HUDSON'S BAY RAILWAY

(fragmentary)

the right-of-way are proceeding, and it is expected that construction will be commenced in the spring, and that the line will be completed before Jan., 1910.

Railway to Hudson's Bay.—Reports received by the Department of Railways recently show that rapid progress is being made with the surveys on the route of the proposed railway to Hudson Bay. Four parties have been placed in the field by the Dominion Government, and alternative routes are being surveyed. It is anticipated that the engineers will be in a position to make a general report to the Government by the end of Feb., and that it will be immediately presented to Parliament. (Nov., 1908, pg. 787.)

Rimouski International Ry.—Application

Dominion Government Railway to Hudson Bay.

Hon. R. Rogers, Minister of the Interior, speaking at Regina, Sask., June 11, is reported to have said that much progress was being made with surveys and he hoped that the Government would be in a position to call for tenders within 10 or 15 days for the remaining distance to the Bay. If the eastern railway companies, he added, did not make connection with the Government line, the Government itself would build the connections.

An advertisement has since been issued stating that tenders will be received to Aug. 1 for the construction of a section of the line, from Thicket Portage, where the G. T. P. MacArthur contract ends, to Split Lake Jct., 68 miles.

A contract is reported let to E. M. Doyle and Co. for the supply of 170,000 ties for the mileage now under construction.

A party of engineers under H. T. Hazen, it is reported, left Montreal, June 5, for Fort Nelson to make surveys in connection with the proposed terminus. (Info. pg. 247.)

Protection of Railway Employes in Yards.

The Board of Railway Commissioners

July 1912

ry reinforced concrete frame and brick
...ress and office building, with basement,
at Pontiac, Mich.

Hudson Bay Short Line.—The resolution passed by the Manitoba Legislature recently, after a lengthy debate and the defeat or withdrawal of several amendments, following a number of preliminary whereases, states that in order that justice may be done in respect to the needs of the province, it respectfully requests the Dominion Government that the present railway route from southern Manitoba to The Pas be shortened by the construction of a cutoff from a point on the route near Mafeking, northward to the Hudson's Bay Ry. at or near The Pas; that the remainder of the existing lines southward from Mafeking be reconditioned and otherwise improved, making them adequate for the handling of all kinds of railway transportation, with facilities equal to those of any other railway line in Canada; and that such freight schedules be established as will enable all railway points in Manitoba share in freight traffic to and from the Hudson Bay port on a reasonable and fair basis in comparison with other points in Canada.

Hudson Bay Jct. Southerly Branch.—The Board of Railway Commissioners issued order 44,608, April 16, authorizing opening for traffic of this branch from junction with Tisdale Subdivision near Hudson Bay Jct. to junction with the

Grain Elevator to be built for Dominion Railways and Canals Department at Hudson Bay Railway Terminus at Churchill.

shore line, at which point action of tide water draws the frost from the ground, and enables piles to be driven to rock. The foundation of the elevator will contain 7,700 piles. These will be cut off at mean tide level and capped with the concrete mattress of the elevator structures. After piles are driven, the area of the building will be filled with gravel up to the level of the pile cutoff. Basements of all buildings will be waterproofed, with a membrane waterproofing above the level of high tide.

Grain will be delivered from the elevator to the deep water dock by a 4-belt conveyor system. The gallery along the a minimum of delay.

The elevator work house will be 100 ft. long by 80 ft. wide, and will be 207 ft. high above the tops of piles. Work house equipment will include 4 receiving legs, with a capacity of 25,000 bush. an hour each; 4 shipping legs, with a capacity of 20,000 bush. an hour each; 11 cleaner legs and one drier leg. Provision is made for future installation of 4 legs to handle extensions of the cleaner system. Cleaning equipment will include 15 no. 11-B monitor receiving separators; eight 5-unit Emerson separators; and eight big-five Carter disc separators, all of which will be load-

be filled in with steel sash and glazing, to give a maximum of light and protection against possible dust explosions.

The storage annex will be 238 ft. long by 100 ft. wide, built end on to the work house. Storage space will be made up of 44 circular bins, 24 ft. diameter; 24 outer space bins, and 70 inner space bins. All bins will have a depth of 100 ft. The annex will be served by four 42-inch conveyor belts in the cupola, and four 36-inch conveyor belts in the basement. Cupola belts will have 2 pulley self-propelling trippers built for high speed operation.

A grain dryer, with a capacity of

HUDSONS BAY RAILWAY PART II

-1928. (fragmentary)

n Railway and Marine World

February, 1928

Recommending Port Churchill for Hudson Bay Railway Terminus.

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from the entrance, to guide ships to the port. These great distances indicate the extent of the estuarial area of shallow waters, with flat and marshy shores, and the beacons were, of course, of little use in times of even light mists.

The roadstead for ocean-going ships is a deep channel known as the Deep Hole, which commences about 9 miles above the entrance and extends upwards for 5½ miles; from the upper end of the Deep Hole to Flamboro Head there is a fairly well-defined channel, with depths varying from 18 to 4 ft. at low water, with extensive shallows on either side. The outer shoal below the Deep Hole is crossed by an irregular channel, which was discovered during the construction period, over which the limiting depth is 20½ ft. It is highly improbable that this channel will be [illegible] by nature, but quite possible

journey as compared with the depth at the time the journey of 22 miles was commenced. For instance a ship leaving the wharf at the time of high water would have to cross the outer shoal 2½ hours later. Add to this the difference, 40 minutes in time of tide, and it will be seen that the tidal rise over the outer end of this shoal would be decreased to the extent to which 3 hours and 20 minutes affects the fall of tide, viz., to practically half tide. The fact that a river is tidal is, generally speaking, in its favor, as the rise of tide makes that river navigable twice a day for deeper draft ships than would otherwise be possible. Both Nelson and Churchill are tidal waters, but in the case of Nelson, there are natural low water depths of about 20 ft. at the outer shoal, whereas at Churchill, there is no natural low water depth of less than 33 ft. between [illegible] and the sheltered area inside the

F. Palmer's Report Recommending Port Churchill for Hudson Bay Railway

(Continued from page 62.)

the terminal yard, not only for future working, but also for construction purposes, while access from land to wharf extends over the whole length. There is ample room therefore for dock facilities, transit sheds, grain elevators, railway lines, etc., and for the efficient handling of all traffic. Material for construction purposes, such as rock, gravel and sand, is obtainable in almost unlimited quantities within a mile of the proposed works.

Such, then, are the physical conditions pertaining to both Nelson and Churchill upon which, in conjunction with other considerations described later, the decision has unhesitatingly been arrived at, that Churchill is the port to be selected as [illegible] harbor in

grain elevator and equipment has been arrived at in consultation with Mr. Howe, and is based on the cost of similar equipment at other ports.

The figures for Churchill include the provision of a permanent wharf, with 30 ft. depth at low water alongside, and the necessary dock equipment, the dredging of a channel to the wharf, 600 ft. wide and 30 ft. deep, from the deep water area inside the harbor, a grain elevator and workhouse on the same scale as that included in the Nelson estimate, and a small sum for the few aids to navigation necessary at Churchill. A winter berth for craft is included in the items for wharf and dredging.

[illegible] wharf to accommodate 3 ships.

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Nelson. The works at [illegible]
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Unit Quantity

Port Churchill for Hudson Bay Railway Terminus.

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carry out the "test development" works at Nelson. The works at Churchill would be carried out in a sheltered situation. No roughness of weather can sensibly affect the progress of either construction works or dredging. The working area is practically unlimited, and materials such as rock, gravel and sand, can be obtained in abundance in the immediate neighborhood. In fact, excepting for climatic reasons, common to both ports, the site at Churchill is ideal. Under these conditions, 3 years has been assumed as a safe time for the Churchill works, which is one-half of the time which would be required at Nelson. The length of time which would be occupied in constructing the initial

	Unit	Quantity	Price	Amount
ommodate 2 ships				
in substructure	c. yd.	101,251	$12 00	$1,215,012 00
in superstructure	c. yd.	20,000	18 00	360,000 00
of crib and wall	c. yd.	1,010,000	50	505,000 00
	c. yd.	1,150,000	$1 00	$1,150,000 00
ds and approach channel	c. yd.	400,000	1 00	400,000 00

1928

Hudson Bay Railway Construction, Etc.

By Hon. Frank Oliver, ex-Commissioner, Board of Railway Commissioners.

Kettle rapids was prac-
steel for the Hudson Bay
pension of work in 1917
on in 1927, although the
ompleted to Port Nelson,
er 90 miles. After its
elson, the railway leaves
plateau and enters upon
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the 90 miles from Kettle
Nelson railway grade is
t entirely of peat. But it
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was found in laying track
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le Rapids to Amery. This
included the crossing of
River, about two miles
on with the Nelson. The
estone Rapids of the Nelson
across Limestone River is
king than that from the
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bed of gravel was found at
south bank of the Lime-

where stream crossings compelled a detour. The tractors hauled seven tons a trip. On June 9 one of the tractors was being operated between Amery and the foot of the rapids on the Nelson, 22 miles, using the railway grade as a highway for 17 miles. Although the grade is of peat, it stood up well under the operation of the tractors, even after the frost was out.

From the foot of the rapids, river boats drawing 3 ft. of water run to Port Nelson, 50 miles. Larger ships operate on Hudson Bay from Port Nelson to Churchill, so that even during this summer there is direct communication from The Pas to Churchill.

Although several small buildings—some for use as stores and others as bunk houses—were being erected at Amery in early June, there was an entire absence of the conditions which are usually found at important strategic points during railway construction. Drifters, floaters and hangers-on were simply not in evidence. On June 8, some 25 miles of 80-pound rails and 240,000 ties for new construction were on hand at Amery. Only cedar and treated spruce ties are being used. Track-laying began on June 18. Some difficulties with soft spots developed at miles 360-365, between the Limestone and Weir Rivers, which caused considerable delay. Further delay was caused by a fire which destroyed part of the peat dump and some ties.

But these difficulties were overcome and better progress was made north of the Weir River, where conditions were much improved. A water tank was constructed at Weir River, mile 374. The Owl, about mile 420, is the principal river to be crossed

winter transportation in the north and overcomes many difficulties that hitherto have been insurmountable.

From The Pas to Amery the direction of the Hudson Bay Ry. is northeasterly. At Amery the new construction turns sharply northward. Because of this almost right angle the railway from The Pas to Churchill is 30 miles longer than had it taken the original direct route. This is one of the results of the change of ocean terminal from Nelson to Churchill.

The first survey for the Hudson Bay Railway was made from The Pas to Churchill, 478 miles. The first contract for construction was let to J. D. McArthur in 1911 for the section of that line from The Pas to Split Lake, 254 miles. In 1912 it was decided to make Nelson the terminal. The first 100 miles from The Pas to Tyrrell siding was common to the route to both ports. From that point the Churchill and Nelson lines took the same general direction for over 100 miles, but diverged so that at Manitou Rapids on the present railway the Churchill line was about 30 miles to the north.

In order to get the shortest possible line to Port Nelson the present railway cuts off the most northwesterly bend of the Nelson River by its crossings at Manitou and Kettle rapids. The Churchill line touched the Nelson at Split Lake, the most extreme point of its northwesterly bend, and then diverged on a somewhat more northerly course to follow the general direction of the Churchill River. The line north from Amery joins the original Churchill line about mile 450, the end of this season's construction contract. 60

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In order to get the shortest possible line to Port Nelson the present railway cuts off the most northwesterly bend of the Nelson River by its crossings at Manitou and Kettle rapids. The Churchill line

hat it may become worse by silting in such a wide and shallow estuary. Ships entering from the Bay, before the erection of beacons during the construction period, had considerable difficulty in discovering the entrance channel, and could only attempt to do so at high water. The best channel then known had a governing low water depth of 18 ft. and led to the Deep Hole, around the sides and ends of which was the anchorage ground. Above this place there were no depths greater than 20 ft. in which ships might anchor. There was, moreover, no protection against storms, excepting the shoals at the entrance to and within the estuary, and even in moderate gales safety was by no means assured. After the beacons were placed in position, it was not so difficult to make the entrance channel in clear weather, but, on occasions of light mists, the beacons are not visible. This was the case on the return journey from Churchill on Aug. 7, last, when the tug George W. Yates, drawing only 10 ft., was obliged to anchor off the entrance until a slight haze lifted, and, even then, struck lightly a boulder or other obstruction on the way in.

Such is the channel approaching Port Nelson, and with strong river and tidal currents to contend with, and exposed to all weathers, the approach can only be described as a constant menace to shipping. The least departure from the strictest reliance and care on the part of those

headlands, and it is this 13 ft. or so of greater depth which makes all the difference to the navigability of the respective entrances.

Churchill harbor is at the mouth of the Churchill River, which rises in Lake Ile a la Crosse, in East Saskatchewan, and as this lake is the outlet for the Beaver River rising in Alberta, 100 miles or so north of Edmonton, it may be said that the Churchill River carries to Hudson Bay the drainage from a territory nearly 1,000 miles long, passing in its course through several large and small lakes. The outlet to the Bay is through a passage between rocky headlands, and as the width of this passage at low water is so narrow, in fact no more than is necessary for a convenient harbor, the considerable and useful entrance depth to which the river maintains its bed in this gateway can be understood. The harbor inside the headlands is about 6 miles long, the low water width increasing from the entrance to about a mile at Cockles Point, 1½ miles inland, and to about 2½ miles farther up. The low water depths in the harbor are upwards of 30 ft., over a width varying from 1,800 to 800 ft. for a length of a mile on the western side, and along the eastern side an arm of water, 24 ft. deep, is found for a distance of a mile, while the 18-ft. depth contour extends inwards on the eastern side for 2 miles from the entrance. A survey of the harbor was made in 1910,

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Such is the channel approaching Port Nelson, and with strong river and tidal currents to contend with, and exposed to all weathers, the approach can only be described as a constant menace to shipping. The least departure from the strictest vigilance and care on the part of those responsible for navigation would result in losses that would prejudice the port to a far greater extent that the intrinsic value of losses sustained. Port Nelson is merely a roadstead in the estuary, and it is in particular exposed to northeast gales, which occur at somewhat frequent intervals during the navigation period. The tidal range of 17 ft. at the outer shoal, and 15 ft. at the inland wharf site, is the factor which makes the estuary navigable for ships of more than 15 ft. draught. There is a distance of 22 miles from deep water in the Bay to the site of the deep water of the wharf basin—22 miles of which all but 5½ miles is over shoals—that constitutes the difficulty of navigating the approach to the wharf from the Bay. And at that distance, which means 2½ hours' steaming, and the 40 minutes' difference in the time of high water between the two places named, necessarily involve corresponding difference in the depth of water available at the end of the

and to about 2½ miles farther up. The low water depths in the harbor are upwards of 30 ft., over a width varying from 1,800 to 800 ft. for a length of a mile on the western side, and along the eastern side an arm of water, 24 ft. deep, is found for a distance of a mile, while the 18-ft. depth contour extends inwards on the eastern side for 2 miles from the entrance. A survey of the harbor was made in 1910, over 2½ miles from the entrance. Beyond this point, to the limit of tidal waters, the depth probably decreases to about 10 or 12 ft. below low water in the channel, with shallow water on either side. The total area of tidal waters inside the entrance may be in the neighborhood of 15 square miles at low water, but as no surveys exist of the whole harbor, this area is only roughly approximate. The configuration of the narrow entrance admits no storms into the harbor excepting those from between n.n.e. and e.n.e., and as the general axis of the enclosed water is slightly east of south, such storms spend their waves on the north end of the west shore. There are 2 small bays on this shore, north of Sloop Cove, which are obviously the spending beaches for such storm waves as may be able to pass between the headlands. Beyond these two bays there is practically no wave effect, even on the west side, while the eastern side affords

1928

attention. A large amount of material and equipment that had been used in harbor work at Nelson was required at Churchill. As the season for harbor work is short, it was desirable that this equipment should be at Churchill when spring opened. The distance is 180 miles. Four Lynn tractors were taken by rail to Amery and then to Nelson, using the 72 miles of old grade as a highway. From Nelson each tractor hauled three loaded sleighs to Churchill. The four tractors travelled in company and ran night and day with double crews. They took 50 to 60 tons of load each trip. They made the 180 miles to Churchill in 22 hours, an average of 8 miles an hour. There was no road. They travelled on the anchor ice along the shores of Hudson Bay for the greater part of the distance, but the last 40 miles to Churchill was over land, cutting across the point by way of a chain of lakes. There was no trouble in operating the tractors if the temperature was above 40 below. About a thousand tons of freight was moved. Ten or twelve trips were made after March 15. This experiment puts a new face on

HUDSONS BAY Railway

not expected to cause any difficulty. The third ballast pit north of the Limestone was located on its banks.

Two months after track-laying began a force of 2,000 men was being employed by the contractors on the 90 miles from Amery north and by the railway in reconditioning, train-filling, ballasting and building between The Pas and the end of steel.

The work is being done by the Canadian National Ry. as agent for the Railways and Canals Department. W. A. McLachlan is the engineer in charge of construction. It is safe to say that, judged by results, the job is in good hands.

Although not directly concerned in the railway construction, there was a winter movement of freight from Nelson to Churchill by the Railways Department that was sufficiently remarkable to claim attention. A large amount of material and equipment that had been used in harbor work at Nelson was required at Churchill. As the season for harbor work is short, it was desirable that this equipment should be at Churchill when spring opened. The distance is 180 miles. Four Lynn tractors were taken by rail to Amery and then to Nelson, using the 72 miles of old grade as a highway. From Nelson each tractor hauled three loaded sleighs to Churchill. The four tractors travelled in company and ran night and day with double crews. They took 50 to 60 tons of load each trip. They made the 180 miles to Churchill in 22 hours, an average of 8 miles an hour. There was no road. They travelled on the anchor ice along the shores of Hudson Bay for the greater part of the distance, but the last 40 miles to Churchill was over land, cutting across the point by way of a chain of lakes. There was no trouble in operating the tractors if the temperature was above 40 below. About a thousand tons of freight was moved. Ten or twelve trips were made after March 15. This experiment puts a new face on

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ys Company.

but he will not be able to close a rear section door while a weight of 8 lb. or more is on the step; with the switch in the third position, the treadle door mechanism will be inoperative, so that the doors cannot be opened. The switch will remain, normally, in the first position, and the rear section doors will require no attention from the conductor except under exceptional dreamstances, such as to prevent passengers from leaving the car when it is stopped opposite an excavation, or to allow the conductor to open all the doors when the car is in the terminal station. The doors will be interlocked with the power, control and brake apparatus, so that if the car doors, or any of them, are open, the car cannot be started, and so that if a door is opened accidentally while the car is in motion, the brakes will be applied at once.

The foregoing description of the door operation contemplates operation of the car by a 2-man crew. As the car will be to all intents and purposes a single unit, and altogether different from the usual train consisting of motor car and trailer, it is the company's intention to operate it with a 2-man crew, and it would be an economic waste to use a 3-man crew by placing an additional man in the rear section. The inclusion of a third man in the car would undoubtedly defeat,

placing an additional man in the rear section. The inclusion of a third man in the crew would undoubtedly defeat, wholly or in great part, the purpose for which the car was designed. The car gives every promise of being a potent instrument in handling of urban mass traffic, with a 2-man crew, and of being an important transportation cost reducer, but with a 3-man crew, its economy would be largely lost. In addition to that, the management's experience, like that of other electric railway operators, induces the belief that the car will be a safer vehicle with a 2-man crew than with a 3-man one, the reason for that being that the treadle door, with its automatic action, has been found a safer door than one controlled by an employe, in other words, if the automatic mechanism fails, it fails on the side of safety, while if there is a failure of the human element, it is very likely to result in disaster. An auxiliary operating button will be placed in the rear section, by means of which an employe riding in that section would have control of the doors in it, but it is the company's intention, in the interest of both safety and economy, to operate the car without an employe in the rear section.

While, as stated above, the car will be operated only on routes where the grades are 6% or less, this limitation will be modified as regards tripper runs, and the car in such service will be run on routes which have on them short momentum grades up to 8%. The motor capacity is sufficient to allow the car to operate over 6% grades of reasonable length throughout the day, and it is also sufficient to allow the car, in tripper service and with relatively cool motors, to operate over the 8% grades without overheating.

Substitution of a single-treadle door for

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In order to get the shortest possible line to Port Nelson the present railway cuts off the most northwesterly bend of the Nelson River by its crossings at Manitou and Kettle rapids. The Churchill line touched the Nelson at Split Lake, the most extreme point of its northwesterly bend, and then diverged on a somewhat more northerly course to follow the general direction of the Churchill River. The line north from Amery joins the original Churchill line about mile 450, the end of this season's construction contract, 60 miles from Churchill. There would have been many advantages in following the original line to Churchill. As the Laurentian formation broadens to the northward and at Churchill extends to the seashore, the peat formation of the coastal plain would have been altogether avoided; there would have been less adverse elevation to overcome and the railway in the latter half of its length would have been as conveniently located in relation to possible mineral-bearing areas as in its first half. But construction from say Pikwitonei to Churchill would have meant 100 miles of additional work, which would have cost an additional $3,000,000 or $4,000,000, with at least a year's delay in completion to the Bay. For these reasons the scheme that would give effective rail connection with Hudson Bay in the shortest time and at the least cost was chosen.—Toronto Star.

Victoria Jubilee Bridge Traffic Rules.—

1928

HUDSON'S BAY RAILWAY PART-III

C.H. RIFF 9-2018

(See C.R. & M. W. Jan., pg. 7, also under "Calgary and Fernie Ry." in this issue).

Hudson Bay Western Ry. Co.—Following presentation of a petition to the Dominion Parliament at its recent session, on behalf of J. F. Grandell, master mariner, Calgary, Alta., and others, praying for the passage of an act to incorporate a company with this name to build a railway from Fond du Lac, on Lake Athabaska, Sask., easterly to Churchill, on Hudson Bay, a bill was introduced in the Senate on May 20 by Senator McGuire, was read the first and second times, and referred to the railways committee, which reported it without amendment. It was passed by the Senate on May 22, but was withdrawn in the House of Commons on May 28 without being read a first time. The bill provided that the company should have the same directors as the British Columbia Alberta Western Ry., which is dealt with elsewhere in this article; its capital was to be $2,000,000, its office was to be in Ottawa, its issue of securities was to be limited to $50,000 per mile of railway, it was to be empowered to develop water powers, and it was to have the right to build and operate pipe lines for handling gas and oil. The route proposed for the railway was

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built from the Montreal-Toronto line, 5.38 miles west of Kingston Jct. and 2.02 miles east of Collins Bay, to the site of the grain elevator being built on Cataraqui Bay for Kingston Elevator Co., a Canada Steamship Lines subsidiary, was given in Canadian Railway and Marine World for January, pg. 12, it being stated that the spur will be 3.22 miles long, and that in the event of the C.N.R. deciding to relocate its main line in the vicinity, it will be able to use the west part of the spur, a little over 1½ miles, as part of the new main line. Additional official information received states that the spur alignment contains 6 curves with a total length of 4,190 ft., and with total curvature of 165 degrees, the sharpest curve being 7 degrees. There is 5,600 ft. of straight track, with a ruling gradient of 2% rising to the west. The spur crosses 2 creeks on standard pile and timber trestles between miles 1 and 2, the trestles being 670 and 395 ft. long, respectively, and the piles driven for them being between 20 and 60 ft. long. Numerous culverts of standard galvanized corrugated iron type, and from 12 to 24 in. diam., have been included in the drainage system. In building the subgrade, rock was encountered at about mile 1, necessitating a rock cut of about 3,700 cu. yd. The balance of the grading was earth, with considerable side borrow at the south end of the spur, where the line crosses marshy land. At the time of our advice, June 16, grading was about 90% completed, and the track laying and ballasting were expected to be finished in time to permit trains to operate over the spur about the end of July.

Peterborough Bridge.—The General Manager, Central Region, received tenders to June 23 for the construction of 2 concrete abutments, and for the steel work for a concrete and steel railway and highway bridge to replace the present timber structure at Bethune St., Peterborough, Ont. The present bridge, just east of the junction of the Lakefield line with the line to Lindsay, carries

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(See C.R. & M. W. Jan., pg. 7, also under "Calgary and Fernie Ry." in this issue).

Hudson Bay Western Ry. Co.—Following presentation of a petition to the Dominion Parliament at its recent session, on behalf of J. F. Crandell, master mariner, Calgary, Alta., and others, praying for the passage of an act to incorporate a company with this name to build a railway from Fond du Lac, on Lake Athabaska, Sask., easterly to Churchill, on Hudson Bay, a bill was introduced in the Senate on May 20 by Senator McGuire, was read the first and second times, and referred to the railways committee, which reported it without amendment. It was passed by the Senate on May 22, but was withdrawn in the House of Commons on May 28 without being read a first time. The bill provided that the company should have the same directors as the British Columbia Alberta Western Ry., which is dealt with elsewhere in this article; its capital was to be $2,000,000, its office was to be in Ottawa, its issue of securities was to be limited to $50,000 per mile of railway, it was to be empowered to develop water powers, and it was to have the right to build and operate pipe lines for handling gas and oil. The route proposed for the railway was

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Atlantic Ry., G. E. Graham.

Hudson Bay Ry.—W. R. Clubb, Manitoba Minister of Public Works, made an inspection trip over the Hudson Bay Ry. and Churchill port facilities early in June, and is reported to have stated on his return to Winnipeg that 2,000 men were employed at Churchill on various construction jobs, working in day and night shifts; that about 800 men were engaged on construction of the grain elevator, which was taking shape rapidly; that the brick walls of the power house for the elevator were completed; that hundreds of men were engaged in dock construction, and that 900 ft. of dock will be added this year to the 700 ft. built last year. While in Churchill, he inspected the layout of the town site, in regard to division into lots, laying out of streets, etc., which is under the direction of the Manitoba Government.

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ing the final group going there for elevator contractors, Carter-Halls-Aldinger Co.

The House of Commons passed the following items in committee of supply, May 22:—"Hudson Bay Ry. and terminal, construction and betterments, including E. B. Jost at $2,500 (revote $1,375,000), $6,000,000". During the discussion on the item, the Minister of Railways and Canals, Dr. Manion, stated that the best efforts of engineers and contractors will be required to make possible even test shipments of grain from Churchill next autumn. He said that the contract for the construction of the elevator does not call for completion until Sept. 15, and that there will not be many days between then and the closing of navigation. He advised against the holding of any celebration to mark the opening of the H.B.R. route until 1932. He stated that various companies have applied for industrial sites at Churchill and for authority to ship goods through the port. He said that no private interests will be allowed to use the port until next year. Upon being asked if it is the government's intention to allow private grain companies to establish elevators at Churchill, he stated

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1930. The lines and lettering were added by the Dominion Bureau
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and as to the possibility of realizing western expectations in the matter of early completion. Only those who have personal knowledge of the difficulties involved, and largely overcome, may properly appreciate the progress that has been made to date. By unusual effort, the railway was extended to Churchill almost a year in advance of schedule, and that made it possible to take care of the additional work involved in the enlargement of the elevator from 1,000,000 bush. capacity to 2,500,000 bush., together with an extension of the pier from 1600 to 1800 ft. in length. These alterations in original plans, though adding greatly to the work of construction, have not been permitted to interfere with schedule arrangements.

"The proposed test movement will entirely depend upon the completion of the elevator. A contract let in June, 1930, by the late government, calls for completion by Sept. 15th. Last season the freeze-up occurred on Oct. 5. The permissible margin of time is, therefore, slight, even supposing there be no delay due to

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Churchill or from 20 to 25 ships [illegible] time when a clear harbor and no interference whatever would best serve the true interests of the undertaking as a whole.

"We look for a large cattle movement via Churchill once the port is open, and are providing trackage alongside the berths, reserving one berth and 400 ft. clear of sheds, so that there may be a space for cattle pens and accommodation for loading. It is suggested that the most suitable place for feeding cattle destined for export via Churchill would be at The Pas, where hay is available in quantity. That, however, is a matter concerning which I do not presume to speak with authority.

"I have read with interest the resolution respecting freight and insurance rates. Of course neither ocean rates nor ocean insurance is within the control of the government. What brings ships to the ports of Canada, or elsewhere, is the business offering, and competition is the deciding factor in the matter of rates. The government is, however, concerned with providing the facilities which will make Churchill a safe and attractive port during the navigation season, and that responsibility has not been evaded, nor will be. Including the work abandoned at Nelson, and the ex-

adson Bay.

The report of the engineer advocated e adoption of Nelson as a terminus, and on Sept. 28, 1910, the first sod was turned at The Pas. In 1913 the bridge across the Saskatchewan was completed and at the end of the season 80 miles of track had been laid. By 1917 rails had been laid to mile 332 and the grade completed to Nelson. After a lapse of ten years activities were renewed in 1927, with the reconditioning of the line and the installation of new divisional facilities at miles 137 and 327. Meanwhile the difficulties involved in establishing a port at Nelson, because of the shallow character of the mouth of the river, led to a reconsideration of the terminus. Frederick Palmer was asked to report on the relative merits of Churchill and Nelson from the standpoint of providing loading berths for three ships at one time and acommodation for six ships at one time, the ships having a draft of not less than 26ft. Machinery was sent in by airplane, and borings were taken of the bottom of Churchill harbor in the winter of 1926-1927. It was found that it would be possible to dredge the harbor to the required depth and with a favorable report from an engineering party on the possibilities of building the railway to Churchill announcement was made in Aug., 1927, that the terminus would be changed from Nelson to that point. The importance of the airplane in making possible this prompt change in plans cannot be overestimated.

The construction of railways after the Great War in the frozen ground area of the district north of The Pas has involved a revolution in engineering. It will be impossible for an economist to discuss the details of this revolution, but a general description may be ventured. The branch to Flinflon was the experimental section in which the technique was devoloped. The experiment involved using a narrow right of way to put down ties and track on the frozen ground and pushing construction rapidly ahead during the winter. Construction began on Jan. 3, 1928, and on March 17, Cranberry Portage was reached, involv- The station men, employed [illegible] build the grade, were transferred under this system to the task of digging extensive ditches to drain off water from the small lakes and pot-holes across which the road had been built in winter. The technique of construction involved the solution of various problems, including the thawing of gravel in the ballast pits and the thawing of ground with steam points for piles. Moreover the problem involved in securing an adequate water supply for winter operations at various water tanks and also at the terminal at Churchill and of laying out buildings and elevators on frozen ground may be satisfactorily solved only after a long period of experiment. Comparatively little scientific investigation has been carried out on frozen ground and it is limited chiefly to work in Russia and to practical experience in the Yukon and on the Hudson Bay Ry. Canada should be in a position to make distinct contributions on the subject. The construction of the railroad has been achieved successfully as the result of the skill and courage of Canadian engineers in advancing boldly to the working out of new technique.

The completed line has a maximum grade of 0.4 northbound. The elevation at The Pas is 1,190 ft. and at mile 10 it increases to the highest point, 1.290 ft. There are few curves of more than 3° and the total curvature is 12.6% of the mileage. Construction includes 51 miles in cuts, 12 miles solid rock work and the remainder embankments.

The port engineers have had a wealth of experience at Nelson and at Churchill. Dredging operations, as carried on at great distances from a base, brought their own problems, but the completion of the railway will contribute to the solution of those problems. The success of a through route for wheat by Hudson Bay must depend on thorough investigation of ice conditions in the straits, in the Bay, and in the harbor, and on the energetic tackling of the problems raised. Such questions as weather forecasting, establishment of wireless stations, and facilities for guiding ships through the straits, and possibly specially de- and to the west are strongly entrenched competitors. Allowing for a possible lengthening of the season through improvements introduced as a result of engineering skill, for a return cargo which will cut down the costs of a back haul of empty cars for at least 510 miles, and for elaborate storage facilities at Churchill cutting down the peak load haul during the open season, there is still the necessity of earning interest on the investment for eight and possibly nine months of the year.

The ultimate success of the line will depend therefore on the development of local traffic along the railway and in Hudson Bay. The task of the engineer and of Canadians is that of opening up the Canadian north made accessible by the railway. It is becoming increasingly apparent that mining and water power are the basic factors in future development. Lumbering and fishing may be developed, as subsidiary industries to mining and power, but the evidence so far available is not encouraging as to their development on a large scale. Narrowed down to minerals and power, the problem may be discussed more clearly. In the first place, in the search for minerals substantial progress has been made in working out a new technique. The construction of the railway has facilitated the establishment of depots along accessible parts of the Bay. From these depots the prospector, with canoe or airplane, is able to get into the country early in the season and to remain later than would otherwise be possible. The east and west coasts have been made accessible and also the western Arctic. The third side of the triangle, of which the Mackenzie River and the Arctic coast constitute the remaining sides, has been opened and airplane and other prospecting facilitated throughout the whole of the northern precambrian area. The search has only begun, but in 1929 the first shipment of quartz gold was sent out from Term Point to Churchill and Cobalt, and promising developments have been made on the Coppermine, Bear Lake, Slave Lake and Lake Athabasca. The airplane is far from perfect as a

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The Engineer and the Hudson Bay Railway.

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By Harold A. Innes, M.A., McM., Ph.D., Chic., Associate Professor of Political Economy, Toronto University.

The driving of the last spike at Churchill, Man., on April 3, 1929, and the completion of the first lift of gravel on Sept. 13, by which the Muskeg Limited was able to proceed as the first train to Churchill marked the end of a long struggle on the part of the engineer. It was a vindication of the skill of the Canadian engineer, and, if it marked the beginning of a long series of new problems, it gave promise of the success with which these problems will be solved. The Canadian north is a challenge to the Canadian people, but it is particularly a challenge to the Canadian engineer.

The history of the line dates back to the abandonment of the Hudson Bay route and the opening up of railway communication from the south and from Montreal. In the 'eighties a short stretch of line was built north of Winnipeg and is now a part of the road which terminates at Gypsumville. The Canadian Northern Ry. continued the line as part of its main line to Hudson Bay Jct., and in 1908 a branch was completed to The Pas, 467 miles from Winnipeg. On Aug. 10, 1908, survey parties left Winnipeg to locate the route to Hudson Bay.

The report of the engineer advocated the adoption of Nelson as a terminus, and on Sept. 28, 1910, the first sod was turned at The Pas. In 1913 the bridge across the Saskatchewan was completed and at the end of the season 80 miles ing the putting down of 51 miles in 56 days. On this unballasted roadbed, supplies were rushed in, and after navigation opened ballast trains were used to dump gravel on the roadbed. The track was lifted up and gravel put underneath. The experience gained with construction on this section was elaborated on the Hudson Bay Ry. In part the problem was solved by the use of the tractor, but the basic consideration as in the Flinflon line, involved putting down the track over frozen ground, and rushing supplies, ballast trains and equipment to the various ballast pits along the line, especially at miles 396, 467 and 507, before the open season. On Oct. 16, steel had reached mile 428, and by April 3 the last spike was driven at mile 510. The ballast trains operated both ways from the pits and gradually filled up the unballasted portions of the line.

Tracklifting gangs were engaged in raising the track by jacks and pounding the gravel underneath the ties. During the open season the whole was kept under close supervision by a completed telephone system and the use of small gas cars operated over the unballasted track. The station men, employed formerly to build the grade, were transferred under this system to the task of digging extensive ditches to drain off water from the small lakes and pot-holes across which the road had been built in winter. The technique of construction involved the solution of various problems, includ-

signed ships, are all within the range of the engineer's problems.

But assuming that facilities have been established by which wheat can be shipped throughout a period of 12 weeks, which is generally conceded, assuming that connections have been built to The Pas by which a railway system built to converge on Winnipeg is realigned to converge on Churchill, and that sufficient time has elapsed to put the road in condition for handling heavy train loads of wheat and the port in condition for the rapid loading of ships at Churchill, the line is subject to numerous handicaps. In the first place the cost, including the abandoned works at Nelson and the port at Churchill, as well as all other equipment, with the interest charges on capital invested during construction, will not fall far short of and will probably exceed $50,000,000. It has been argued that the port will be able to handle 100,000,000 bush. in a favorable season, but it is necessary to keep in mind that freight charges, insurance and general expenses must be adjusted in line with other ports, Vancouver, Montreal and New York. The Canadian National Rys. and the Canadian Pacific Ry. to the east and to the west are strongly entrenched competitors. Allowing for a possible lengthening of the season through improvements introduced as a result of engineering skill, for a return cargo which will cut down the costs of a back haul of empty cars for at least 510 miles, and

of the government. What brings ships to the ports of Canada, or elsewhere, is the business offering, and competition is the deciding factor in the matter of rates. The government is, however, concerned with providing the facilities which will make Churchill a safe and attractive port during the navigation season, and that responsibility has not been evaded, nor will be. Including the work abandoned at Nelson, and the expenditures of the Marine Department in aids to navigation in Hudson Strait and Bay, this work involves a capital expenditure of $56,000,000. It will be the aim of the present government to protect that outlay and to endeavour to see that it affords commensurate return to the producers of Western Canada. I have no reason to expect that western shippers will be disappointed in the rates that will obtain from Churchill; nor that the underwriters, in view of the modern aids to navigation now available, will consider it necessary to demand unreasonable marine insurance. A proper estimate of the cost of Hudson Bay insurance can, of course, only be arrived at as a result of experience in the use of the new route, over a period of years, but should there be any disposition to discriminate against the Hudson Bay route, either as to rates or insurance, you may be certain that the government will take whatever action may be available to it to redress the situation. On the other hand, the government ought not to be expected to do for any one port of Canada what it is not prepared to do for all."

Prescott Grain Elevator.—The Dominion government grain elevator built on the St. Lawrence river near Prescott, Ont., contained, on March 1[illegible], 181,060 bush. wheat, and 539,149 bush. barley.

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