tonsena River.

Here one has the choice of two routes—one following the river, the other following over a rather high divide known as Kimball Pass into the valley of Bernard Creek, also a tributary to the Tonsena River. Mosquito Creek joins the Tonsena about 5 miles above the mouth of Bernard Creek. I made the trip over both routes and feel satisfied that the survey down the valley of the Mosquito Creek follows the one along which a road would be built.

At the summit of Kimball Pass, along the present summer trail, the great valley of the Copper River comes into view, and is indeed a magnificent relief from the rocky, broken, narrow, gorge-like valleys followed all the way practically from Valdez.

Copper River Valley.—This immense tract of country extends north and south fully 100 miles and east and west over 100 miles. The divide between this valley and the valley of the Shushitna is hardly noticeable, and the two valleys make up an immense area of flat land. The valley is traversed from north to south by the Copper River, whose source is the glaciers of Mounts Wrangell and Sanford. The fall of the river is rapid, being five-tenths foot to the hundred at Copper Center. The current is swift and the channel which winds from bank to bank splits up into minor channels, giving the river a wide and shallow appearance under normal conditions.

To illustrate its general character, take a locality where the river passes a point confined between banks 400 feet apart, with depths greater than 10 feet, and bears off, for instance, toward the right bank. Shortly after passing this point a channel makes off to the left, separated from the main channel by a gravel island; a short distance below another channel will make off to the left from the main stream; farther down other channels make off to the left, and ultimately, all joined, become the main channel, the original main channel now being a minor one. In one place, not far above the mouth of the Gokona River, seven of these channels were noted. There is, however, one well-defined main channel which appears to carry more water than any of the others. At no place is the Copper River fordable below the mouth of the Chestochena River. It has a width of 250 feet at the mouth of the Sanford River, an estimated depth of 12 feet, and an estimated velocity of 7 miles per hour.

At this point and for a distance of 1 mile above and 1 mile below there is a cut bank about 200 feet high, which is continually sloughing into the river.

10 WAGON ROAD FROM VALDEZ TO FORT EGBERT, ALASKA.

Any wagon-road location would of necessity follow along the top of this high bank.

It is doubtful if the Copper River could be navigated above Copper Center or below the mouth of the Taznuna. From information I was able to obtain, it would seem that the part of the river between the above-named points was in its present state navigable, but there are those who question this. It would require a careful examination and perhaps a survey to determine even this.

Important tributaries join the Copper from both sides. Below the Tonsena they come chiefly from the eastward, while above the mouth of the Tonsena they flow from the westward. Those met and crossed by the trail and the survey are as follows:

Tsina River, a glacial stream, a branch of the Telkhell River.

Kanata River, a clear-water stream.

Tonsena River, a glacial stream.

Klutena River, a glacial stream.

Tazlena River, a glacial stream.

Gulcana River, a clear-water stream.

Gokona River, a glacial stream.

Tolsona River, a clear-water stream.

Chestochena River, a glacial stream.

Indian Creek, a clear-water stream.

Ah Tell Creek, a clear-water stream.

Salana River, a glacial stream.

The first four, except the Kanata, are crossed at present by crude bridges badly in need of repair. The Kanata is forded. The next three have ferries—small roughly built boats—upon which foot passengers are crossed. Animals are made to swim these streams, the Tazlena always and the other two at high water. The Tolsona, Indian Creek, and Ah Tell Creek are usually fordable. The Chestochena River under normal conditions can be forded. It is a most uncertain river, however; its fords are continually changing and its several channels shift about considerably. First, one is the most important one, then another, and so on, making it a puzzle to the traveler as well as a crossing to be dreaded. Neither ferry nor bridge crosses this river. It is estimated that about 200 people crossed this stream during 1904.

The Salana, or Slahana, is confined to one stream most of the time, but at flood times the plane is extended to fully a mile in width, though covered with only a few inches of water. Except at high water this river can be forded, and the ford is rather permanent. Neither bridge nor ferry is maintained here.

The Copper Valley is made up of benches more or less regular in their altitudes, directions, and formation. Those near the water courses are from 10 to 30 feet above the rivers, are usually well drained, fairly dry, covered with alder or quaking asp, and would be the ones used where practicable for any road location. The higher benches are usually covered with moss, spruce timber, more or less scrubby, and swamps. The trees have roots which spread over considerable area and are quite close to the ground. This forms a combination very difficult to travel over, and a trail through it is a very bad one indeed.

Where moss is found the frost is just below it, or at most only a few inches below it. In many places fire has run through sections of the country, and this illustrates the possibility of the country when systematically cleared. Where the fire has been of recent date traveling through it is tedious on account of the mud and unpacked ashes; but where the burn is two or three years old the moss has disappeared, the ashes have become packed, the scrub spruce thickets have died, and the sunlight is allowed to reach, to warm up, and to thaw out the ground. Grass takes the place of the moss-covered thickets, the drainage is greatly increased, evaporation is more rapid, the swamps lose their source of supply, and a section of country which was formerly wet, mossy, and difficult to travel through has become an easy and desirable location for trail, road, or meadow.

Where a trail, such even as that constructed by Major Abercrombie for the Government, follows through a moss and tree covered country, it soon becomes a mudhole or a bog. After a pack train or two has passed over it the moss becomes packed close to the ground and thawing begins. Soon the moss becomes torn up or worked up into pulp, when the thawing operations become more rapid. The trail then becomes worn below the adjacent moss beds and tree roots. At the sides of the trail thawing continues, and the water thus formed finds its way into the trail, which now becomes the drain or reservoir for this basin, and soon becomes well-nigh impassable. This is practically the condition of the military trail throughout nearly its whole length.

At the mouth of the Klutena River is the important trading point—Copper Center. Here is located the experimental farm, operated by the General Government. Upward of 20 acres had been cleared and placed under cultivation. On the way into the interior I noticed the growing grains, grasses, and vegetables. All looked thrifty and gave promise of good results. Early in August a severe frost occurred and blighted some of the grains and vegetables, but did not injure the oats or the hardy vegetables. I visited the farm as I returned in September. The farmer was harvesting the crops and expressed himself as pleased with the season's results, but regretted the occurrence of the early frost, which had it been delayed a week would have caused but little damage. The season, I was informed, was an unusual one, being cold and wet and backward. Frost occurred earlier than usual.

The Government maintains a school for the education of the Indians at Copper Center.

From Copper Center to the Gokona River the country is rather well drained, except in places, and some settlement has already begun. Little difficulty will be experienced in locating or constructing a road over this section.

From the Gokona north to the Chestochena the trail passes through a country about the swampiest I have ever seen trails or roads located over. The survey line follows the trail, which follows a bench 300 feet higher than the Copper River and distant from it from 1 to 3 miles. The impracticability of an economical road being constructed along this route was so apparent that I caused another line to be surveyed which follows close to the Copper River. This line has not the objectionable features of the trail route.

The country followed by the trail over this section consists of an immense swampy meadow covered from a few inches to a foot and a half with water. Here bunch grass grows on stump-like clods called locally "niggerheads." These are about a foot in diameter, 1½ feet tall, and are joined to the ground by a neck only a few inches in diameter. The drainage of this flat country is at present poor, the fall being slight and the flow interrupted by moss, niggerheads, and grass.

From Chestochena to the upper end of the valley the survey follows for a distance of about 20 miles along a low bottom near to the river. This bottom is covered with scrub spruce timber and moss which, if removed, would make a good hay country, and the country would be ridded of a great deal of its objectionable dampness. The valley of the Salana is reached by following slightly up grade to the Ah Tell Creek, which it crosses some miles from its mouth. From Ah Tell Creek the line follows through a very pretty pass known as Indian Pass, which cuts through the high hills separating the watersheds of Ah Tell Creek and Salana River. No difficulty would be experienced in locating a road on easy grades and good alignment through this pass.

About a mile north of the Salana is the village of the Mentasta Indians to the number, all told, of about 40. It is located on a little clear-water stream which drains Lake Mentasta. The lake has an area of about 1 square mile. At the upper end of the lake the survey enters the Mentasta Pass, a naturally easy route through the hills which separate the watersheds of the Tanana and Copper Rivers. In this pass is to be found about the best quality of timber (spruce) met with along the whole route. The small creeks along the northern slope of the Mentasta Pass form the headwaters of the Little Tokio River, the course of which is short. About 5 miles north of the north end of the pass the Little Tokio joins the main Tokio River. The trail and survey line follow along the Little Tokio, cross it, and finally cross the Tokio a few hundred yards below the junction of the two rivers. From the crossing of the Tokio they follow across a wet flat to the hillside on the west of the valley. A reconnaissance of the country shows that it is unnecessary to cross the Little Tokio and that a great deal of the wet flat could be eliminated; as well as one bridge crossing.

Both trail and survey follow this hillside to Mica Creek, a tributary to the Tokio. From here they cross a bottom about 7 miles, where the ground is soft and firm alternately, but over which a good road can be constructed. Suddenly this soft flat disappears, the foothills of the Tanana Hills bear off to the westward, and the valley of the upper Tanana is entered. This wide valley, upon which small quaking aspen trees grow abundantly, is dry and firm. Both trail and survey line lead in almost a direct line to the crossing of the Tanana River, 15 miles. This stretch of valley is low, being less than 50 feet above the Tanana anywhere and about 15 feet above it at the crossing. The construction of a road over this 15 miles is simply to remove a few stumps and fill in a few hollows.

At the crossing Tanana River has a width of 550 feet, a velocity of about 5 miles per hour, and depths of from 5 to 11 feet. On the north side of the river is Tanana Island, which has a length of about 7 miles and a width of about 3 miles. It is formed by the main Tanana and a cut-off channel known as the Little Tanana River. After crossing the island the line follows in a northeasterly direction over the Ketchemstock Hills, which separate the Tanana and Forty Mile valleys. The trail follows over the hills, often raising 2,000 feet above the valleys. The survey follows the sidehills and low saddles, the grades being in all instances less than 4 per cent.

Descending from the hills, the valley of the South Fork is entered and crossed near its headwaters. A low divide separating the south and middle or Mosquito Fork valleys is crossed on easy grades and the extensive valley of the Mosquito Fork of the Forty Mile River is entered. This valley has a length of about 50 miles and a width of about 15 miles. It is flat and in places poorly drained. One of the softest places met with along the whole line (from the Mosquito Fork stream to Indian Creek, 8 miles) lies in this valley. Wild meadows of red top grass (*Calamagrostis langsdorffii*) extend over a great part of this valley. The trail and survey follow this valley more or less separated for a distance of 24 miles to the telegraph station on Ketchemstock Creek, a tributary of Mosquito Fork. There is a fall of 60 feet in the 24 miles of this valley as followed by the survey. At Ketchemstock the trail and survey separate, the former following up Mitchell Pass to the summits of the Forty Mile Hills, the latter following down the valley to Gold Creek. The trail follows the ridges and valleys of these hills, often descending into valleys whose elevations registered 2,000 feet above the sea level from hills whose elevations registered 4,000, 5,000, and 5,500 feet above sea level. It continues along in this way through to the Yukon at Eagle. The survey follows up Gold Creek to Willow Creek; thence up Willow Creek to Craigie Pass, over which it follows to the watershed of the North Fork of Forty Mile River. Leaving Craigie Pass, it follows down Humbug Creek to Confederate Creek; thence down Confederate Creek to Hutcheson River; thence down Hutcheson River to the North Fork of Forty Mile River.

The valleys of all these creeks are narrow, offering little promise from an agricultural point of view, but may some day prove of great value for their mineral wealth. Very little prospecting has been done, however, owing to the great cost of bringing supplies into the country and the length of time now necessary to concentrate a food supply for a few months' prospecting.

Like those of the creeks, the valley of the North Fork River is narrow and confined between high hills, from which lead innumerable creeks. From North Fork the line goes to Champion Creek by two routes. One route follows up North Fork to the mouth of Champion Creek and thence up a very wet niggerhead swampy bottom to a point opposite Limestone Butte. The other route follows up an unnamed creek, which joins North Fork near its junction with Hutcheson River to the saddles of the hills near Limestone Butte, and thence down another small creek to the valley of Champion Creek. The first route is longer by 12 miles and has the single advantage of a flat easy grade. The second route while it is shorter has the disadvantage of steeper grades. These approximate 7 per cent for a distance of 3 miles, but it is thought that a lesser grade might be developed. This would be a dry route and passable all the year.

Following up Champion Creek, the summit of a low divide is reached by easy grades, and the line then begins its last section of the route down American Creek to Eagle. The route down American Creek is a practicable one, with easy grades, but there will be some rock work to do in the canyons. The narrow valley of the creek makes it necessary in places to cut the road out of the solid rock hillside. The crossing of this narrow stream at frequent intervals is necessary to avoid some heavy work. Timber suitable for bridges grows near by and could be brought to the bridge sites with but little cost. This section, like the section over Thomson Pass, is more or less rocky, and it would prove more expensive to construct a road over this than over other sections.

The survey consists of a continuous transit line from Valdez to Eagle. The whole distance was carefully measured by steel tapes. Levels were taken at frequent intervals, usually at every 100-foot station, but occasionally at greater intervals. The topography was closely sketched—using clinometer—for a distance of from 100 to 200 feet on each side of the line, and approximately taken for a considerable distance farther. I regret my inability to

turn over at this time complete maps, profiles, and estimates, as required, but the exhaustion of available funds makes this an impossibility.

The line of survey follows the trail wherever the trail follows the best route or a route that passes through representative country. This was done for various reasons, chief among which are:

(a) The brush had been cleared away, which permitted of progress being made rapidly enough to admit of the preliminary survey being completed this season.

(b) It was desirable to use as much of the trail as practicable, as communications had been established, public houses had been installed, and camp grounds and feeding places for stock established along its route.

(c) Impracticable routes along this trail would have been determined by actual survey.

(d) The line was a preliminary one.

It is to be understood that when it is to come to the actual construction of the road advantage will naturally be taken of any opportunity to improve the details of location, and that additional reconnaissances and in places extensive revision of surveys will no doubt be found advisable.

Probably three-quarters of the supplies carried in over Thomson Pass during the past season were taken into the Chitina Valley, a tributary to the Copper, lying between the mouth of the Taznuna and Copper Center and extending eastward from the Copper River. The largest deposits of copper found in Alaska are in this valley, I am reliably informed. Development work is now in progress, and is being most systematically and thoroughly done. The isolation of the district and the cost of constructing means of transportation have made it necessary to determine beyond doubt that copper or other mineral exists in sufficient quantities to guarantee the construction of any means of transportation other than a trail, along which to move the supplies necessary to do the development work.

Prospecting and placer mining are being carried on in various parts of the country tributary to the trail, but to a limited extent. In the Chitina Valley some placer mining is being carried on and prospecting by a few men backed by persons of means is in progress. Placer mining is also being carried on on the creeks tributary to the Chestochena River. Placer mining and prospecting are being carried on on the creeks tributary to Forty Mile River. The trail and line run through country where whole creeks have been staked, but had been abandoned. There is no doubt that more prospecting would be done and many more persons would be engaged in hunting for gold in the interior if more economical means for transporting supplies existed than at present. There are thousands of square miles of country, no doubt tributary to this trail, over which no man has been. The life of a prospector is too hard a one under the present conditions for men to engage in it to any great extent. Only the strongest of men have any business in this country of long marches, few settlements, scant provisions, and short seasons.

In the district tributary to the Forty Mile River things are very much like what they are in the Copper River districts. Supplies for miner and prospector come from either Dawson, Forty Mile, or Eagle. At present the miner of this district finds it cheaper to buy his goods at Dawson or Forty Mile, pay the duty, and freight it in winter season up the Forty Mile River to where wanted. A number of creeks along the trail have been staked by miners and abandoned for various reasons, presumably on account of discoveries in other districts more accessible or giving greater returns for the labor of mining.

The theory was advanced by Mr. Stephen Birch, a mining engineer of New York, in letters to the Hon. R. Wayne Parker, referred to Major Millis by indorsement of the Chief of Engineers of June 20, 1904, for his information in connection with the survey of road from Valdez to Fort Egbert, that a road might be built over the Marshall Pass to the Copper River, and a line of steamers placed upon the river, which, it is claimed, is navigable as far as Copper Center.

It has been argued by Mr. Birch in personal interview that the expense of a road would be lessened thereby, as in summer the steamers would form the connecting link and in winter the frozen river would make an excellent road with an easy or water grade. This is a strong argument, but all depends upon a steamer being able to navigate the river with ease and without delay. I obtained no definite knowledge that the river is navigable, but accept that it is, and it is seen that the continuity of any such highway is interrupted in summer by the open river and delays are bound to occur. In the winter season there is dan-

ger of unfrozen patches of river, as well as the freeze up and break-up of the ice to be considered. It seems to me, therefore, that the idea is not a good one so far as a wagon road is concerned, and that any road constructed between the Yukon and the coast should be one graded all the way over the land, and be located so that it could be used during both the summer and winter seasons.

Feed for stock grows in abundance between Valdez and Ketchemstock, but there are places where forced marches have to be made to reach it. There should be regular camps established, small clearings made, and some grass seed sown. This would lighten the hardships and burdens of the immigrant, settler, or ordinary traveler. To this end it seems advisable to recommend the setting aside of certain reservations for such purposes and the improving of them. This, I believe, could be done at small expense. Between Ketchemstock and Eagle the feed is poor and scarce. Animals actually go hungry and wander away from the camps. A small crew of men in a single summer could provide suitable feeding places along the route and scatter some seed that would provide good pastures. If the country is ever to be opened up by the immigrant, aid must be extended in the construction of roads, trails, and pastures. It is impossible for the person just passing through the country to do anything along this line, and the spirit predominating appears to be to let the other fellow do it.

Along the route whole outfits of miners' tools were found in caches, where I was informed they were abandoned on account of a worn-out pack train being unable to proceed farther with them.

Along the route Indians are living in settlements at the following places:

Copper Center, about.....	50
Gokona, about.....	15
Tolsona, about.....	5
Chestochena, about.....	2
Mentasta, about.....	"40
Tanana, about.....	50
Ketchemstock, about.....	30
Total, about.....	192

GENERAL FEATURES ALONG ROUTE OF PROPOSED ROAD.

The construction of a road across Alaska virtually means the excavation of two parallel ditches across the country, except, of course, in the canyons and on high levels. By this means a drainage system will have been provided for, which feature is really the key to any practical road building in the swamp regions of Alaska.

I would recommend that a strip of country 1 chain wide be cleared completely of all moss and trees and the rubbish burned, and that the middle width of 33 feet be cleared of all roots and boulders. By so doing the sun's rays are allowed to thaw out the ground readily, thereby promoting drainage, and the air currents are allowed to strike the ground and evaporate the moisture, which means a dry road. All of that part wherein lies the roadbed is freed from a nonconducting mantle, and the roadbed is flanked by ditches into which the water can drain. By means of lateral ditches it can be carried to levels lower than the road elevation. Berms lie without the ditches, freed of this same mantle, which allows the ground to dry readily and removes the damp, spongy ground a safe distance from the roadbed.

In winter the conditions are very different than in summer. There are the snow, ice, and winds to consider. At present in crossing the summits the winter sled routes follow the sidehill saddles and benches in the order of their occurrence. The labor of keeping the sled from overturning is great, as there is no grade upon which to break a winter road. Oftentimes the sidehills are improved by piling brush on the lower side to level them. A graded road over the summit would provide a foundation upon which to break a winter road.

Slides and snowdrifts are bound to occur in the mountain sections, and it is doubtful if any economical plan could be devised whereby a road could be kept free from them. The cold winds and the absence of fuel on the summits make it necessary to cross them in as short a time as possible. Wherever the river parallels the road the former will be used as the winter highway, as it presents no adverse grades, and there would be fewer snowdrifts and slides to contend

^a Seven men, 20 women, balance children.

with. That part of the road along the flat sections would be used entirely, as there would be no tree roots or other obstructions to interfere with the passage of the sleds. At the present time this is a source of annoyance. Practically all supplies are now hauled into the interior on sleds during winter, and this is a most severe operation. It is probable that there would be more freighting done in the summer season than in winter with a roadway constructed. West of the Coast Range the snowfall is as great as 10 feet, and on the summits banks of greater depth are sometimes found. East of the Coast Range the snowfall averages from 3 to 4 feet. Ice on the sloping sides over the summits is a most difficult thing to contend with. A great deal of the objectionable features would be removed by the graded roadbed.

The spoil taken from the ditches is to be cast upon the axis of the alignment and given a surface. This forms the roadbed and will be elevated above the ground level from 1 to 2 feet. In most instances the spoil is sufficiently charged with gravel to make a firm roadbed without ballasting. There are sections where ballast will have to be used, and there are short sections where corduroy would prove the most economical. There are other sections where plank roads on trestle bents will be necessary.

In the mountain sections the work will consist largely of sidehill work, where some rock removal will be necessary, both solid and loose. Lateral ditches, which from the fall of the plains will for the most part be short, should be provided at intervals of at least one-half mile, for the purpose of freely draining the main ditches.

In cross section the roadbed should have at least a width of 10 feet—15 feet would be preferable—except where it is constructed in rock canyon, where it may be reduced to a width sufficient to pass an ordinary vehicle with safety going at slow speed. Where narrow roadbeds are used frequent turn-outs should be provided.

The maximum grades will be 5 per cent, except in one instance, where there may be a few miles of from 7 to 8 per cent grade, in order to save 12 miles in distance. Maximum grades are used only in descending from the higher plains to the valleys at river crossings and in crossing the summits of divides.

Bridges should cross every stream, except, perhaps, the Tanana River, which differs from the others in that it is an important one and navigable. A draw-bridge here would be most expensive. A good ferry operated here would answer every purpose, at least for the present. Timber suitable for bridge construction at all the river crossings is comparatively handy. In some instances it may have to be floated down the stream several miles, but this will not be a very difficult or expensive operation. Many of them can be crossed by a trestle of pile bents supporting a plank roadway. There will be about 30 of these bridges, the most important of which will be at the following places:

Valdez glacial stream, about 1 mile of trestle and plank road.

Lowe River, upper end canyon, span about 125 feet.

Lowe River, above canyon, 500-foot trestle.

Tsina River, about 500-foot trestle.

Stewart Creek, 60-foot span.

Kanata River, two crossings, each 60-foot spans.

Fall River, one 50-foot span.

Mosquito Creek, one span 75 feet.

Tonsena River, three 50-foot spans.

Willow Creek, one 30-foot span.

Klutena River, repairs to present bridge, 250 feet.

Tazlena River, two 60-foot spans; one 75-foot span.

Gulkana River, 300 feet of bridge.

Gokona River, 400 feet of bridge and approach.

Tolsona River, 60-foot bridge.

Chestochena River, three channels aggregating 600 feet and a flood plane aggregating 1,000 feet more.

Indian River, 200 feet of trestle.

Ah Tell Creek, one 75-foot span.

Salana River, 200 feet; includes 100-foot approach.

Tokio River, 500 feet of trestle, probably.

Mica Creek, trestle, 250 feet.

Tanana River, ferry, 500 feet.

Mosquito Fork, 75-foot trestle.

Ketchemstock Creek, 75 feet of trestle.

Gold Creek, 100-foot trestle.

16 MILITARY TRAIL BETWEEN YUKON RIVER AND COLDFOOT.

North Fork, bridge, 300 feet wide in aggregate, or a ferry.

American Creek, several crossings on trestles from 20 to 30 feet long.

Estimates.—There has not been the opportunity to work up the notes or to prepare more than a rough approximate estimate of the cost of constructing a road along the line of survey, but from the best information at hand and the experience gained by practical road building in the Dawson country, as found out by my assistants and myself, I respectfully submit that a wagon road can be constructed between Valdez and Eagle as contemplated by the law providing for the survey at an average cost of \$3,500 per mile, or for the total sum of \$1,505,000. It is quite possible that when the notes are worked up and detailed estimates are made it will be found that the cost of the whole length of road will be less. It is certain that there are sections where the cost per mile will be many times the amount estimated for the average, and there are sections where but little work and expense will be necessary to make a good road.

* * * * *

Very respectfully, your obedient servant,

J. M. CLAPP,
Assistant Engineer.

Maj. JOHN MILLIS,
Corps of Engineers, U. S. Army.

SURVEY FOR A MILITARY TRAIL BETWEEN THE YUKON RIVER AND COLDFOOT, ALASKA.

UNITED STATES ENGINEER OFFICE,
Seattle, Wash., December 15, 1904.

GENERAL: I have the honor to submit preliminary report upon survey of a military trail between the Yukon River and Coldfoot, Alaska, as follows:

I was directed to make this survey by telegram from the Chief of Engineers of May 13, 1904, and letter of the same date. Provision for the survey was made by the army appropriation act, approved April 23, 1904, as follows:

For surveying and locating a military trail, under the direction of the Secretary of War, by the shortest and most practicable route, between the Yukon River and Coldfoot, on the Koyukuk River, twenty-five hundred dollars, to be immediately available, and a report and estimate upon said trail to be submitted to Congress at the earliest practicable day.

The instructions were to complete the survey and report with estimate at the very earliest date possible, consistent with a proper execution of the work, and I was directed that it was all important to complete the field work during the past season. In pursuance of the above instructions, Mr. O. A. Piper, one of the regular employees under this office, was directed to make the survey.

Mr. Piper and two assistants sailed from Seattle on May 31 for Skagway. The party proceeded to Fort Egbert, near Eagle, on the Yukon River, where pack animals, camp outfit, and additional men were procured. They then took steamboat on the Yukon and landed near Fort Hamlin. From this point the trail to Coldfoot, which is near the headwaters of the Koyukuk River and about 75 miles north of the Arctic Circle, was traversed, and on the return trip over the same route the trail was marked. Photographs^a were taken along the route, observations, notes, and sketches were made, and these, together with the map when it is completed, and Mr. Piper's detailed report, will identify the trail so it can be recognized and followed by those

^a Not printed.

desiring. Mr. Piper and the men taken from here returned from Fort Hamlin by the Upper Yukon, the White Pass Route, and Skagway, the same way they went, and reached Seattle on August 31.

The results as contemplated by the law and the instructions of the Chief of Engineers were accomplished, and Mr. Piper's work and the success with which it was attended was in all respects commendable. It is understood that the law contemplates an estimate for marking the trail in a more permanent manner than could be done under the appropriation available. Mr. Piper estimates the cost of this at \$6,000. I think, however, if this is undertaken it should be with a view of completing the whole trail, 126 miles in length, with certainty during one working season, and that the chance of weather conditions being less favorable than Mr. Piper found them, the possibility of the working party having to return down the Yukon after the upper river is closed, as well as numerous other contingencies, should be taken into account. I would suggest an appropriation of at least \$15,000. Mr. Piper's report is herewith.

Very respectfully, your obedient servant,

JOHN MILLIS,

Major, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. Army.

REPORT OF MR. OSCAR A. PIPER, SURVIVOR.

SEATTLE, WASH., October 18, 1904.

MAJOR: I have the honor to submit the following report of a survey made in accordance with an act of Congress approved April 23, 1904, for surveying and locating a military trail, under the Secretary of War, by the shortest and most practicable route between the Yukon River and Coldfoot on the Koyukuk River, Alaska.

Under verbal instructions given May 20 I was assigned to aid Asst. Engineer J. M. Clapp in his preparations for the survey of a wagon road from Valdez to Fort Egbert on the Yukon and of the trail between the Yukon and Coldfoot. On May 30 I was assigned to the task of the latter survey and also to the general charge of two of the road survey parties while en route to Fort Egbert.

CHOICE OF ROUTE.

As the act of Congress specified no definite point of departure from the Yukon, the first problem to present itself was choice of route. Available information on the subject was limited, and in the end the question was largely decided by such information as could be gathered by the party en route from Seattle. Routes via the Chandlar, the Hosana, and the Dall rivers were considered as evidently the most practicable, as well as for the reason that the shortest distance between the Yukon and Coldfoot lay through the region drained by these rivers.

The Chandlar River joins the Yukon near the one hundred and forty-sixth parallel. Starting from Fort Yukon, travelers have followed this route to the Koyukuk to a considerable extent since 1898. The route is, however, mainly a winter one, travel in summer usually being up the river by boat. The principal objections to this route for a trail survey were its length and the long stretch of flats to be crossed near the Yukon. Mr. A. E. Carr, of Fort Yukon, who has made 24 trips over this route, carrying mail to Coldfoot, says it is a difficult route for winter and impracticable for summer. His winter trail crosses 32 lakes and sloughs in 28 miles, and all efforts on his part to find a practicable pack trail have met with poor success.

Of the Hosano, Hosiana, or Swift River little could be learned. Whether the mouth was approachable by steamboat or far distant from the main traveled channels of the Yukon flats could not be learned. In the language of a trader,

18 MILITARY TRAIL BETWEEN YUKON RIVER AND COLDFOOT.

it would probably take an Indian pilot to find the river, its character being probably similar to that of all the rivers joining the Yukon in the flats, a network of sloughs. In the probable location of the river low hills could be observed not more than 20 miles distant from the Yukon, but whether they were continuous or isolated could not be determined. The Hosana offered a new and consequently the most interesting field for the surveyor, but the limited time allowed by the appropriation for the work rendered it imperative that that route be chosen which was known as practicable and offered the best chances of success in getting through and back again during one season. In consequence the Dall River route was chosen as offering the best advantages for a trail which could be followed both winter and summer.

ITINERARY.

The party, consisting of the writer and two assistants, H. W. Boetzkes, surveyor, and J. R. Mackay, surveyman, together with two of the Valdez-Fort Egbert road-survey parties, left Seattle on the steamer *Humboldt* on the evening of May 31. Skagway was reached on June 4, and here the party was delayed until June 9, while awaiting the departure of the steamer from White Horse. Leaving White Horse on June 9 on the steamer *Victorian*, Dawson was reached on the night of June 14, several days being lost owing to low water in Lake Lebarge and the Thirty Mile River. Eagle was reached on June 16. In accordance with previous arrangements, supplies were here purchased for the expedition. A pack train of eight animals and camp equipment were obtained from the Government post at Fort Egbert. Two packers and a cook, previously engaged, were added to the party. Leaving Eagle on June 19 on the steamer *John Cudahy*, the party and outfit landed opposite Fort Hamlin on June 21.

As but little could be learned of the existing trail leaving Dall River, and it was evident that an extensive timbered area had to be traversed to the headwaters of the Dall River, it was deemed of advantage to go through to the objective point first and gain a first-hand knowledge of the country. In this the party was aided to some extent by the previous knowledge and cordial cooperation of Mr. J. C. Hatch and others en route to Coldfoot. After cutting trail for a day and a half through dense spruce and birch thickets the party left the Yukon on June 24. As the outfit was more than could be carried by the animals in one load it had to be carried ahead by relays, camp being moved every two days. On June 28 a bewildered prospector, two days without food, was found wandering aimlessly through the flats and was given food and directions.

The course pursued from the Yukon was northwesterly and skirted the edge of the hills on the western rim of the Yukon flats. The exertions of the whole party were continually required in picking out and cutting the trail. On July 2 the old trail was crossed about 20 miles from the Yukon, and here a cache was built and the outfit reduced to one load. From July 2 to July 5 fair progress was made, though considerable difficulty and loss of time were occasioned by the animals miring. Footing for the animals was, on the whole, very good, but in certain places, particularly in birch thickets recently destroyed by fire, the protecting mantle of loam and sod was destroyed and the ground seemed to thaw 2 or 3 feet deep. In such places our small-hoofed mules sank down helplessly, though horses with their broader hoofs got through without miring. After much loss of time the plan of corduroying suspicious places with brush and limbs was adopted, and thereafter no trouble was experienced. About 1 mile of such ground was encountered, though on the return trip in August the same places were as firm as pavement.

On July 5 the divide between the Dall and Kanuti or Old Man River was reached and here another portion of the outfit was cached. The divide was wet and mushy, owing to the recent disappearance of the snow. Travel was in consequence rather difficult, being ankle deep in tundra and water. This condition prevailed throughout the rest of the journey. Good progress was made, however, no other delays occurring than those incident to picking out the route. The best day's travel was 18 miles, a day's travel for loaded pack animals being about eight or nine hours. On July 8 two prospectors were met, bound for Coldfoot, guiding their way by a rough sketch map and such evidence as could be picked up on the way. Without further incident Coldfoot was reached on July 12. Here the party delayed until July 16, gathering information relative to routes and conditions and taking necessary observations. Charles McKnight was engaged to assist on the return trip, which was made without incident over nearly the same route followed in. The Yukon was reached August 14. On

August 15 passage up river was taken on the steamer *Monarch*. Eagle was reached on August 20 and the pack train and camp equipment returned to the quartermaster at Fort Egbert. The party returned to Seattle on August 31.

METHODS OF WORK.

Having a good knowledge of the country to be traversed and the approximate distance aided materially in determining the amount of work which could be done.

A continuous transit line was maintained from Coldfoot to the Yukon, distances being determined by stadia measurements, and where densely timbered areas were to be crossed, by triangulation. Elevations were carried by vertical angles. The elevation of the Yukon River, near Fort Hamlin, was assumed as 300 feet above sea level, this value being deduced from data contained in reports of the United States Geological Survey. Elevations determined from this datum agree closely with those given by the Geological Survey.

Where possible, prominent landmarks were located by intersections, and in some cases by estimated distances. These are shown on the accompanying map by contours.

A barometer was provided for the party, but was found to be defective. For temperature a maximum thermometer was carried.

^a Photographic records were secured along the whole route, though in some cases they are not as satisfactory as hoped for.

Stations along the line of traverse were marked with poles and a mound of rocks. As much of the country crossed was devoid of timber and covered only with moss, grass, and stunted shrubbery, a sufficient number of poles for each day's work was carried on a mule. Across stretches of country where no trace of a trail was visible a pointer was left at each station and the proper direction of the trail marked. This work was not as thorough and permanent as could be desired, owing principally to the want of material at hand. It is hoped, however, that sufficient marks were left to enable the traveler to find his way where traces of the old trail cease.

Latitude and azimuth observations were taken as often as conditions permitted, and the magnetic variation was determined at each station. Many of these were not very satisfactory, owing to the continuous cloudy condition of the weather.

The length of the trail as determined by the survey is 126 miles. The apparently wide detour to the westward after passing the Dall River divide is made necessary in order to reach timber and forage. A straighter course is possible, but is much rougher, and the traveler is out of reach of timber and the shelter it affords him.

DESCRIPTION OF ROUTE.

Near Fort Hamlin the water of the Yukon emerges from the flats and narrows into a single stream, flanked on either side by densely timbered ridges, here 1,000 feet above sea level. The Dall River joins the Yukon 9 miles above Fort Hamlin. From the mouth of the Dall River the old pack trail, cut through by prospectors in 1893, leads westward across the flats to the hills, skirting their western rim, and then follows along the hills, slightly northwest, to the headwaters of the river. The portion of the trail near the river's mouth crosses a slough, and in early spring is often flooded. Avoiding this difficulty, another trail begins at the Yukon about 5 miles above Fort Hamlin, at the point where the ridges and flats meet. After passing along the ridges for about 5 miles it again descends to the flats and joins the old trail. The route traversed by the survey was in the same general direction as the old trail, but for the first 18 miles more to the southward. Crossing the ridges from a point 2 miles above Fort Hamlin, the line follows a northwesterly course and almost directly toward a prominent mountain some 3,200 feet in elevation and 18 miles in an air line from the point of departure from the Yukon. Near the Yukon the ridges crossed rise quite abruptly and are deeply cut by ravines. A few miles to the westward they give way to lower bench-like plateaus and rolling country, containing numerous small lakes, but somewhat above the general elevation of the flats. These benches and low ridges are dry and in some cases sandy. A few years ago they were covered with a dense belt of green timber, but now show the devastation of fire.

Travel over this section of the country was very good, though a few narrow stretches were crossed which are swampy at some seasons of the year. Near

^a Not printed.

the base of the mountain on the westward the ground is much more broken, more densely timbered, and somewhat softer underfoot. From the base of the mountain the course of the trail is somewhat more north along the eastern flanks of low but densely timbered ridges, trending northwest, and not far from the edge of the flats. At a distance of 36 miles from the Yukon by the trail and drained on the north side by Coal Creek is a range of hills 2,000 feet or more in elevation and having three culminating points, the easternmost of which is a castle-shaped cluster of rocks and a prominent landmark. The trail crosses the ridges at a lower elevation 2 miles to the east of these rocks.

In going through our party crossed directly over these ridges and somewhat northwest across the deep canyons of the Dall, a route involving too much climbing.

The drainage at the southern base of the ridges is both eastward to the Dall and westward, presumably to Ray River. The route surveyed crosses the divide of this drainage basin, which is almost flat, and swings 2 miles to the eastward, intersecting the old trail, which is then followed to Dall City. From Dall City the trail follows north and west along the crest of a ridge separating the two main forks of the Dall. Timber line is reached 6 miles from Dall City at an elevation of 2,000 feet, and the summit of the divide, 3,200 feet high, 5 miles farther. Near the summit, but at a somewhat lower elevation, and on the north side of the trail is an isolated knob surmounted by a cubical mass of rock, which serves as a prominent landmark. At the summit the trail turns due north, and at a distance of 5 miles from the knob above mentioned passes between the headwaters of the Kanuti, or Old Man River, on the left, and the Hosana, on the right. Four miles farther and slightly northwest a low gap is reached, and the westward-flowing stream, probably a branch of Fish Creek, is followed for 4 miles, when a low divide on the right is crossed to a branch of Bonanza Creek, also a supposed branch of Fish Creek. Bonanza Creek is followed down 6 miles to the junction of the second fork on the right. This place is known as "Happy Camp." Here the first timber and grass are reached after leaving timber line on the Dall River.

From Happy Camp the trail climbs north 3 miles to the summit of a divide 1,250 feet high, and then turns slightly to the right, at the end of 6 miles crossing what is probably the most northern tributary of Fish Creek. From this stream, at a distance of $2\frac{1}{2}$ miles across a low divide, a tributary of Jim River is reached. Following up this stream for 1 mile the trail passes northeast up a timbered slope, and swinging around the head of small feeders of a stream on the left crosses a divide 650 feet high to the main branch of Jim River. From Jim River the trail climbs northeast over a divide 1,400 feet high, and at a distance of 6 miles descends to what is probably the most northern fork of Jim River. From this point the trail is very plain. Following upstream a distance of 2 miles it crosses through a low pass known as "Good Pass" to the headwaters of Granite Creek. From Good Pass, after passing northeast 2 miles, and then north over two divides between tributaries of Granite Creek, Mosquito Fork is crossed $1\frac{1}{2}$ miles from its mouth. The trail then follows the hillside along the east side of the South Fork of the Koyukuk, crossing the latter at the end of $5\frac{1}{2}$ miles from Mosquito Fork. Two miles west of the South Fork the trail leads through Sitkum Pass to Slate Creek; thence directly down that stream to Coldfoot at its mouth. In summer, after the middle of July, the trip from the Yukon to Coldfoot can be made by good travelers and pack animals with moderate loads in seven or eight days. In spring and early summer it takes ten days or more according to the load carried.

Snow usually disappears from the divide sufficiently for pack animals to pass early in June. During the present year the earliest travelers with horses left the Yukon on May 23, but near the divide they were obliged to wait until about June 10, owing to deep snow.

From the Yukon to 6 miles above Dall City the country is thickly timbered and good camping places and forage are found everywhere. The old trail is narrow and tortuous, and up to the middle of July it is in a few places difficult for heavily loaded animals. No places dangerous for pack animals were seen.

The timber line at the head of Dall River stands at 2,500 feet, and until the divide is crossed and the vicinity of Happy Camp reached no other suitable camp or forage is found.

Timber and grass can be found in the headwaters of the Hosana, but it is difficult to reach. From the divide no timber can be seen on any branches of the Kanuti or Old Man tributaries. Between Happy Camp and Coldfoot good camps and forage are found every few miles.

Distances by trail.

Locality.	Distance from—	
	Yukon.	Coldfoot.
	<i>Miles.</i>	<i>Miles.</i>
First large creek crossed after leaving the Yukon.....	11	115
Base of Bald Mountain.....	18	108
Cache Camp, second largest creek.....	20	106
South side of ridges, south of Dall City.....	36	90
Coal Creek.....	41	85
Dall City.....	43	83
Timber line on the trail.....	49	77
Knob near summit of divide.....	52	74
Summit.....	54	72
Headwaters of Hosana and Kanuti rivers.....	57	69
Headwaters of Fish (?) Creek.....	61	65
Bonanza Creek tributary.....	67	59
Happy Camp.....	73	53
North tributary (?) of Bonanza Creek.....	79	47
South tributary of Jim River.....	81.5	44.5
Jim River.....	91	35
North tributary of Jim River.....	97	29
Good Pass.....	100	26
Granite Creek.....	101	25
Mosquito Fork.....	106.5	19.5
South Fork crossing.....	112	14
Sitkum Pass.....	114	12
Slate Creek, junction of creek at north end Sitkum Pass.....	120	6
Myrtle Creek.....	121	5
Coldfoot.....	126	-----

MOUNTAINS, PASSES, AND RIVERS.

Physically the country traversed by the trail on the Koyukuk side of the divide is very different from that near the Yukon, being continuously through hills and mountains. The highest elevations are perhaps less than 5,000 feet. Granite composes a great portion of their make-up. In the beds of streams are various kinds of schists and some quartzites. Where bare and weathered the mountains look very black. In general appearance most of them are smooth and rounded.

Except in the creek bottoms and on sheltered north and east slopes, the country is devoid of timber and is covered with a thick tundra growth, over which travel is quite arduous.

The divides between streams and the mountain passes are not difficult, though in some cases quite high. The lowest portions of the passes are nearly always too deep with moss, niggerheads or bunch grass, and mud to afford good traveling. It was much easier for our animals to climb higher on the mountain sides where the footing was firmer. Usually the passes are well defined and easily identified from a distance. Sitkum Pass, lying between Slate Creek and the South Fork, can be easily seen from near the headwaters of Jim River. The trail through this pass is well beaten, but is one of the worst parts of the trip, being deep in mud and niggerheads.

The rivers crossed by the trail present no difficulties. The Dall where crossed spreads out over a width of 100 feet and is usually quite shallow. In August it can be crossed dry shod by stepping from one stone to another. The tributaries of Fish Creek and Jim River are small, varying from 10 to 30 feet wide. The main branch of Jim River where crossed is a stream 100 feet wide and quite swift. In freshets it may present some difficulties, but it is always fordable with horses. Mosquito Fork is a swift stream, ordinarily about 60 feet wide and of considerable volume. It rises and subsides very rapidly and at high stages can not be forded. The South Fork where crossed is 200 feet wide and when crossed in July was 2½ or 3 feet deep.

As a winter trail the route surveyed is practicable, but admits of cut-offs. The divides, however, though not high or difficult, are in some places quite steep for sledding and expose the traveler to the wind. Winter travelers usually prefer the bottoms of streams, where they are always within reach of fuel and shelter. A route successfully followed lies directly across the flats from the mouth of the Dall to its headwaters, thence across the divide and down Fish Creek or other tributaries to the South Fork.

SETTLEMENTS.

No settlements or camps exist along the route traversed by the trail. Fort Hamlin, on the Yukon, was abandoned, but late in the present summer was reoccupied, principally on account of the Beaver Creek discoveries. Near the mouth of Dall River is an Indian village and a small trading post. Dall City consists of a few abandoned prospectors' cabins. Except on the Yukon and at Coldfoot no natives were met, though evidences of their old camps were seen on Jim River.

COLDFOOT.

Coldfoot is situated at the confluence of Slate Creek and the Middle Fork of the Koyukuk River, and approximately in latitude $67^{\circ} 17'$ north and longitude $150^{\circ} 16'$ west. The camp contains about 80 well-built cabins. In summer the place is quite deserted, the reported winter population, including a few natives, being about 60 people. Previous to 1902 the Alaska Commercial Company maintained a post at the place, and this is now operated by Stevens & Plummer, a local firm. Supplies are freighted up from Bettles, 65 miles away, by boat in summer and in winter over the snow. The town was established in 1900 at the time of the gold discoveries on Slate and Myrtle creeks. The commissioner and recorder for the district reside here. Mail is delivered by carrier from Fort Yukon once a month, but it is expected that this service will be improved. The head of navigation on the Koyukuk is Bettles. During the open season a steamboat makes a trip once a month.

MINING.

Mining operations on the upper Koyukuk are carried on about three months during the summer in a radius of 40 or 50 miles from Coldfoot. The diggings are shallow and usually very little work is done in winter. The present season was a favorable one for mining purposes and satisfactory results were reported by miners coming out for the winter. In the Coldfoot district Nolan Creek is reported as the most promising. No new discoveries were reported in the district, which includes mainly the tributaries of the upper, middle, and north forks of the Koyukuk.

Crevice Creek, a new discovery 60 miles above Bettles, on John River, is reported as attracting considerable interest.

The mining population of the Coldfoot district for the present season was about 150—300 being reported operating in the whole Koyukuk Valley. Government reports give the gold yield of the Koyukuk district between the years 1900 and 1903 as \$700,000.

CLIMATE.

In the Koyukuk Valley winter temperatures of 60° or 70° below zero are reported, though these conditions are usually of short duration. Windy weather is infrequent. The settled snowfall at Coldfoot in 1902 is reported as 12 or 14 feet. Comparatively very little snow fell during the winter of 1903. Meteorologic records are being kept by Mr. Howard, the recorder of the district, but on the occasion of our visit his outfit was as yet incomplete. Summer temperatures vary from 50° to 80° F. Vegetables, such as cabbage, lettuce, radishes, and turnips are successfully grown at Coldfoot. During the progress of the survey rain fell during twenty-nine days. Morning and evening temperatures varied from 30° to 75° .

VEGETATION.

An attempt was made to collect the flora of the country traversed, but owing chiefly to want of facilities for preserving specimens, but little was done. The country contains numerous flowers, very generally distributed, and in places growing in great profusion, brightening an otherwise dull landscape. There are a number of wild fruits, among which the most common are the bilberry, red currant, red raspberry, mountain and high-bush cranberries, and salmon or cloud berry. The bilberry is a variety of huckleberry, and is the most widely distributed. On the Yukon side the red currant grows in abundance along streams and in ravines.

Except on the high divides, grasses, furnishing good subsistence for pack animals, are very plentiful. The most common are a variety of blue grass or *ad-*

top, rye grass, and varieties of bunch grass. The blue grass, or redtop, known scientifically as *Calamagrostis Langsdorffii*, is the most abundant, and attains the roughest growth in recently burned ground. Arboreal vegetation is composed of spruces, birches, alders, willows, and poplars. The spruces compose by far the greater portion of the forest, and attain a maximum diameter of 18 to 24 inches, and a height of 50 to 80 feet. Birches attain their best growth on hillsides. On the western edge of the Yukon flats they grow to a height of 50 or 60 feet, and have a maximum diameter of 20 inches. Poplars, including Balm of Gilead and aspen, are found on the drier ridges and knolls. Willows, varying from small shrubs to full-sized trees, are found on all the water courses. The alder grows along water courses in the flats and in clusters on the mountain sides above timber line.

FISH AND GAME.

Fish and game are not as plentiful as supposed. Some of the lakes in the Yukon flats contain white fish, and in the flats nearly all the streams contain grayling. Above the timber line a number of mountain goats were seen and four were killed during the season. On the hillsides porcupine were quite common, and a few Canada grouse were seen in the spruce thickets. On the Yukon, Lake, moose and bear were found, but they are not much hunted by the Indians. Muskrats, squirrels, and rabbits are common. Near the Mesopit, a small ground rodent played havoc with buck straps and saddles. Wolves, in packs with young were found in ponds and lakes.

COST.

Present developments in the Koyukuk Mining District do not warrant a large expenditure of money, such as would be necessary for a large highway of selected grades. Besides being inaccessible to the west in the open season, the distance is too great to make any sort of freighting practicable. A well-defined trail would furnish an important piece of road, and as an aid to the future development of a region as yet little known, and of great interest, making it much more accessible, would be a decided gain in the future. Future surveys will undoubtedly find a route easier to run between the Chuk and Yukon, but as a general route to the Koyukuk Valley, the route suggested is the best. Travel has been by this route, though in the last year or two it has been considerably less than formerly. During the present year only 25 people are known to have gone over this route. Of these the greater number had dogs, and some are reported to have returned to the Yukon. Since 1890, 4 people are known to have lost their way and perished.

The cost of constructing a trail by the route surveyed, with an trail plainly marked and sufficient for the use of pack horses, is estimated at \$500, \$70 per mile through the timbered region and \$80 per mile over the mountain divides. Sixty miles of the route passes through timber, mostly of small diameter, which can be rapidly cut. Over the divides riding trails are necessary. The best guides would be high signposts, with directions and distances marked. For this purpose timber can be found not more than 1 mile from the trail at any point of the route.

A map of the route of the trail is submitted herewith.

Very respectfully,

OLIVER A. PIERCE, Engineer.

Maj. JOHN MILLIS,
Corps of Engineers, U. S. Army

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