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# A Brief History of the Bangor and Aroostook Railroad

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## A BRIEF HISTORY OF THE BANGOR AND AROOSTOOK RAILROAD.

In the fall of 1890 Hon. Albert A. Burleigh authorized the publication of the details of a plan that he had conceived that might result in securing the long desired railroad into Aroostook County over American soil.

The plan, or "Burleigh scheme" as it was called, is familiar to all our readers. It was, in short, that the County of Aroostook should be allowed to subscribe a sum not exceeding five per cent. of the county's valuation towards the building of the road. We will not give here the history of the publication of the scheme, but will only say that on its announcement it at once met with favor, and petitions were circulated asking the legislature to pass an enactment allowing the county to vote on the proposition.

The enabling act was secured and then followed a canvass of the larger towns by Mr. Burleigh. Large meetings were held and great enthusiasm was awakened. Mr. Burleigh explained the details of the plan, answered all questions asked him in a clear and convincing manner and imparted to his audiences the same faith in the enterprise and in the products and resources of the county with which his own soul was filled.

The papers of the county did loyal service in the good cause and nobly supported the enterprise. The vote of the county was almost unanimous in favor of the proposition.

At the urgent solicitation of the business men of Aroostook, Mr. Burleigh had written a letter to F. W. Cram asking him to aid in the great undertaking. Mr. Cram as manager of the New Brunswick Railway had become thoroughly familiar with the magnificent possibilities of Aroostook, as nearly all its immense products were conveyed to market by the way of the railroad with which he was connected.

In another column we give a biographical sketch of Mr. Cram, and will only say here that railroad business has been his life work, and that he is thoroughly familiar with every detail of railroad work from running an engine to managing a great system.

Mr. Cram had resigned his position as General Manager of the New Brunswick Railway, and was about to accept an important and lucrative position in West Virginia, when the letter reached him.

He promptly accepted the invitation thus extended, and from that time to the present he has given himself body and soul to the task of building the Aroostook Short Line. His faithful, persistent work, overcoming obstacles and difficulties that would have discouraged men of less resolute spirit, keeping right on during the awful financial crash and distress of the last two years, inducing capitalists in Boston and New York to take the mortgage bonds of the road by infusing into them a portion of the faith in Aroostook County and its possibilities that was the mainspring of the marvelous earnestness that seemed a part of his being, these



things are a part of the history of the building of the Bangor and Aroostook Railroad, that can never be fully written, and will not probably ever be fully realized.

— The necessary legislation additional to the enabling act was secured, and work was commenced on the new road in the spring of 1893. The route selected was from Brownville in a north-easterly direction through the wilderness to Sherman, thence onward to Houlton passing through the towns of Island Falls, Smyrna, Oakfield and New Limerick.

The Bangor and Aroostook Railroad Co. purchased the Bangor and Piscataquis Railroad in 1892. Brownville is on the Katahdin Iron Works branch of the last named road. Work was pushed forward so energetically in 1893 that Houlton was reached in December of that year, although the last 26 miles of the road were not ballasted, and many of the ties were laid on the snow and ice instead of on the ground.

Trains commenced running Jan. 1, 1894, and notwithstanding that everything was in an unfinished state, and there were no store houses along the line, still the road more than paid the expenses of operating during the cold and trying winter of 1893-4, and the report of the railroad commissioners for the year ending June 30th, 1894, when the road had been in operation just six months, shows a balance of \$57,955.79 above operating expenses. The earnings have steadily increased month by month and probably no new railroad ever constructed in this country can show a better re-

cord, as regards net earnings, for a similar period of operation than can the B. & A.

The summer and fall of 1894 were busy seasons in Aroostook County. While the business depression continued in other sections, here all was life and activity. Pending the completion of satisfactory financial arrangements, Mr. Burleigh, the President of the road, personally guaranteed the payment of the contractors and work on the construction of the road northward from Houlton was commenced.

The whole story of the anxieties endured, the energy and persistence displayed and the obstacles overcome, will never be published to the world, but the unfailing faith, the indomitable pluck, and the unconquerable determination of F. W. Cram and Albert A. Burleigh are the principal factors which have been potent in carrying the B. & A. Railroad to a successful completion to the flourishing towns of North Aroostook.

These two men know no such word as fail and to them Aroostook County is indebted for the well built and finely equipped railroad which now connects it with the great "Outside" over American soil. The railroad is a fixed fact, and how it became so, should never, and will never be lost sight of by the people whose good fortune it is to possess the fairest portion of this great State, which under the fostering influence of direct communication, will develop and prosper as never dreamed of by the most sanguine believers in the possibilities of Aroostook County.



The road was opened for travel and traffic, to Presque Isle, Fort Fairfield and Caribou, Jan. 1, 1895. The business done during the past two and one-half months, has been far beyond the expectations of the officials of the B&A. R. R. Company, and it has taxed the present capacity of the rolling stock to the utmost. More than fifty freight cars a day have been required since the middle of February to move the potato crop and other products of the county towards a market.

The whole length of the new road is as follows: From Brownville to Houlton 95 miles; from Houlton to Presque Isle, 45 miles; from Presque Isle to Caribou, 12 miles; from Fort Fairfield Junction to Fort Fairfield, 14 miles, making in all 166 miles of new road. The whole distance from Bangor to Houlton is 140 miles and from Bangor to Caribou is 207 miles.

The road was built for the heaviest of freight trains, and there is not in the country a more solid and substantial road bed, stronger culverts and bridges, easier curves and grades than has the B. & A. The rails are of steel and weigh 70 lbs. to the yard. The rolling stock is first class in every particular, and the passenger cars are specially neat and comfortable.

The stations, awnings, tanks, coal sheds, etc. are all of sufficient capacity for present and future needs and the waiting rooms are all neat and comfortable. The rolling stock is fitted with the most improved Westinghouse air

brakes, and the passenger coaches are provided with the latest apparatus for heating by direct steam from the locomotive.

The railroad is one of the finest in the country, and unlike many roads which have to struggle many years before even paying running expenses, the B. & A. R. R. is placed at once on a paying basis, and the outlook for the future is brighter than the friends of the enterprise ever dared to hope.

The following article may be termed a technical description of the construction of the Bangor and Aroostook Railroad. We are indebted to Chief Engineer, Moses Burpee, for the very full, accurate and valuable information contained in the article. It will well repay perusal by all who take an interest in Aroostook county, and in the successful completion of the most important enterprise ever undertaken in this State or in New England. The article explains many features of railroad construction that the general reader has no knowledge of, and does it in an intelligible and interesting manner.

The Aroostook Division of the Bangor and Aroostook Railroad, or the newly built portion of the road, which runs from Aroostook Junction in Brownville to Caribou, is 154.5 miles long and the branch to Fort Fairfield is 13.3 miles, making a total of new line 167.8 miles.

Its grades rising north are never more than one and a quarter percent. or sixty-six feet per mile, and rising south



are one percent. or nearly fifty-three feet per mile. There are but two exceptions to the latter where for only a short distance, a steeper grade has been used temporarily owing to the insufficiency of material within any practical distance for the heavy embankments the standard gradient would have required. These will eventually be brought up by ballast trains.

The sharpest curve used except in some special case is six degrees, in which there is a gradual uniform change of direction of six degrees in every hundred feet until the end of the curve is reached. The number which expresses the degree of a curve is thus the same as the number of degrees change of direction per hundred feet. The exceptions to the above maximum curvature are at Pleasant River, West Branch of Penobscot, East Branch of Penobscot and the first crossing of the Meduxnekeag, where there is in each place an eight degree curve instead, in leaving the north ends of the bridges. These curves are necessary to permit the line of the road to conform to the direction of the valley after crossing the stream at nearly or quite a right angle, and as in each of these cases the direction of the valley has to be followed for some miles before the line can by means of a gradual rise get out of it. The above gradients and curvatures are used by any first-class road in the country which requires them.

The rails are steel, weighing 70 lbs. per yard, and with only a few exceptions they are 30 feet long. The fastenings are four hole angle bars, weighing 50 lbs. per pair, and the screw bolts used with them weigh about a pound each.



The spikes weigh about half a pound each. There are, as a rule, 2816 ties per mile, but frequently a few more. The weight of track material per mile in tons of 2,240 lbs., which is still used for these things, is 110 tons of rails, about eight tons of angle bars, two-thirds ton of bolts and two and one-half tons of spikes.

The bridges are all of steel and rest on granite masonry abutments and piers. Spans 8 to 20 feet long are rolled steel beams. Above 20 and to 75 feet are plate girders. Greater lengths than above are truss spans.

All bridges between Brownville and Houlton were built by the Wrought Iron Bridge Co., Canton, Ohio, except the Mill Brook viaduct, which was built by the Edgemoor Co. of Delaware. Those north of Houlton were built by the Pennsylvania Steel Co.

The principal bridges are as follows: Pleasant River bridge, within a quarter of a mile of Arrostook Junction, crosses the river at an oblique angle instead of a right angle, and is therefore a skew bridge. It has two through spans, each 135 feet long. Its south abutment rests on a pile foundation, the center pier on a rock, and has a concrete bottom about six feet thick, and the north abutment is built on a stratum of hard pan and boulders.

The Canadian Pacific Railway Crossing in North Brownville is made by an overhead bridge. It is a through plate girder, 60 feet clear span, and on a skew. Its abutments are founded on the hard pan below the influence of frost.

The above is followed by a pile trestle, 227 feet long, and extending to the south abutment of Mill Brook viaduct. This trestle is considered as only temporary and will eventually be filled with earth.

Mill Brook viaduct, 360 feet long with greatest height of trestle of 59 feet, is on a four degree curve and is supported by two abutments and nine trestle bents. Eight of these are arranged in four groups or towers, connected with struts and braces so as to have ample stiffness in all directions. The ninth trestle bent is the one next the north abutment. Those trestles which are grouped into towers are 30 feet apart longitudinally, and carry 30 feet plate girder spans on top. All the other girders are 40 feet long, and these span the spaces between towers, so that the 30 and 40 feet lengths alternate. The girders on the outside of the curve are six inches higher than those on the inside, and the center line of bridge is also slightly outside of the center line of track, for the purpose of balancing or compensating the natural centrifugal force of trains in motion on the curve to which the viaduct is built. This arrangement makes it easy to give the necessary elevation to the outer rail of the curve and also prevents an unduly heavy stress from coming on the legs under the outside of the curve.

The foundations of the south abutment and the pedestal south of the brook rest on hard pan. The pedestals north of the brook, except the last pair are on concrete beds, the



last pair and the north abutment, on pile foundations.

The West Branch of Penobscot has four spans, one at each end being through girders, 75 feet long each, and the middle two, through truss spans of 105 feet each. The foundations are on ledge or boulder beds. Considerable difficulty was encountered in putting in the foundations of the center pier where the current is very quick.

Smith Brook bridge is a 30 feet deck girder with pile foundations under the abutments.

The Millinocket bridge is a 105 feet through truss span. There are pile and timber foundations under the abutments. The Schoodic Stream Bridge is a through girder, 50 feet span.

The East Branch of Penobscot has two through truss spans of 150 feet and on the east end a deck girder of 30 feet span, crossing the Medway road. The foundations are on rock and the bottom of the pier is a mass of concrete about 7 feet deep.

Hay Brook is a 20 feet span with abutments on pile foundations.

West Branch of Molunkus bridge is a 30 feet span deck girder.

Molunkus bridge is a 40 feet span deck girder with pile foundations under the abutments.

Cold Brook bridge is a 40 feet span deck girder.

Fish Stream bridge is a 75 feet span through girder with pile foundations under the abutments.

West Branch of Mattawamkeag has two spans, 60 feet each,

through girders, with pile foundations under all the masonry.

Dyer Brook bridge is a 50 feet span through girder.

In the town of Dyer Brook between Dyer Brook and Oakfield stations is a wooden trestle, 648 feet long on a five degree curve.

East Branch of Mattawamkeag bridge has 3 spans, a central one of 70 feet, and one at each end, 50 feet long, all deck girders. The north pier is on a pile foundation, the other masonry on rock or hard pan.

Thomas Brook bridge is a 40 feet span deck girder.

Titcomb Lake outlet has a 56 feet deck girder. This bridge is on a 3 degree curve. It has also about 150 feet of wooden trestle, which eventually will be filled with earth.

Philpot stream has a 50 feet span deck girder.

McCarty Brook has a pile trestle bridge 277 feet long.

Moose Brook has three spans, 50 feet each, deck girders supported on trestle bents on the intermediate piers, and on abutments at the ends.

The first crossing of Meduxnekeag is a skew bridge of three deck truss spans of one hundred feet each. The south abutment is on hard pan and both piers, and the north abutment are on rock.

The second crossing of Meduxnekeag is the first bridge north of Houlton. It begins at south end with a timber trestle, 245 feet long. At its north end the permanent bridge begins and this is 410 feet long, in five spans, a



deck girder of 55 feet at each end, and three deck truss spans between. This is also a skew bridge. The south abutment and piers 1 and 2 are on pile foundations. Pier 3 is on concrete, 7 feet deep on rock bottom, and pier 4 and north abutment are on rock. A second wooden trestle joins on to the north end of the permanent bridge. It is 257 feet long and extends to the 45 feet through plate girder which bridges the County road. At present this is a continuous bridge 947 feet long, but when the wooden trestles have been replaced with earth embankments, the second crossing 410 feet and the overhead crossing 45 feet only will remain.

Johnson Brook bridge is a 50 feet span deck girder, with rock foundations under the abutments.

Monticello viaduct is 400 feet long. There are two central deck truss spans of 100 feet each. The south approach is a viaduct of three 30 feet deck girders, and the north approach has one 30 and two 40 feet deck girders. The trusses and girders are supported by heavy steel columns resting on masonry at all intermediate points, and by the abutments at the two ends. The arrangement of the columns at the ends include one tower in each approach. The foundations south of the stream are on rock. The middle pier is on a pile foundation and all north of this are on hard pan.

Whitney Brook bridge is a 50 feet span deck girder.

"Three Brooks" bridge is a 50 feet span through girder.

Young's Brook bridge is a 40 feet span through girder.

Clark Brook bridge is a 50 feet span through girder.

In Presque Isle, just south of the crossing of Main Street is a pile trestle 193 feet long.

About one and a half mile north of Presque Isle village is the crossing of the Aroostook River. Including the timber trestle approaches, the whole length of the structure at present is nearly 1,100 feet. At the south end is a timber trestle 189 feet long, and north of this the viaduct approach of the permanent bridge 150 feet followed by three spans of 150 feet each deck trusses, and these again, by 180 feet of viaduct extending to the north abutment, and north of the abutment, a short piece of temporary wooden trestle which is to be filled shortly. The three large spans exactly cross the river from bank to bank. Piers 1, 2, and 3 are on pile foundations; all others are on hard pan or gravel. The temporary trestle, with the pile and timber foundations was put in in two months. It contains about 21,000 lineal feet of piling and round timber 180,000 feet of sawn timber, and 22,000 pounds of iron. Since winter set in, all the masonry, about 1,400 cubic yards has been built and the iron work of the bridge erected.

There are a number of small pile trestles between Presque Isle and Caribou, the longest one being at Presque Isle brook, 165 feet long.

Caribou Stream bridge is two 75 feet span deck girders. The pier is on a pile foundation and the abutments are on hard pan.

There are no bridges of consequence on the Fort Fairfield branch.



Besides the above bridges there are three 20 feet spans, nine ten feet spans and one 8 feet span.

The pile and timber trestles including those mentioned, number in all twenty-three structures with an aggregate length of 3,120 lineal feet. There are four open culverts, 5 to 8 feet span, and all other water ways are carried through box or arch culverts. Of the latter there are two of 8 feet width, and of the former about 600.

Where stone for culverts was obtainable, it was used, and elsewhere, timber. The latter will be renewed by iron pipes as becomes necessary.

Something has been said above about the ruling grades, but it may be of interest to know more about them in detail, and about the reasons for adopting them. The main point was to connect Houlton and the rest of Aroostook County by a railroad with the nearest Maine city or port, through which the world might be brought nearer. The existing line of B. & P. R. R. could be utilized as far as Brownville. Surveys had been previously made through Brownville to the East Branch of Penobscot, and from Mattawamkeag to Houlton, which were believed to demonstrate the feasibility of a route from Brownville to Houlton. When, however, a line is drawn on the map connecting the two ends of an important division or route, a very interesting study begins. We not only look to see where the air line crosses the rivers and ridges, and whether for these purposes it can be advantageously broken up, and diverted to the right here, or to the left there, so as to

secure bridges which shall be either safer or cheaper, and grades which will give little resistance to traffic, but we also inquire whether it strikes water powers, manufacturing sites, good agricultural districts, or, in short, whether it links together the greatest possible number of places capable of development in any line of industry. It may be that the latter should govern in the choice between routes, for it is better to build a line which is needed and will at once furnish traffic, even if the line must have grades and curves, than to build one which may be mechanically perfect, and yet be an unnecessary thing. As railroads are commercial institutions it follows that they should be built where they will serve the largest interests and develop the greatest resources. After this principle has been adopted, the service and skill of the engineer and contractor should be made to avoid all possibly avoidable obstacles, and to overcome by the most careful possible location the resistances to traffic that are sure to be found everywhere.

In the selection and location of the B. & A. R. R. the above principles were kept uppermost in view by the Company, and such points as North Twin Dam and Grindstone Falls, without any development as yet, but with good possibilities, and Island Falls, and New Limerick with partial development, were selected as points on the route which ought to be connected. Thus it is that having selected the route, a rough examination of the country with the assistance of guides is made, first ascertaining the feasibility of crossing the ridge between Pleasant River and Schoodic Lake, and



where to cross it, then the ridge between Schoodic and Seboois Lakes and next, the height of land between Seboois and South Twin Lakes. After settling on a crossing of the West Branch of Penobscot, below North Twin Dam, a way must be found to the Millinocket Stream, and then from that to Grindstone Falls, on the East Branch of Penobscot. This was a piece of work which took some time in location, but after it was done, seemed all plain enough. From Grindstone Falls to Stacyville, it is impracticable to use a lighter gradient than 66 feet per mile. From Stacyville to Houlton and north of Houlton there is no country which requires any steeper grades than that south of Houlton. The ruling grade therefore adopted as against the heaviest trains is one per cent., 53 feet per mile. This is opposed to the trains going south, and as it is always fair to consider that very much lighter trains will be hauled in the opposite direction, or northward, it is concluded not worth while to spend money unnecessarily in making grades of 53 feet per mile where 66 feet per mile will answer just as well, and better, because they cost less and save distance.

The elevation of grade at Aroostook Junction is 349 feet above the sea. From the Pleasant River bridge the line follows the east bank, gradually rising until at the crossing of the Canadian Pacific R'y. it is 469. At this point the location and construction are quite interesting. Three things presenting opposing influences have to be considered. First the crossing of the Canadian Pacific R'y. which at this point ought to be, as it is, carried over by a bridge.

Second, the deep ravine of Mill Brook which, were it possible, ought to have a grade several feet lower than at the C. P. crossing, but it is within so short a distance that no practical difference is possible; and third, a heavy summit cutting, but a very short distance beyond Mill Brook, requiring a grade level fully as high as at the C. P. crossing, and even higher if possible. The plan adopted was to establish a grade at the C. P. crossing high enough to give the lawful headroom under the bridge, and to carry this grade level across Mill Brook, which is something above 60 feet from the bottom of the brook, and then as soon as the end of the embankment is passed, to raise the grade as is necessary to go through the summit with no greater depth of cutting than absolutely required. This gives such a height of grade above the bottom of Mill Brook ravine, that the viaduct is the most economical method of crossing it, that is substantial. From the summit cutting here mentioned to Schoodic Lake the surface is undulating. The elevation of Schoodic station is 482 feet, and of the lake about 440. From this eastward, there is a sharp rise to 555 feet at the summit between Schoodic and Seboois Lakes and then a quick descent to the level of the swamp at the head of Seboois, but a little above the flowage of the dam at its outlet. This is 443 feet above the sea. The line over this ridge is much more curved than the average, but from the foot of the grade on the Seboois side a tangent or straight line four miles long extends to West Seboois station and stream of same name,



where the elevation is 490 feet. Thence to South Twin Lake, the line across the ridge in a sag or summit bog where the Sebcoois flowing southward and Partridge Brook flowing northward, take their rise. The elevation of this summit is 579 feet. Along the shore of South and North Twin lakes the line is crooked but the grade is almost level at an elevation of 490 feet.

From the West Branch bridge the celebrated North Twin Dam can be seen just above. This dam backs the water in North and South Twin and Pamedumcook lakes, and over it annually 50 to 60 millions feet of logs are sluiced. About a mile east of the bridge, a down grade begins which makes a descent of about 120 feet ending near the Smith Brook. In a mile further the Millinocket is crossed at an elevation of 368 feet.

As the water of Millinocket is smooth from this to its junction with the West Branch, the difference of 120 feet in the level of the two streams is shown to have taken place in the latter one. This occurs in the mile between the dam and Quakish Lake, and below Quakish at Island Falls, Rines Pitch, Grand Falls and Shad Falls. As the Millinocket and Twin lakes are about the same elevation, we have to look for the rapids and falls of Millinocket above the bridge where they really are. Crossing the Millinocket opposite the mouth of a small brook, entering on the north side, the line follows this little valley to the summit about 50 feet higher, and very soon with scarcely any fall, crosses the Schoodic stream

another tributary of the West Branch. From this, after crossing a few spurs from a high ridge on the northward, a decided descent is begun and, at a difference in level of about a hundred feet, comes into the valley of Meadow Brook, a small tributary of the East Branch of Penobscot, emptying into it below Rocky Rips. Meadow Brook valley is the lowest ground on the whole line, 319 feet above the sea. There are evidences of its once having been the bottom of a lake. Between Meadow Brook and the East Branch there is a high gravel horseback or kame; and it is through a depression in this that the line runs before crossing the West Branch.

As the direction of the line has been about parallel with the river, a sharp curve is necessary before crossing. A cutting through the horseback still further reduces its height, and the line emerges at once on the river where a very beautiful view of a quiet reach of water between Grindstone and Crowfoot Falls is seen. Another sharp curve after crossing brings the line again parallel with the river, which direction it follows for about three and one-half miles, with no change in elevation. At this point Hay Brook is crossed and an ascending grade begins. This is necessary to cross the ridge which divides the East Branch from the Molunkus. The rise is 183 feet in three miles, followed by undulating grades, which, however, rise more than they fall, until Stacyville is reached at an elevation of 523 feet. The line is here in the valley of the



Molunkus and its various branches are separated by such low ridges that they are scarcely noticed, and do not form a feature in deciding the location of a road, and a twelve mile straight line extends nearly to Island Falls, having run through Sherman and Crystal, and crossed the two branches of Molunkus and the Cold Brook.

Fish Stream, the west branch of Mattawamkeag, and Dyer Brook are crossed near Island Falls, and the valley of the latter is followed about six miles to the highest ground south of Houlton, namely at Dyer Brook station, where the elevation is 646 feet above sea level. The grade at once descends to the East Branch of the Mattawamkeag, near which is Oakfield station, 560 feet above the sea. From this the valley of Thomas Brook and Spaulding Lake takes the line to the true summit of the road, viz: the divide between the Penobscot and the St. John waters near Timoney's, where the elevation is 645 feet above sea level, one foot less than at Dyer Brook.

From this summit the valley of a rapidly descending brook running into Titcomb, or Cochran Lake, is followed. The foot of the maximum grade is reached a little west of Smyrna Station, which is situated on the north side of Titcomb lake. Continuing eastwards, in a half a mile or so, the outlet is crossed at an elevation of 495 feet. The grades from this to Houlton are undulating, as there are several streams to be crossed. The more important are Philpot, McCarty and Moose Brooks, and at Houlton the South

branch of the Meduxnekeag. There is a gradual descent, however, and the elevation at Houlton is 362 feet.

On leaving Houlton station northward the second crossing of the Meduxnekeag is made immediately and just below the confluence of the south branch and B stream; and the valley of B stream is followed for a short distance until well onto the table land. There is a very gradual ascent until about the center of Littleton township, from which it rapidly descends to the crossing of Johnson Brook, and immediately rises again to the table land, just south of Littleton station, where the elevation is 446 feet. There is a descent into Littleton swamp and then a gradual ascent to a summit near the south line of Monticello, at an elevation of 516 feet.

Up to this point the course has been about due north, but here it swings to the northwest in order to follow a hillside which allows the grade to drop to a convenient height for the crossing of the Monticellow stream, which it does at an elevation of 439 feet. The same course is continued along the valley of the Monticellow stream until the summit is reached, 543 feet above sea level, on the west side of Sugarloaf Hill. When once clear of this hill the line turns to the east of north and recovers the easting which was lost south of it. This, however, was not by choice, but by necessity, owing to the hills to the westward in the vicinity of Bridgewater Corner. The above summit divides the Meduxnekeag waters from those of the Presque



Isle of the St. John, and the valley of Whitney Brook is the way taken to reach it, which it finally does at the mouth of "Three Brooks" near Robinson's mills, 366 feet above the sea.

This valley is followed closely until within the town of Presque Isle, but of course the grade is now an ascend-one. At Mars Hill station the elevation is 331, and at Fort Fairfield junction 581 feet above the sea.

From this station the line sweeps to the westward and crosses the center line road in Presque Isle at the summit dividing the Presque Isle of the St. John from the Presque Isle of the Aroostook at an elevation of 654 feet. This is the highest point on the main line between Brownville and Caribou, being 8 feet higher than Dyer Brook and 9 feet higher than Timoney's summit.

From this to Presque Isle village is a continuous descent of one per cent., the elevation at the station in the village being 456 feet.

One and a half miles farther is the Aroostook River Bridge, the largest yet erected on the line. Its grade elevation is 460 feet above the sea.

From this to Caribou,  $13\frac{1}{2}$  miles the falls is very little, the elevation of Caribou yard being 405 feet.

The Fort Fairfield branch at the junction is 581 feet above the sea. This is in the valley of a tributary of the Presque Isle of the St. John. A table land between this and Aroostook valley must be crossed before reaching

Fort Fairfield. The greatest elevation of the line on this table land is 673 feet, the highest point of the Aroostook division. From this the descent is gradual and not continuous until the elevation 600 is reached from which to elevation 402 is made in a little more than 3 miles or at a rate of about 66 feet per mile, which is in some places slightly increased and in others slightly decreased. Neither grades nor alignment of the branch are so good as on the main line, for, though in a comparatively smooth country the direction of the line is almost at right angles with that of its principal valley necessitating almost certainly a steep grade, and the adoption of whichever ravine might offer itself for a route without the chance to make any choice is likely to incur sharp and frequent curves.

The above description must have made it clear to the reader that the line has not followed for any great distance any of the rivers or larger streams, but runs across country, so to speak. This increases the liability of having steep and frequent grades and a large amount of curvature, but it is possible that it may also be productive of a much greater degree of development in the country, and that each stream may be made to some extent a feeder of business to the line.

An analysis and comparison of the alignment of the different sections of the road is as follows:

From Aroostook Junction to Houlton the total distance is  $94\frac{1}{2}$  miles. About 72 per cent. of this is straight line or tangent, and 28 per cent. curved line. Of the curved



portion the average curvature is three degrees per hundred feet. The total amount of curvature is about 4,271 degrees or about 45 degrees per mile for the whole distance. This is about equally divided into right and left curvature.

From Houlton to Caribou, the total distance is  $60\frac{1}{2}$  miles. About  $68\frac{1}{2}$  per cent. of this is tangent and  $31\frac{1}{2}$  per cent. is curved line. The average curvature of the curved portion is about two and a third degrees per hundred feet. The total amount of curvature is about 2,332 degrees or  $38\frac{7}{10}$  degrees per mile of the whole distance, and is about equally divided into right and left curvature.

The Fort Fairfield branch has a total length of  $13\frac{1}{3}$  miles. About 67 per cent. of this is tangent and 33 per cent. curved line; of the curved line the average is three and one-tenth degrees per hundred feet. The total curvature is about 726 degrees, or  $54\frac{1}{2}$  degrees per mile of the whole distance.

A comparison of the above shows that the Fort Fairfield branch has the greatest percentage of curved line and the Brownville-Houlton section the least, and yet while the Houlton-Caribou section has a considerably greater percentage of curved line than the Brownville-Houlton section; it also has a much smaller amount of curvature per mile and a less average curve per hundred feet. The latter is due to a greater diversity of the physical features of the Brownville-Houlton section, as it contains some of the roughest and also some of the smoothest country

on the line.

The country through which this line runs is for the first five miles or so in cleared farming lands, or outlying wood lots, but from this to Stacyville, nearly 50 miles is through wilderness unbroken except by lakes, and without roads other than those used for log hauling and transportation of supplies to lumber camps, with the single exception of the road along the East Branch of the Penobscot running from Medway to Stacyville. From Stacyville to Houlton the aggregate of cleared land through which the line was run was at the time less than ten miles, but roads are crossed frequently, and farming settlements are found all along on both sides. A rather greater proportion of cleared land is found north of Houlton, but it is rather surprising to one who is accustomed to traveling by the stage road to see so little of the fields from railroad.

The first growth on the ridges and dry land is nearly all birch, maple and hemlock, with occasional spruce and pine, and if the soil be quite rocky white birch is likely to predominate largely. In low, moist ground, there are spruce, cedar and hackmatack as is usual.

The industries already developed and being developed along the line, and which give business to it, are the slate quarries at Brownville and the cutting of logs between Brownville and Norcross which previously could only be taken out, if at all, by very tedious water courses.

The cuttings of spool wood for spool bar mills, and



the manufacture of spool bars, between Schoodic and Norcross the manufacture of last blocks at Stacyville, Sherman, Crystal, Island Falls, Oakfield, Smyrna, Houlton, Bridgewater, Blaine and Westfield, the cutting of hard wood for fruit boxes at Stacyville, and for ship timber at Crystal, and the production of telegraph poles, fence posts, railroad ties and all ordinary kinds of lumber and tan bark at nearly every station on the line, to say nothing of shingles, hay, potatoes, starch, etc.,.

The development of the agricultural resources of course produces a large proportion of the business of the line and is perhaps credited with a greater portion of indirect business than some others. The capacity of Aroostook County soil to produce abundantly is proverbial, and has been written about and talked about for many years, and yet has probably not been overstated. It is hard for most farmers to realize that any soil can be inexhaustible, but probably that of Aroostook comes as near to it as possible. Its basis is a calcareous rock, which in almost every field is so near the surface that the disintegrating action of the frost and moisture are forever at work upon it, and the distributing agencies of cultivation are spreading this fertilizer to parts which are not naturally supplied, so that the exhaustion which comes by the production of crops is being replenished by these natural means from a sure supply. This does not, of course, permit heavy farming without the use of fertilizers, but it is a pretty good

foundation for a farm after all.

The soil being kept in a favorable condition by the lime from the disintegrated rock, is quicker to respond when fertilizers are used, than soil that lacks this important element, and the crops are larger than could be produced in other sections of the State even if an equal amount of fertilizer were used.

Farming becomes profitable therefore in Aroostook County, and that section is to-day in a more satisfactory condition than any other farming section of New England.

That this is true may be seen by the evident thrift and comfort enjoyed by the farmers and the prosperity of the traders of the towns and villages, and by the rapid increase in proper valuations yearly. -

We now leave the road itself and glance at the appliances for the accomodation of business. (At Brownville there are separate passenger and freight stations. <sup>and a warehouse</sup> At Schoodic, West Seboois, Norcross, Grindstone, Stacyville, Sherman and Crystal <sup>also</sup> are combination passenger and freight stations and at the last two are private warehouses and stock yards. At Island Falls there are separate passenger and freight buildings, stock yards and private warehouses. At Oakfield, Smyrna, New Limerick and Cary's Mills are combinations of passenger and freight stations with private warehouses. At Houlton there is a large passenger and large freight station, several large private warehouses and a stock yard. At Littleton there is a combination passenger and freight station



with private warehouse. At Monticello and Bridgewater there are separate passenger and freight buildings and private warehouses. At Robinson's Mills a combination passenger and freight station and private warehouses. At Mars Hill and Blaine separate passenger and freight houses and private warehouses. At Fort Fairfield Junction there is a combination passenger and freight station and private warehouse, and at Easton separate passenger and freight and private warehouses. At Presque Isle, Caribou and Fort Fairfield are large passenger and freight stations and several private warehouses at each place.

Besides sidings at each of these stations there are also sidings at intermediate points such as Drummond's, Ingalls's, Stewart's, Perkins', Lincoln's, Millinocket's, Buswell's, Summit, Molunkus, Belvidere, Gilpatrick's, Dyer Brook, Spofford's, Timoney's, and granite quarry south of Houlton, and Wiley Road, Sharp's, Harvey's, Milliken's, Church's, Westfield, Maysville and Maple Grove, north of Houlton. At the last three there will probably be stations erected.

Tanks of 60,000 gallons capacity each are located at Brownville, West Seboois, Millinocket, Grindstone, Sherman, Oakfield, Houlton, Bridgewater, Fort Fairfield Junction, Presque Isle and Fort Fairfield. All these are supplied by steam pumps except that at Caribou which is fed from the town stand pipe.

There is a six stall engine house at Houlton, one of the same size at Caribou, and a two stall house at Fort Fairfield and at each of these places there is a 60 feet steel turn-table. There are coal sheds at Aroostook Junction, Houlton and Fort Fairfield Junction, each with a capacity of about 2,500 tons.

There are several other smaller buildings in connection with the maintenance of track and for the accomodation of the workmen.

The sixteen new locomotives are as follows: Nos. 9, 10, 11, and 12 are eight wheel engines with 18 x 24 inch cylinders and 60 inch driving wheels. Nos. 13, 14, and 15 are also eight wheel engines with 16 x 24 inch cylinders and 58 $\frac{1}{2}$  inch driving wheels. No. 16 is an engine, eight wheel, with 16 x 24 inch cylinders and 60 inch driving wheels. Nos. 17, 18, 19, and 20 are ten wheel engines with 19 x 26 inch cylinders and 60 inch driving wheels. 21 and 22 are eight wheel engines with 18 x 24 inch cylinders and 66 inch driving wheels. These were all built by the Manchester Locomotive Works, of New Hampshire.

For the B. & A. R. R. there have been purchased about 25 new passenger and combination cars, more than 600 new freight cars in addition to the stock of the B. & P. R. R.; four snow plows and four flange cars.

Before leaving the subject entirely it may be well to glance back to the time, four years ago, when the surveys were being made from Brownville to Houlton, to look into



the methods of surveyor's work. The principles are quite simple after the engineer has fixed in his mind the proper thing to be done, or in other words the route which he wants to survey. This he has probably done by going over the ground quickly but carefully noting its characteristics and determining where the trial or preliminary lines had better be run. This is done by first setting up a transit at the starting point and giving a course for the axemen and chainmen to proceed on. The former cuts out all bushes and trees that would interrupt the sight of the transitman, and the chainmen follow, measuring and driving a stake each 100 feet. The chief of the party determines the length of the courses and the angles to be turned. The leveller, with the levelling instrument and staff, takes a sight at each stake and records in his field book the actual elevation of the ground above an arbitrary plane, which is usually, when obtainable, the sea level, although for his purpose it may be any other. When the level notes are platted on profile paper, they form the most important information which is acquired by the party, if any of it can be considered the most important. When the transit notes are also platted the two plats along with the side notes taken sometimes by the transit or level men, or, much better still, by an engineer detailed for that duty alone and designated the "Topographer", the "chief" has all the information before him that is necessary to determine the location which he will make. After the whole route has been gone over with preliminary

survey, the location according to the determinations as above found is made. In this way obstacles found in the preliminary may be avoided, and unnecessary curvature or angles eliminated, and what is of still greater importance, the grades can be established to the best rates the country affords.

The practice, however, brings in a good many features that may seem entirely unnecessary but nevertheless these are usually found inseparable from the work. It involves in addition to the responsibility for good work, long tramps in the morning and evening to and from work, not over good roads where four miles an hour is a comfortable gait, but through woods and swamps, over windfalls or under them, and at best following the line cut the previous day or two, or some tote or logging road; sleeping under canvas or nothing, occasionally going without a midday lunch when the cookee fails to find the party; frequently when the weather is hot and dry, going for hours without water, sometimes suffering from fires, always worrying lest you may; and if the weather is wet, undergoing a reversal of these hardships along with slow progress in work. Sometimes on a moving day, the party will fail to make connection with camp. As a preventive it is a good plan for the cook to blow a dinner horn at intervals about the time the party may be expected, to guide them to the new camping ground.

Should any or all of the above never happen to a party, yet it is in the summer pretty sure to enjoy or otherwise,



the persistent sociabilities of myriads of flies and mosquitoes.

Notwithstanding these, there is no real hardship except in very rare conditions and you can seldom find a healthier or happier crew than a survey party. A good commissary and cook are very important men, and they can usually keep things running quite smoothly, and allow the Engineers to devote their time solely to the details of their work.

The work in forest country is very greatly facilitated in many ways by the logging and tote roads which abound, but it needs a guide perfectly familiar with them to make the most of them.

Not infrequently, too, it is found that the roads laid out by lumbermen are as nearly as possible in the place where the railroad ought to be. This is not strange, for it is as sure as the attraction of gravitation that where heavy loads are to be hauled the result will be the shortest and easiest road. The latter means the road that is slightly down hill. Logs are very seldom hauled up hill. Thus in crossing the country from river to river you will find in the woods usually a "main hauling road" running up the valley of a tributary and if it does not meet directly a road on the summit which leads down to the next river, there is almost certain to be branches from the main roads that will connect one with the other.

A very active interest was taken in the progress and details of the survey by all the members of the Company and

especially by the Manager, Mr. Gram, and the President, Mr. Burleigh. The latter gentleman frequently visited the camps and his knowledge of the country and of surveying enabled him to direct to good advantage many of the movements of the parties. They were also aided very much by Job Abbott, Esq., of New York, Consulting Engineer, who assisted in placing contracts for work of different kinds, and arranged many of the details of the financial part of the work, and had direct charge of the plans for steel bridge work as well as its construction and erection.

The engineers employed in the surveys were Moses Burpee, Chief Engineer, with parties in charge of C. E. F. Stetson with C. F. K. Dibblee, transitman, and Bert. Fletcher and George Thompson, levellers; F. H. Butler with Frank Hull, transitman, and Mark White, leveller; T. C. Burpee, with C. L. B. Miles, transitman, and W. B. Goodwin, leveller. On Mr. Butler's being given charge of the office, Mr. Warren Nickerson was placed in charge of his party. The surveys were begun June, 1891, and finished including the Van Buren line and the Ashland branch in February 1892.

Construction was begun with C. P. Treat as Contractor, in June 1892. His staff includes S. H. Doty, Engineer, J. A. Lane, Manager, Rob't. Smith, Assistant Manager and H. C. Decker, Cashier.

The engineers employed on construction were T. C. Burpee, who in 1892 had charge of Section 1, at Brownville,



and in "93" Section 2, with the masonry at Pleasant River and C. P. R'y crossing bridges and Mill Brook viaduct, also re-running track center line and ballast grades in '93 and '94 and masonry of Aroostook and 2nd crossing of Meduxnekeag bridges in the winter of '94-5.

Section 7 was under the charge of C. F. K. Dibblee in '92, and Section 3 in '93. Section 8 was in charge of E. H. Drury in '92 and '93. This includes the masonry of the Fish Stream, West Branch of Meduxnekeag, Dyer Brook and the East Branch of Mattawamkeag, and the long wooden trestle in Dyer Brook.

Section 9 was in charge of H. Hilliard. It includes the 8 feet arch culvert at Smyrna, and the masonry of Rugged Brook in same town. It was built in 1892. Mr. H. also had charge of Section 4 in 1893, which included the masonry of West Branch of Penobscot and the 8 feet arch culvert at Grant Brook. In this he was assisted by J. C. Boyd as masonry inspector. In 1894 he had charge of the trestling at 2nd crossing of the Meduxnekeag, Johnson Brook and Monticello.

Section 10 was built under C. E. F. Stetson, in '92 and '93. His work included the masonry of 1st crossing of Meduxnekeag, Philpot stream and Titcomb Lake bridges. He also had charge of Sections 11 and 12 in 1894. Section 5 was in charge of R. H. Cushing in 1893. His work included the masonry of the East Branch of Penobscot, and Schoodic bridges with a number of smaller ones. He had charge of Section 13 in 1894.

Section 6 was in charge of C. L. B. Miles in 1893 and Section 18 the Fort Fairfield branch in 1894. He also revised the location north of Houlton in 1892.

Section 14 was in charge of J. C. Boyd in 1894. He also ran track centers and grades in fall of same year. Section 15 was in charge of Hugh Jardine in 1894. He also engineered the trestle work of the Aroostook bridge.

E. E. Greenwood had charge of Section 16 in 1894. In 1893 he was masonry inspector at East Branch of Mattawamkeag and some other bridges.

W. B. Goodwin had charge of Section 17 between Presque Isle and Caribou.

Geo. E. Thompson, who assisted Mr. Stetson through the season of '91, '92, '93 and '94, was in charge of ballast grades in fall of the latter year. Among the Junior assistants who have rendered valuable services are H. A. Brink, John D. Nelson, C. C. Gibbs, Frank Holmes, Willard Edgarly, P. C. Newbegin, C. Wetmore and Harry Dibblee.

Mr. W. Z. Earle has been Principal Assistant Engineer since April, 1893, and Mr. Butler has had the charge of the draughting room since fall of '91. Luther Gerrish, a man thoroughly competent, and who was perfectly familiar with the country traversed, acted as Guide in the work. He worked on the Shor Line in Maine, on the Canadian Pacific, on the Northern Maine, as well as the B. & A., as Guide. He is spoken of in the highest terms by the engineers who were in the surveying party of the Bangor and Aroostook road.



## SUB-CONTRACTORS OF B. & A. R. R.

### GRADING.

Fisher & Grandall of Oakfield.  
Mr. Bowden, Brewer, Maine.  
Smith & Steeves, Salsbury, N. B.  
McQueen, Stewart & Co., N. B.  
John O'Hara, Orono, Maine.  
Joseph McLaughlin, Cedar Rapids, Iowa.  
W. O. Johnson & Sons, Cedar Rapids, Iowa.  
A. E. Trites, Salsbury, N. B.  
Duffy Brothers, Bangor, Maine.  
J. A. Wheaton, Salsbury, N. B.  
McPhail Brothers, Perth, N. B.  
Malcolm & Ross, Edmunston, N. B.  
Nelson Heddeen & Co., Ellsworth, Maine.  
Partridge & Chisholm, New Brunswick.  
C. Mullen, Oldtown, Maine.  
W. H. Maxwell, St. Stephen, N. B.  
John E. Stewart, Andover, N. B.  
Wiley & Libby, Patten, Maine.  
Whalen & Gallagher, Houlton, Me.  
Barney Doohan, Houlton, Maine.

### MASONRY SUB-CONTRACTORS.

McDonald & Merrill, Bangor, Maine.  
McKelleher, Bangor, Maine.  
Joseph McVey, St. Stephen, N. B.  
Joseph McLaughlin, Cedar Rapids, Iowa.  
Most of the masonry was built by C. P. Treat direct.

Timber trestles and temporary bridges by Simmons &  
Burpee, Fredericton, N. B.

Stations south of Houlton, and also Littleton and  
Monticello, by E. T. Hartwell, Old Town, Maine.

Houlton station and buildings by C. A. Swett, Houlton,  
Maine.

Buildings north of Monticello by M. C. Foster & Son,  
Waterville, Maine.

### CONSULTING ENGINEER BANGOR AND AROOSTOOK RAILWAY.

Joe Abbott, of New York City, Consulting Engineer for

the Bangor and Aroostook Railway and Aroostook Construction Company, was born at Andover, Mass., Aug. 23rd, 1845; graduated in the English Department, Phillips Academy, Andover, in 1861, and in the Lawrence Scientific School at Harvard College in 1864.

His first work after leaving school was in the drafting rooms of the Manchester Locomotive Works, the builders of the new locomotives on the B. & A. Ry., where he worked in the spring of 1864, going from there as an Assistant Engineer on the Glencove branch of the Long Island Ry. during the summer of 1864, and then as Assistant Engineer to John B. Jarvis, C. E., P. F. W. & C. Ry., where he was engaged until 1866.

He then opened an office at Canton, O., as Civil and Mining Engineer and Patent Expert, reading law and being admitted to the Ohio bar in 1869. In 1872 he was made Vice President and Chief Engineer of the Wrought Iron Bridge Co., of Canton, O., continuing in that position until 1880, when he was elected President and C. E. of the Toronto Bridge Co., Toronto, Ontario, and erected the large bridge works at that point, which were the pioneer works in iron bridge building in Canada. In 1883 he was elected President and C. E. of the Dominion Bridge Co., Limited, of Montreal, P. Q., which absorbed the Toronto Bridge Co. and erected at Lachine, near Montreal, one of the largest and most completely equipped bridge establishments in the country, embracing



many novel features in the use of gas as boiler fuel, distribution of steam to small motors distributed through the works instead of driving from one central plant, and system of overhead roof truss railways for handling material which has since been incorporated into nearly all the leading bridge shops in this country.

Most of the large bridges erected in Canada during the past ten years have been built at these Lachine works, notably the St. John cantilever bridge, at S. John, N. B.; St. John Railway bridge at Fredericton, N. B.; bridge across Grand Narrows, Cape Breton, together with all the bridging and trestling on the Cape Breton R'y; the Canadian Pacific Railway bridge over the St. Lawrence at Lachine, P. Q.; the Canadian Atlantic Railway bridge over the St. Lawrence river at Coteau, P. Q., and the Canadian Pacific bridge at Sault Ste Marie, Mich.

In the fall of 1888, Mr. Abbott was appointed Chief Engineer of the Wheeling Bridge & Terminal R'y., retaining his position as Pres. and C. E. of the Dominion Bridge Co. till June, 1890, when he disposed of all his Canadian interests, and during the years 1889-91 had active charge of the construction of the Ohio River bridge with the 525 foot double track channel span and of three double track tunnels from 700 to 2,500 feet in length and a large amount of other bridge, trestle and masonry work with buildings and equipment representing the expenditure of over \$3,000,000.

During the winter of 1891-2, Mr. Abbott met Mr. Cram in connection with the negotiations by the management of the Wheeling Terminal System for securing Mr. Cram's services as General Manager, having known Mr. Cram previously during his general managership of the New Brunswick R'y. Mr. Abbott became interested in looking into the B. & A. R'y. scheme, and, being much impressed with its unique and valuable features both from a financial and railway standpoint, made his connection with the enterprise after finding it impossible to secure Mr. Cram's services for the Terminal System. The peculiar feature of the financial plan for building this road was that of subordinating all the interest of the promoters to that of the parties who should advance moneys for its construction on the bonds and preferred stock of the enterprise, so that the original promoters would receive nothing whatever for their time or investment until the bond holders and preferred stockholders were getting their interest or dividends, a feature which was entirely unique in the railway construction world and which will prove of the greatest value to Aroostook county in protecting its investment in the preferred stock of the Company.

Mr. Abbott's work as Consulting Engineer has covered the working out of the details in contracts and specifications by which the contracts between the Railway and the Construction Co., the Construction Co. and Mr. Treat, principal contractor, and others; of the American Express Co.



and others have been carried into working form, and he has made monthly inspections of all work under construction, with monthly estimates of payments in securities or otherwise from the Railway to Construction Co. Trustees, and from Trustees to Contractors and others for construction purposes, with certificates to the mortgage trustees as to monthly issues of bonds, so that all parties should be protected during the construction, and in this position has acted as arbitrator between the Railway Co., Construction Co., Contractors and Financial Companies furnishing funds.

Mr. Abbot has made the designs and superintended the construction of all the bridges on the line excepting the masonry which has been under the direct charge of the Chief Engineer, and he also made the plans for the station buildings, engine houses and coal sheds; the former having among other unique features that of illuminated letter signs giving names of station; and the latter having an improved plan of handling coal from overhead rails in large tubs to enable engines to be quickly coaled.