

CHAPTER IX.

THE RESTIGOUCHE DISTRICT

General Description - Metapedia Valley - Restigouche Valley - Bay Chaleur - Geographical features - Division G, Contract No. 17 - Division H, Contract No. 18 - Division I, Contract No. 19 - The Restigouche Bridge - Artificial foundation - Climatic forces - Ice jams - Shoves - Freshets - The massive character of the Piers - Division R, Contract No. 8 - Division L, Contract No. 6 - Division M, Contract No. 6 - Division M, Contract No. 9 - Division N, Contract No. 15 - The Tête-a-Gauche Bridge - The Nipissiguit Bridge.

This District includes the lower half of the Metapedia valley, crosses the Restigouche at the mouth of the Metapedia, and continues by the Bay Chaleurs. Its length is 128 miles.

It embraces the following divisions

Division G - Contract No. 17	20 Miles long
Division H - Contract No. 18	20 Miles long
Division I - Contract No. 19	10 Miles long
Division K - Contract No. 3	24 Miles long
Division L - Contract No. 6	21 Miles long
Division M - Contract No. 9	21 Miles long
Division N - Contract No. 15	<u>12</u> Miles long
Total	128 Miles long

The Line 40 miles follows a south-easterly direction, and then runs easterly for 30 miles, after which, its course is south-east, finally bearing nearly due south.

The Metapedia valley is generally contracted, with steep hills and rocky sides rising to the height of 600 to 800 feet, for many miles, barely affording space for the Railway, the river and the Metapedia Road. The adjoining country, in many places deeply furrowed by streams, rises, approximately, 800 feet above the valley.

There are several lateral valleys, the principal of which are those of two rapid tributaries of the Metapedia, the Rivers Causapsal and Assametquagan, rising in the Shikshok Mountains to the east of the Railway, and those of McKinnon's Brook and other streams, on the western side. For a distance of 20 miles below the mouth of the Metapedia, the Railway follows the valley of the Restigouche, between high, steep, rocky hills. It then crosses the promontory, at the point of which lies the Harbour of Dalhousie. The Line runs about a mile from the Bay Chaleur, sometimes touching the shore, until it reaches the village of Bathurst. It then leaves the shore, in order to cross the promontory between Bathurst and Miramichi. The country is slightly rolling, and comprises clayey, gravelly, peaty and rocky soils. The high mountainous country is found more inland, the intervening distance being broken and hilly.

The rocks in the Restigouche district, with some trifling exceptions, belong to the Gaspé limestone series of upper Silurian age. This series is known to occupy an immense area. Nearly the whole hydrographic basin of the Restigouche belongs to this series. The rocks consist of grey and dark shales and limestone. On the Metapedia, vast deposits of calcareous shaly and slaty strata appear interstratified with limestone bands. Near the "Devil's Elbow," sandstone is met of a greenish gray colour. At the mouth of the River

Restigouche, a small basin of the lower carboniferous rocks occurs. It consists of red sandstone and conglomerates. Conspicuous conical hills of amygdaloid and other trap rocks attract attention near Dalhousie. The basin is flanked on both sides by the Gaspé limestone series, which generally occupies the elevated country overlooking the valley, and it extends from Dalhousie to Bathurst. It afforded excellent limestone for the masonry at several places.

Grey granite is exposed on the rivers flowing into Bathurst Harbour, composed of opaque white feldspar, colourless translucent quartz, and black mica. In some respects it resembles the celebrated Aberdeen granite; and yielded massive building material for some of the finest masonry on the Line.

The principal rivers are the Metapedia, the Restigouche, Eel River, the Charlo, Jacquet River, the Tête-à-gauche, and the Nipissiguit.

The Metapedia drains an area of 1,700 square miles; the Restigouche, with its tributaries above the crossing of the Railway, drains about 5,200 square miles, of which the Upsalquitch, a branch from the south, drains 1,400. The rivers from the Restigouche down to the Nipissiguit drain about 1,300 square miles, and the Nipissiguit in a course of 70 miles drains 800 square miles.

Mr. Marcus Smith conducted the surveys of the District in 1868-69, and afterwards had charge of the works of construction until April, 1872. He was succeeded by Mr. L. G. Bell.

DIVISION G. CONTRACT NO. 17.

This Division lies in the valley of the Metapedia river. The western half traverses a comparatively open country with gently sloping hills. The eastern half is contracted between steep, rocky banks. About one half of the Line is curved, but the curves, except in a few cases, are of ample radius. The grades, which are easy, have generally a descent eastwards. The greatest difference of level, that between the two ends, is 212 feet. The works are moderately heavy, requiring care in their execution, but no very great difficulty was experienced. The total quantity of cutting is about two-thirds of a million cubic yards, of which one-fifteenth is rock. But little of the rock excavated was found suitable for masonry. The ashlar stone had to be brought some distance chiefly from the eastern end of Lake Metapedia, but material for the smaller structures was obtained near the middle of the Division at Otter Brook quarry. This stone is a kind of sand-stone, close and firm in the texture, and generally well stratified.

Two bridges cross the Metapedia, the first at Causapscal, near the middle of the Division, the second nearer the eastern end. At each crossing the line passes the river at an angle of 45°, and the bridges consequently, are askew. Each bridge has three spans of 100 feet wide on the skew face. No difficulty was experienced in their construction. The foundations were built in caissons excavated from within, pump of some power being requisite to control the water. At one point, the Line passes through a sharp bend in the river, called "Aleck's Elbow," owing to a very high cliff which causes it to sweep round a sharp curve of a quarter of a circle. A diversion of the river was made, the Railway being

protected by crib-wharfing. There are several pieces of crib-wharfing in the Division, but the work at "Aleck's Elbow " is the heaviest and most important. Figure No. 32 illustrates the manner in which crib-wharfing was constructed when the line encroached on the river.

The embankment was faced with rip-rap, interlaced with a rough framework of cedar timbers, as a precaution to prevent inroads by flood-water on the newly formed earthwork.

Abundance of ballast was found on the Division. The contractor was Mr. S. P. Tuck, the price being \$440,000. The work was to be completed on the 1st July, 1872. In 1874, there being still much of the work to be performed, the Government took the Division out of the contractor's hands and finished it by day's labour. It was completed in 1875.

The Division is 20 miles long.

The average quantity of excavation is about 30,000 cubic yards per mile, and of masonry 435 cubic yards.

The resident Engineer was Mr. Walter George Bellairs. Mr. Bellairs dying in April, 1874, was succeeded by Mr. John R. Macdonell.

DIVISION H. CONTRACT NO. 18.

This Division lies in the valley of the Metapedia, but in a more contracted portion than the Division last described; the line being confined within the narrow limits of the high, abrupt boundaries, and generally following the windings of the river. The curves are numerous, and many are of short radius, but very few exceed 1,000 feet in length.

There are several heavy cuttings and embankments, but neither cuttings nor embankments were attended with difficulty.

Many of the rock cuttings turned out excellent stone for masonry backing, and for covering culverts; but little of it, however, could be used in face work. A portion of the building stone used came from the Otter Brook quarry. As the slopes of the embankments, in some cases, extended to the bed of the river, crib-wharfing, similar to that constructed at "Aleck's Elbow;" was adopted where expedient. In other places, near the large rock cuttings, large seized flat stones were built into a heavy wall with a face batter of 1½ to 1, backed up with ordinary stones as in Figure No. 33.

There are but two bridges of any importance on the Division, namely, that over McKinnon's brook, having two spans eighty feet wide, and that over the third crossing of the Metapedia at Millstream, having four spans, each 100 feet wide on the skew face. Like the upper Metapedia bridges, the latter crosses the river at an angle of 45° with the general direction of the stream. Notwithstanding that the whole bed of the river, for a considerable distance up stream, is rock, the foundations of the bridge did not reach it, owing to the dip of the strata being too great. Attempts were made but it was found impracticable to sink the foundation down to it. They are accordingly on the coarse gravel which forms the bed of the river. Piling was not considered necessary. The eastern abutment and the three piers were built in water, from 6 to 8 feet deep, all the masonry being carried 14 feet under low water and protected by rip-rap. A good quarry was discovered near the bridge; not, however, until a quantity of stone had been brought down from the quarry at Metapedia Lake. The cost of transportation was necessarily great; but the Contractor requiring

cedars for crib-wharfing, which he procured at the Lake, they were used for rafting the stone. Each raft was worked by three Indians, and carried about two cubic yards of stone. The distance from the quarry on the Lake to the bridge is nearly 50 miles. Plates Nos. 12 and 13 are illustrative of the site and character of the structure.

There are several cast iron pipe culverts, 3 feet in diameter, on the steep side-hill, for which they are peculiarly suitable, and prove highly satisfactory.

The work on this Division was undertaken early in the summer of 1870, to be finished by 1st July, 1872. It was not, however, until the beginning of 1876 that the work was finally completed.

The Contractors were Robert H. McGreevy & Company, the contract price \$648,600. At the beginning of the season of 1875, the Government took the work into their own hands.

The length of the Division is 20 miles. The average quantity of excavation is about 45,000 cubic yards per mile, and of masonry 445 cubic yards. There is a total length of 424 feet of cast iron pipe culverts. The first Resident Engineer was Mr. W. G. Thompson. In April, 1872, he was succeeded by Mr. Peter Grant.

DIVISION I. **CONTRACT NO. 19.**

About two-thirds of this Division is located in the Valley of the Metapedia. At the mouth of this valley the Railway crosses the Restigouche, by the bank of which the line is continued. It has many curves, few of them, however, extend for much length. Heavy cuttings and embankments are not frequent, owing to narrow stretches of flat ground along the river bank which afford space for the line. At the crossing of the Restigouche there are two heavy rock cuttings and one long and somewhat high embankment. The rock cuttings supplied a great quantity of the stone required to raise the base of the embankment above high water mark; one cutting furnished all the stone used in the Restigouche bridge, except material for the face of cutwaters, copings of piers, and girder seats, which are of Bathurst granite.

There are several pieces of heavy protection work, but none attended with any special difficulty. A large quantity of crib-wharfing had been provided for in the estimates.

Owing, however, to a method of removing earth, then, at little cost, successfully introduced by the Contractor, the crib-work was not considered necessary. At this place, a steep bank about 120 feet high and composed chiefly of gravel projected for a distance of about 1,000 feet along the edge of the river, leaving no site for the Railway. It was designed to construct an embankment along the river side protected by extensive crib-wharfing. The sub-contractor introduced a method of washing away the gravel by means of water jets. Streams from the high side-hills were dammed up at a point about half a mile from the work; the water was conveyed by a wooden trough to the place where required, and directed against the face of the bank in a continuous stream. Its force undermined and loosened the material so effectually that masses, often by thousands of yards, would slide into the river in a brief space of time. Immense quantities of material were thus removed, with very little manual labour and at a cost, probably, less than one-sixth of ordinary

excavation. The result was that the railway was made on solid ground, requiring little or no protection. The change had also the effect of flattening the curvature of the line. This system of excavating material by an available flow of water was so successful, that it was adopted on other portions of the line where streams with sufficient fall could be obtained.

There are several small girder bridges on this division, but the chief structure is the Restigouche bridge, a work which calls for special notice.

The Division was originally let to Mr. S. P. Tuck, to be completed 1st July, 1872. It was afterwards transferred to Messrs. Thomas Boggs & Company. Subsequently an arrangement was made, by which, the Bridge was severed from the other work, Mr. Martin Murphy becoming contractor for the main structure.

THE RESTIGOUCHE BRIDGE.

The River Restigouche, constitutes the boundary between Quebec and New Brunswick. The Railway bridge connecting the two Provinces is the only bridge which crosses the River. It is situated below its confluence with the Metapedia. After emerging from the contracted valley through which the Metapedia flows, the railway turns almost at right angles, to follow the Restigouche. The main stream for some distance is hemmed in between high steep hills, rising abruptly to a height of from 500 to 700 feet, and the sudden change in the direction of the Railway, necessitates the construction of the bridge on a skew of forty-five degrees.

The hills are composed of a metamorphosed slate, much contorted and so tilted, that the direction of the cleavage is not easy to determine. The river takes the direction of the strike and has, no doubt, shaped its course from denudation. Blue clay underlies the gravel in the bed of the river, but it is undoubtedly local.

Soundings and borings were made through the ice, early in 1869, which led to the opinion that the bed of the river was rock overlaid with some inches of gravel. But it was found that stones imbedded in gravel, were the hard substance met, and that the solid rock was at a much greater depth. The outcrop of rock on both sides of the valley suggested that the stone in the gravel was rock, *in situ*. Subsequent borings, however, showed the gravel to extend from seven to ten feet, underlying which, plastic blue clay is found. The Section, plate No. 17 will show the position and thickness of the different strata.*

At pier No. 1, rock was reached at 53 feet under the summer level of the river; at pier No. 2 at 75 feet at Pier No. 3 at 62 feet; and at Pier No. 4, at 54 feet.

Accordingly, piling was necessary in all the foundations, except for that of the Easterly abutment, which was built on the rock. The work of piling was continued throughout the winter, that season being suitable for this operation, the ice forming a platform for the machinery. The coffer-dams were protected by triangular shaped cribs to act as breakwaters, so constructed as to prevent injury to the works, from the ice. The arrangement of the piers, coffer-dams, and breakwaters is shown on plate No. 17.

* The more recent borings show the following strata at the different structures.

	West abutment	Pier No. 1	Pier No. 2	Pier No. 3	Pier No. 4	East abutment
Loam above summer water	ft. 10	ft.	ft.	ft.	ft.	ft.
Depth of ordinary water		5	3	7	10	6
Gravel.....	10	7	10	7	4	
Blue clay.....	60	38	60	48	48	
Blue clay and sand	6	3	2			
Total Depth from ordinary low water to rock.....	No rock met.	53	75	62	54	6

The pumping was effected by five engines, with an aggregate of 70 horse power. Centrifugal pumps, capable of discharging nearly 6,000 gallons per minute were used. Owing to the stratum of gravel, and the heavy flow of water, the excavation was performed with difficulty. The pier foundations consist each of close square piling, enclosing an area of 102 feet by 16 feet, with four rows of intermediate piles, three feet apart. The space between the piles was filled with concrete and a platform was constructed upon them 8½ feet under water, so as equally to distribute the weight of the superincumbent masonry. Much difficulty was experienced in the execution of these works in a deep and rapid river. The pile driving, of more than 60,000 lineal feet of timber was carried on almost continuously from August 1872 until April 1874. Ice begins to form in this River in November; and although the rapids of the River remain for some time open, where the current is slight, ice sufficiently firm to carry a man will form in twenty four hours. From November until March, but little rain falls, the thermometer ranging from 32 above to 32 below zero. The average, during the five years occupied in constructing the bridge is slightly below zero. A change in the weather, when the winter sets in unusually early, accompanied with rain, will occasionally raise the water and break up the ice; producing "ice-jams." The Metapedia is especially liable to these incidents; in the Restigouche they are not common. The low temperature as a rule, from November to March, produces ice from two to four feet thick and about the end of March it reaches its maximum strength. Moreover, the ice is not confined to the surface of the River. As in many northern localities anchor ice is developed to a great extent, sometimes to double the thickness of the surface ice. It is not therefore surprising that at the end of winter a sudden thaw raising the water of the main stream and setting adrift the whole winter ice, should produce astonishing results. Floating down stream, these masses of ice meeting with obstructions will pile one on the other, until a "jam," completely across the river, is produced. The water thus dammed back will in a few hours rise to a height, sometimes of twenty feet. The "jam " ultimately gives way, and a moving mass of ice, water and uprooted trees is borne onwards often with a current of 7 or 8 miles an hour.

The piers were designed to resist these occasional forces, and hence their peculiar form shown in the drawings, plate No. 18.

The river Restigouche is liable not only to these "ice shoves," but to occasional freshets; the most marked of which, the "spring freshet," occurs yearly with regularity at the end of May, or beginning of June. So regular is this periodical flood, that it is annually

anticipated. The spring freshet is distinct from the "run of ice," several weeks intervening. It always occurs immediately after the warm weather sets in and is due to the melting of the snow in the uplands, where the tributaries take their rise. This freshet usually raises the Metapedia 12 feet, and the Restigouche 18 feet above ordinary summer level. The rise of the water is gradual, and still more so is its fall; the former generally occupies several days, and the latter as many weeks; the river rarely assuming its ordinary level until the last week in June.

The Restigouche has been famous for its lumbering operations for half a century; and a great quantity of timber is still cut on its banks. The contingency of rafts and drift logs striking the piers and endangering the superstructure, had to be provided against. Hence the prolongation of the cut-water to the extent shewn in the drawings.*

Every precaution has been taken to render the piers of the bridge capable of resisting the formidable forces, to which they will periodically be exposed. It is believed that they will remain uninjured.

It has been stated that the masonry is built on a pile foundation, except in the easterly abutment which is built on rock. Although, owing to the current, the ice impinges with great force on that side of the river, the foundation being well let into the rock, and the wall being well built and protected, no injury is likely to result.

The masonry, generally, is built of stone found in the adjoining railway cutting, on the south-easterly bank, where blocks of good dimensions were obtained. The work is executed in courses, 30 inches thick in the footings, and 24 inches in the body of the work, the blocks being from six to eight feet long. The stone is tough and well adapted for work requiring great strength. Being difficult to dress, however, except in the line of cleavage, it was decided to use granite for the cut-waters and quoins.

The granite was brought from the River Nipissiguit, beyond Bathurst. It is not unlike the well known Aberdeen granite, the scales of mica only being somewhat smaller. The distance from the quarry is nearly 90 miles, 70 of which only were by open navigation.

The blocks were therefore prepared in the quarry, and when reduced to their proper size, weighed from three to nine tons each. The massive character of the piers is shown by plate No. 15.

The necessity for great strength is evident from the foregoing account of the phenomena yearly witnessed in the river, which no light structure could resist. The face stones of the cutwaters, the coping, bridge seats, and the two upper courses of ashlar, together with the skew quoins on the down-stream end of piers, are of granite. A striking contrast is accordingly obtained to the dark slate colour of the body of the masonry, which adds to the appearance of the structure.

Plate No. 16 is a view of the bridge from the south bank of the river.

* The writer has witnessed the entire removal of a bridge in Canada through this cause. When proper precautions are not taken the occurrence is not uncommon. During a "timber drive" at flood water, the logs form a jam against the piers; and as the water rises, are raised beneath the superstructure; lift it from its seat, and finally carry it away.

The total quantity of masonry exceeds 6,000 cubic yards; the whole is built in Portland cement, and the exposed parts of piers were secured by strong iron clamps, so contrived that it would be impossible for floating logs, or ice, to disturb a single stone without moving the whole mass to which it is attached.

The work was commenced in the summer of 1870, and completed by Christmas, 1875. During the whole of that time, notwithstanding the heavy plant and material employed, not a single serious casualty occurred. Mr. Martin Murphy was the contractor. Mr. Peter Grant was in charge of the work throughout, as Resident Engineer.

DIVISION K. **CONTRACT NO. 3.**

This Division is for several miles of its length on the slope, or at the base, of steep and rocky side-hill.

No especial difficulty attended any of the cuttings, or embankments, except the cutting at Morrissey's Rock, a point of rock jutting out sharply into the River Restigouche, and which it was necessary to pierce in order to avoid curvature and heavy protecting works. The maximum depth was 95 feet, the length of the point was 600 feet, half of which was about 20 feet deep. As material was required for embankment, it was designed to make an open cut throughout, but 166 feet of the length is tunnelled. The rock lies in shapeless unstratified masses, and no difficulty was experienced in completing the work. The rock is hard, but exposure to the weather may render it friable, in which event, it may become necessary to line the tunnel with masonry. This is the only tunnel through which the railway passes.

At Morrissey's Rock there is a diversion of the public road for a length of 2½ miles.

There are on this Division four bridges; one with a single span of 40 feet wide; one at Christopher's brook, near the "head of the tide" in the Restigouche, has eight spans, each of 60 feet: the two other bridges, one at Campbellton, and one over Eel River, have each three spans 60 feet wide. The bridge at Christopher's brook provides for the passage of the stream, the conduit to a saw-mill, the tail-race from a grist-mill, and access from the public road to a lumber yard. The masonry is built of hard, red stone found near the spot. The Campbellton bridge is built in tideway over the mouth of a small river. The foundation is on piles. The embankment leading up to the bridge is protected by crib-work from the wash of the sea.

On the steep side-hill, pipe culverts are introduced to a greater extent than on any other division in the District.

Much of the stone was taken from the quarry at Bordeau on the Quebec side of the Restigouche; of a bluish, grey sandstone, easily quarried and worked.

The port of Campbellton, about the middle of this Division, was of advantage during construction; and the Government made a pier and a short branch railway, by which the rails were delivered. About 10 miles eastward from Campbellton, the line leaves the shore of the Restigouche, and traverses the promontory on which Dalhousie is situated. Dalhousie, at the head of the Bay Chaleur, has a fine natural harbour. It was much to be

desired that the railway should pass by this place, but though the portion of the line to the west would be of easy construction, that from Dalhousie, toward the east, would have involved heavy cuttings, sharp curves, and a tunnel, besides increasing the length about four miles.

The contract was let to Messrs. Elliott, Grant and Whitehead, in March, 1869, for the sum of \$288,000. But the work could not be completed for that amount. Accordingly in May, 1870, a new contract was made with Messrs. F. X. Berlinquet & Company, for the sum of \$462,444, being an addition of about 77 per cent. to what remained of the money unpaid to the original contractors under their contract. This sum, however, proved still insufficient. The contractors were bound to complete their work by 1st July, 1871, but though they had received from the Commissioners large advances, in the beginning of the working season of 1873, nearly two years after the date appointed for the completion of the work, and when there was still a great deal of work of all kinds to be done, they notified the Commissioners that, without considerable help in money, they could not continue. Their contract was then annulled, and the work was completed by the Government in 1874.

The division is 24 miles long. The average quantity of excavation is about 26,000 cubic yards per mile, and of masonry 477 cubic yards. There is also a total length of 1065 feet of cast-iron pipe culverts.

The Resident Engineer was Mr. Henry A. F. McLeod, who remained in charge until the work was practically completed.

DIVISION L. CONTRACT NO. 6.

This Division lies along the Bay Chaleur at no great distance from it. There are several heavy cuttings and embankments, but none which caused any especial difficulty. Several embankments being close to the waters of the Bay, have been protected by rip-rap, or crib-wharfing.

The first five miles of the Division are straight, and the curves on the whole are few and easy.

The grades also are light.

There are on the whole Division nine bridges, amounting to 1,150 feet in length. The largest is the Jacquet bridge, which has three spans, each 100 feet wide. It is built in the estuary of the River Jacquet, which, although 1,500 feet wide at high water, has very little water at low tide, except in the main channel, about 100 feet wide. A good gravel foundation was obtained for the piers and the eastern abutment, but the foundation for the western abutment was not attained until the excavation had reached a depth of between 12 and 15 feet below the bed of the river. The main channel lies between the west abutment and the west pier, from 6 to 8 feet deep at low water. The force of the current, in the spring, against temporary obstructions, caused such an eddy that a great deal of the bed of the river near the west abutment was scooped away, almost to the level of the foundation, 12 feet or more below the level of the old bed, but no farther damage was done. In the following winter a large quantity of heavy stones was sunk through the ice into the bed of the river, completely covering all parts liable to be acted on by freshets, and so arresting

the scour. The embankments on both sides of the Jacquet river bridge have been protected by crib-wharfing.

Of the nine bridges on this Division an illustration of one - New Mill Bridge - is furnished. Plate No. 20. The contract was let in April, 1869, to Mr. Jacques Jobin, for \$241,500, the work to be finished on 1st July, 1871. This contract was annulled, and a new contract was entered into in May, 1870, with Messrs. F. X. Berlinquet & Company, to be finished by the 1st July, 1871. The price contracted for was \$456,946, being considerably more than twice the amount then remaining unexpended under Mr. Jobin's contract, and nearly double the amount of the first tender, made by Messrs. Berlinquet & Company, for the whole of the same work. But the new contractors, in the beginning of 1873, were unable to proceed; their contract was annulled, and the work was completed in 1874, by the Government.

The length of the Division is 21 miles; the average quantity of excavation about 26,000 cubic yards per mile, and of masonry 572 cubic yards.

The Resident Engineer was Mr. Edward Lawson, who had been on both the exploratory survey of 1864, and the location survey of 1868. He was succeeded by Mr. Henry N. Ruttan, who remained until the whole was nearly completed and transferred to the Department of Public Works.

DIVISION M. **CONTRACT NO. 9.**

This section is generally light; nevertheless there are several heavy rock cuttings, and one deep, but short embankment.

The grades are easy, there being a difference of only 113 feet between the highest and lowest levels. The Division is almost all on tangent lines, there being but five curves of a total length of something more than a mile. But as all these curves, except the last, which is only 500 feet long and flat, turn in one direction, toward the south, the general direction of the line at the end of the division, is nearly at right angles to that at the commencement. There is one tunnel across the line, made in rock on the side of a deep valley, by which tunnel, a long culvert in the bottom of a mill-dam has been obviated. The rock in which the tunnel has been cut is not firm, so that eventually the tunnel may have to be lined.

There are three bridges, all on rock foundations, with but little excavation. That over the river Belledune, has two spans 60 feet wide, and is across a short valley 50 feet deep. The other bridges, over the Elm Tree and Nigadoo rivers, have each only one span 80 feet wide.

The Division is almost all in bush land, and generally about one mile distant from the shore of the Bay Chaleur.

The length of the Division is 21 miles. The average quantity of excavation is about 22,200 cubic yards per mile, and of masonry 339 cubic yards. The work was let in October, 1869, to Messrs. J. B. Bertrand & Company, for \$354,897, and was to have been finished on 1st July, 1871. These contractors signified their inability to proceed with their work at the time when Messrs. Berlinquet & Company, with whom they were connected, failed to carry out their contract. In 1873 the Government assumed the completion of this division also.

The Resident Engineer, was Mr. Charles Odell, who had been employed on the location surveys of 1868-69.

DIVISION N.
CONTRACT No. 15.

This Division leaves the Bay Chaleurs, but again touches it at the head of Bathurst Harbour. In general direction it bears southwards, towards the base of the promontory which lies between the Bay Chaleur and Miramichi, terminating at Shippigan.

It is a short section, only 12 miles long, but in proportion to its length, it is one of the most expensive.

There are nine curves, amounting in the aggregate length, to nearly $2\frac{3}{4}$ miles; they are all easy. The grades also are light; the greatest difference of level between any two points, being only 78 feet. The rock cuttings are comparatively light, but there are several heavy earth cuttings and embankments. Of these, two embankments, at Tête-à-gauche, contain 120,000 cubic yards, and the cutting between them held 90,000. Another embankment at Nipissiguit river, contains 90,000 cubic yards, and the cutting at the west end of it, from which it was principally made, gave 74,000 cubic yards. Several of the cuttings east of Tête-à-gauche, had good clear gravel, from which a large quantity of ballast was obtained. In a few cuttings the clay was of a slightly sandy nature, and slipped until the sides assumed a flat slope. The excavation caused some trouble during wet weather; but the cuttings are neither long nor deep.

The heaviest work was in masonry, there being six bridges, besides three large arched culverts. One of the latter is 20 feet span, in an embankment 30 feet deep, and is built of heavy granite ashlar. Near to this is the bridge over the River Tête-à-gauche, which has five spans, each 100 feet, crossing a valley about 55 feet deep. The next important bridge, is that over the River Nipissiguit, with six spans, each 100 feet. The river is 500 feet wide and the depth of its bed, below formation level, is 43 feet. The water is not deep during the summer season, but flows in a shallow, turbulent stream, on a rough rocky bed. The masonry was laid at low water, without difficulty. Plates Nos. 21 and 22 illustrate these important structures.

The masonry on this Division is marked by the massive character of its granite courses.

The granite cutwaters and quoins of the Restigouche Bridge, were transported from this locality. The granite was easily cut, and the quarrying of stone was not expensive, as there was little waste and no stripping.

The length of the Division is 12 miles. The average quantity of excavation is 52,000 cubic yards per mile, and of masonry 1,061 cubic yards.

The work was let on the 15th June, 1870, to Messrs. J. B. Bertrand & Company. They failed in fulfilling their contract, and the work was assumed by the Government and completed in 1874.

The Resident Engineer was Mr. P. A. Peterson who had been employed on the location survey. He was succeeded by Mr. Charles Odell, who remained in charge until the work was completed.

The starting point for the proposed branch to Shippigan, has been located near the crossing of the Nipissiguit. This branch was surveyed in the winter of 1873-74, and was designed to form a short mail route between England and America. The harbour of Shippigan was also surveyed, soundings being taken through the "Shippigan Sound," and the channel out to the Bay Chaleur, over an area of about 20 square miles.

The result of the survey is to show that only wharves and piers, a short distance out from the land, are required to make the harbour available for the largest steamers; they likewise establish the fact, that the branch railway can be constructed without any extraordinary expenditure.

February 10, 1999