1878.

NEW ZEALAND.

SURVEY FROM CANTERBURY TO THE WEST COAST

(REPORTS ON, FOR THE PURPOSE OF ASCERTAINING WHETHER A RAILWAY CAN BE MADE TO CONNECT THE WEST COAST WITH THE MAIN SYSTEM OF RAILWAYS ON THE EAST COAST).

Laid on the Table by the Hon. Mr. Macandrew, with the leave of the House.

NOTE.—The plans connected with these Reports can be seen at the Public Works Office, Wellington.

REPORTS PREVIOUSLY PUBLISHED.

(1.) *Report on Survey from Canterbury to the West Coast.*—Mr. Foy to the Engineer-in-Chief, dated Amuri Pass, 21st December, 1874. *Vide* Appendix, H. of R., 1875 (E.–4., p. 2). Mr. Foy to the Engineer-in-Chief, dated Nelson, 6th March, 1875. *Vide* Appendix, H. of R., 1875 (E.–4., p. 4).

(2.) *Report on Surveys to connect Nelson and Picton with North Canterbury.*—The Engineer-in-Chief to the Hon. the Minister for Public Works, dated Wellington, 5th August, 1875. *Vide* Appendix, H. of R., 1875 (E.–4., p. 9). Mr. Foy to the Engineer-in-Chief, dated Nelson, 30th June, 1875. *Vide* Appendix, H. of R., 1875 (E.–4., p. 10).

(3.) *Report on Survey of Line of Railway from Amberley to Blenheim viâ Hurunui and Kaikouras.*—Mr. Foy to the Engineer-in-Chief, dated Nelson, 22nd June, 1876. *Vide* Appendix, H. of R., 1876 (E.–1, p. 35).

(4.) *Report on Survey of Line of Railway between Blenheim and Nelson.*—Mr. Foy to the Engineer-in-Chief, dated Nelson, 22nd June, 1876. *Vide* Appendix, H. of R., 1876 (E.–1., p. 41). The Engineer-in-Chief to the Hon. the Minister for Public Works, dated Wellington, 25th July, 1876. *Vide* Appendix, H. of R., 1876 (E.–1., p. 42).

No. 1.

Mr. T. M. FOY to the ENGINEER-IN-CHIEF.

SIR,— Kaikoura Township, 22nd January, 1877.

As instructed, I called upon the Hon. Mr. Robinson at the Cheviot Hills, anticipating on arrival some information from him relative to the line north from the Waiau or Conway Rivers, and was greatly surprised to find that he neither expected nor was he prepared to offer me any information upon the subject himself, nor did he refer me to any other person for it.

On his remarking to me that he was very busy at the time, it being the wool season, and would continue to be for another week or ten days, I suggested to him that at the expiration of that time I should be prepared to meet himself or any other person he might choose to depute for that purpose at Mr. Rutherford's, the owner of the Mendip Hills Run, as I had reason to believe that this was the only route he could possibly allude to. On my leaving the Cheviot Hills it was arranged between us that I should telegraph my arrival at the Kaikoura Township. This I did, and, as the above-mentioned time had expired, I also mentioned the day of meeting at Mr. Rutherford's.

Being desirous that you should have the opinion of another engineer in addition to my own, I detached a small party under Mr. Simpson to proceed to Mr. Rutherford's, at the Mendip Hills, and I am sorry to have to say that Mr. Robinson neither replied to my telegram, nor did he send any person, nor attend himself, although Mr. Simpson arrived on the day named and remained for three days after in the locality. Mr. Simpson in the meantime examined the country by himself, and his opinion on the subject will be found attached to the end of this report.

I must say, in conclusion, that I found myself in anything but a pleasant position during my interview with Mr. Robinson at the Cheviot Hills.

My further report upon this line, with sketch-map, accompanies this letter.

I have, &c.,

The Engineer-in-Chief. THOMAS M. FOY.

No. 2.

Mr. T. M. Foy to the Engineer-in-Chief.

Sir,— Kaikoura Township, 22nd January, 1877.

I have the honor to forward you a report upon the further exploration of the Cheviot Hills District, as the route for the main trunk line from Amberley to Blenheim.

On my way to the Cheviot Hills I made a further examination of that portion of the line lying between Amberley Station and the Conway River, and I find that I have no reason to alter my opinion, as already expressed in a former report, as to the course of the line between these two places.

On my arrival at the Hurunui River I found that an engineer was engaged in laying out a road on the north side of this river, which appears to be in connection with the bridge which I understand is to be erected at the place shown upon the sketch-map, and which would have formed the site of the railway bridge had the line followed the route of the Greta River. The fact of the work being proceeded with led me to the conclusion that the idea of a railway line ever passing through that district had been abandoned, at all events, by the persons interested in this work. I may here remark that the principal and, in fact, the only objection the owner of Cheviot Hills appeared to raise against the route of the other line was that, in his opinion, it would be impossible to maintain a line of railway over the Greenhills District, from the fact that owing to its elevation — viz., between 1,400 and 1,500 feet above the sea-level—the snow in the winter time would form an insuperable barrier thereto. I have never seen this locality during the winter months, but it appears to me that from the elevation alone it would scarcely warrant such an assertion, and, strange to say, he is the only person that I have met with that hazards such an opinion, and, stranger still, as I informed him, should the line ever pass through his district it must of necessity also pass over that of the Greenhills, and of that he must now be fully convinced. As regards the snow in winter upon the Greenhills, I heard from a disinterested and intelligent person, who has known the locality for the last twenty years, that an objection to the route over the Greenhills on the score of snow is not warranted by facts, for it is only at the time of severe winters that the snow remains upon the ground for any length of time in this district, and that it is only where drifts occur that it ever exceeds a foot in depth upon the plains. Its close proximity and exposure to the sea air appears to me to justify the belief that its stay upon the ground must be of very short duration.

On my recent exploration I made a minute examination of the country from the Conway by the sea-coast, as also the route of the telegraph line to the Kaikoura Township; and, although I have never met with nor heard of any person advocating or even thinking of a line by either of these routes, still I was anxious to be able to form some idea of the cost of these lines, and I can now say that to follow the coast line it would involve at the Amuri Bluff about one and a half miles of tunnelling, whilst between the Kihikihi and Kahautara Rivers it would be impossible to construct a line that could be kept in a state of repair, as the base of Riley's Hill in places dips into the sea, and for nearly the whole length of this distance a railway line would be exposed to the full force of the waves during ordinary tides, and during a storm along this part of the coast the exposure would be fatal to any works that might ever be constructed.

The route by the telegraph line, as I have already stated in my former report, is altogether impracticable, as it passes over hills, some of them rising to the height of five or six hundred feet, then across a valley and over an equally high hill, and, after a succession of these flights, it falls nearly vertically into the valley of the Kahautara River. It is therefore demonstrably certain that a line of railway can never pass over any portion of the country that lies between the Conway River and the sea-coast, as it is, financially speaking, as well as from an engineering point of view, altogether out of the question.

The practicable and impracticable portions of this line along the Conway River and the sea-coast are shown upon the sketch-map, the former by a red and the latter by a black line. This being the case, we must return back to the Waiau River, and, instead of passing by way of the Hawkswood Run to the Conway, we must take the course of the Leader River, which, as I have already reported, is practicable for a certain distance, which I have now shown upon the sketch-map accompanying this report. The high hills, from the point marked B, obstruct further progress in this direction, and if it were otherwise, from the course this line here takes, it would join the other line at a point west of the saddle which divides the Mason River from the Campbell Creek, so that, as a recompense for increase of distance, something more than that which the Cheviot Hills District possesses would be required to justify so great a detour from its proper direction, more especially when we consider that the Cheviot Hills line passes through an isolated and exclusively pastoral district, and that there is a certain possibility that the owner may object to allow a population to be formed within the precincts of his own grounds and dwelling-house, as the land in question is mostly, if not all, freehold property. However remote this latter idea may appear, the fact of the possibility still remains, but such a contingency, if possible, would have to be guarded against.

But the more weighty objections to this line, apart from all other considerations, must be based and I consider rest sufficiently upon its engineering and financial difficulties, as any progress onwards to the Kaikoura Township from the points marked A, B, upon the sketch-map could only be accomplished at considerable and unnecessary cost.

Another serious objection to this line is that the branch to the West Coast would be considerably affected if the main line passed through the Cheviot Hills District, as it would become the means of adding nine or ten miles at least to its present length, having to join the main line at or near the point shown on the sketch-map and noted "Junction of line to West Coast," in the Waikari Valley. The traffic along this part of the line would be sure to meet with opposition by the boats that ply during the wool season between the small ports along the coast and Lyttelton. At present the wool from the Motuuna, Stoneyhurst, Cheviot Hills, Parnassus, Hawkswood, and all the minor stations, is conveyed to Lyttelton by boat, and I question whether, if a line of railway was constructed through these districts, any alteration in this respect would be made. The owner of Glenmark Station would no doubt

send all the produce from his extensive run by the railway, as a station on the north side of the Waipara River, as I have before alluded to, would afford accommodation for that purpose.

I have purposely kept open this report until our arrival at the Waiau, as I should then have had an opportunity of passing again through the country that forms the route of the other line; and I must say that I feel more than ever convinced that the best route for the main line is through the Hurunui and Waiau Districts, for whatever life and travel at present exists, and from all appearances is likely to continue, is undoubtedly through this part of the country, and the land, contrary to the other line, appears to be in possession of a far greater number of persons. The grades that constitute, equally with the traffic, a most important feature of a line of railway will compare most favourably with any of the other lines that have been examined; whether we take the West Coast line, from Nelson by way of the Buller River, the Wairau and Clarence Rivers by way of Jack's Pass, the Wairau, Tarndale and Acheron and Clarence Rivers by way of Jollie's Pass, or the Awatere, Ward's Pass, the Acheron and Clarence Rivers, by way of Jollie's Pass. The steepest grade by way of the coast line is that at the Greenhills, which I have reason to believe will not exceed 1 in 40.

From a second examination of the line between the Kaikoura and Waiau Townships I feel certain that all the grades as shown upon the sections accompanying my former report can be much improved; and, as we now have an exploration of all the possible routes for a line of railway between Amberley and Blenheim, I feel myself justified in recommending that a trial "survey line" should be made through this district, so as to be certain of its practicability and the nature of the grades the country will afford.

As the most expensive and at the same time the most difficult portion of the line is between the Waiau and Kaikoura Townships, especially in respect to grades, this portion might be done first, and if found satisfactory the other portions can be done afterwards, more especially that along the sea-coast between the Kaikoura Township and Flaxbourne.

I have, &c.,

The Engineer-in-Chief.

THOMAS M. FOY.

No. 3.

Mr. T. M. FOY to the ENGINEER-IN-CHIEF.

Survey of Trial Line for Railway, Conway to Kaikoura.

SIR,— Kaikoura, 24th October, 1877.

I have now the honor to forward you plan, section, and report of the above-mentioned work.

As the line by the Campbell Creek and the crossing of the Conway River, with that of the ascent from the Greenburn to Greenhills, constitutes, in my opinion, the most difficult portion, as regards the location of the main line from Amberley to Blenheim, I was anxious to have the former portion included in this survey. We therefore commenced at the saddle, on the western side of the Whale's Back, instead of at the Conway River.

With the view of expediting the survey I subdivided the work, giving the first 11 miles—namely, from the above-mentioned saddle to the Charwell River—to Mr. Simpson, with Mr. Evans, cadet, as an assistant; whilst the remaining 25½ miles, including the Greenhills portion, I took myself, assisted by Mr. Coom.

I have prepared an index map of both plan and section, by which the grades and the general direction of the surveyed line will be seen at a glance. By the plan it will be seen that the general direction of the line surveyed between the two extreme points is favourable enough. The only place where any marked deviation occurs is at the crossing of the Charwell River. The sharpest curve upon the line of survey will be of five chains radius, but this only occurs in two or three places—namely, at the ascent from the Greenburn to the Greenhills (and which I need scarcely remark is unavoidable owing to the configuration of the ground), and at the Campbell Creek.

The grades, as will be seen by the index section, are not quite so uniform as I had expected, that of 1 in 25, the ruling gradient, occurring in many places. The frequent recurrence of this grade is caused, first, by the descent from the saddle at the Whale's Back to the Conway River, and then by having to rise over the Quail Range, and from the Charwell River on to the high ground at the Greenhills, with the descent from that place to the Greenburn. But when the Cribb Creek is reached the grades immediately improve, and will continue favourable, with the exception of one or two places, the whole way to Blenheim.

This survey embraces that portion of the main trunk line situate between the saddle at the Whale's Back to the point where the line along the sea-coast commences, and in regard to length is 36 miles 43·55 chains. It also includes that portion of the line that I mentioned in my former report as being likely to cause extra expense in working, owing to the steepness of the grades, and as containing about a mile of bridging.

Division 1.

The Campbell Creek.—The line by the course of this creek has been surveyed, and I must say that it has been found to be far more rugged than I had anticipated. However, it was necessary that a survey should be made, as I knew that it was the only route that would give us a grade so as to enable the line to be worked on the one principle. The steepest grade along this creek is, as the section shows, 1 in 25, but wherever it occurs the cuttings are very heavy. The alternative line is over the Whale's Back, showing respectively grades of 1 in 28 and 1 in 7.

No doubt but the line along the Campbell Creek could be somewhat improved in location, but not sufficiently to alter the general character of the work, or in any way to improve the grades. The crossings of the Conway River in connection with this route cannot be improved. However, as we now have a complete survey of the creek, having surveyed both sides, and thereby ascertained the best line obtainable, we are in a position to make a fair comparison between the two routes.

In the first place it would certainly be desirable to work the line through (especially as it is a portion of the main trunk line) without a change that would involve our having recourse to "special machinery" for the purpose. But when we consider the nature of the best section that the line of 1 in 25 gives, together with the crossing of the Conway River seven chains in length, which must from its height be a suspension bridge, and the heavy cutting through solid rock in some places to obtain 1 in 25 grade as marked upon the section, it becomes a matter of importance as to whether it would not be better to forego the desirability of the case, and consider the two routes in the light of their respective merits, before the matter is finally decided upon.

In favour of the line over the Whale's Back, it may confidently be asserted that both of the grades can be improved. In the case of the grade of 1 in 7 the ground is so favourable that without any difficulty sufficient length by curving can be had, so as to improve the grade to 1 in 15, but not to 1 in 25. The ground for the whole way would be easy of excavation, and without any chance of rock appearing, whilst the work would be of the lightest description; add to this a far better crossing of the Conway River can be had, with half the length of bridging that would be required at either of the other two crossings, a far lower bridge, and with better approaches.

I should have made a survey of this other line over the Whale's Back, but as this portion was not included in my division of the work I was not aware but that a far better line could be had along the creek. Nor did I discover this until the work was plotted in the office and I became engaged in putting the grades upon the section. But, feeling as certain as if a survey had been made that what I have above stated can be depended upon, I scarcely considered it worth while to lose the time in doing so afterwards.

The only question therefore that arises is, whether the portion of the line over the Whale's Back should be worked in a special manner, in connection with a good road-bed, easy of construction and maintenance; or whether, in dispensing with this alternative, the line should be built permanently along the Campbell Creek, with an easier grade, but over far more difficult ground, costly in construction and, comparatively speaking, difficult of maintenance, with a far greater liability to accident in working, by reason of it passing over ground that has been much ravined by the destructive agencies of rain, frost, and snow.

Considering not only the probability, but the almost certainty, of improved motive power in a few years hence, I am of opinion that the Whale's Back line would prove a far better one than the other in every respect. And speaking from long experience, as regards the necessity of constructing a line of railway over ground that will enable it to be kept in good working condition, and with the greatest economy, I certainly must give preference to the line over the Whale's Back, with its grade of 1 in 15, to be worked by special machinery until the time arrives when the mode of working our railways shall have undergone alteration and improvement.

I have shown in sketch upon the index plan the route of the line over the Whale's Back; also the grades upon the section, which must be considered as only approximate, having been copied from the section that accompanied my exploration report, which gives the heights "barometrically" taken.

In crossing the Quail Range you will perceive that two lines have been surveyed. The first of these is represented by the continuous chainage along it, which is somewhat the shortest, but passing over a high ridge, necessitating a tunnel of about 14 chains in length. The other line crosses higher up the range at the same time, at a slightly lower point than the other, and doing away with the necessity of a tunnel. Therefore, as tunnelling (especially at a place of that description) would undoubtedly be objectionable for many reasons, the alternative line in blue would, I consider, be altogether the most preferable for location, where no tunnelling will be required, and the heavy cutting free from rock. The line thence to the Charwell River passes over very favourable ground.

Division 2.

In the selection of the crossing of the Charwell River, I first surveyed a line higher up under the hills, as will be seen upon the plan, Sheet No. 1, also another crossing of the river lower down. The sections of these crossings will be found on Sheet No. 1A. Both of these crossings of the river are objectionable, by reason of the height of bridging that would be required, with an increased length of line. After considerable examination, I found the crossing that I have adopted the best that could be found, having the lowest height of bridging, with grades of 46 and 42 on the south approach to the bridge, and along a side hill with a very gentle slope and a grade of 1 in 25 on the north side. The northern approach to the bridge, with its grade of 1 in 25, has but little side hill cutting.

The first line run, as will be seen by the section, was objectionable in consequence of the depth of the cuttings, but the alternative line shown in blue for location is a very great improvement, and the ground over which it passes will insure a good firm road-bed. The line from the top of the grade of 1 in 25 will be easy of construction the whole way to the commencement of the descent from the Greenhills to the Greenburn.

The result of the survey of this part of the line has been to show that a grade of 1 in 25 is the best that can be obtained. By an inspection of the plan upon Sheet No. 4, it will be seen that a general contour survey of the hills has been made, resulting in the adoption of the red line as approximately showing the course of the line for location, and, although the section shows a grade of 1 in 19 and another of 23 at this place, yet the continuous grade of 1 in 25, as also shown upon the section, can be obtained, and on its location a section can be produced which need not show more than an average cutting of from 10 to 12 feet on the side hill, or a sufficient depth to obtain the proper width of the road-bed, as there is distance enough for the purpose, with room sufficient to enable curves of five chains radius to be laid in. The deep cutting upon the section at the end of Sheet 4 will disappear when the curve at that place is located.

The crossing of the Greenburn (like that of the Charwell River) has been chosen at the place where the dray-road crosses, as it is the only one where ground is to be had to approach the bridge at a comparatively low level. This bridge is between 20 and 30 feet higher than that over the Charwell River, but much shorter; and as there is but little water in it, even at its highest flood (by reason of

its draining so small an area of country), I think the best way to cross it would be by the construction of two 40-feet or even 30-feet semicircular brick arches, which I feel certain would be quite sufficient water way to carry off the greatest flood that ever occurs in it: in short, it is but a mere stream, with very high banks.

There appears to be plenty of good brick-earth and limestone in the immediate locality, and the application of the design to this particular place would further benefit the work by utilizing a portion of the great quantity of material that will of necessity require removal from the heavy cutting on the north side of the stream; otherwise it will have to go to spoil, which will undoubtedly entail considerable expense. The curve when located at this place will reduce the cutting shown upon the section very much.

The line for the next mile and a half is over favourable ground, and when the line is located the section along this length can be improved so as to leave but a small amount of earthwork to do.

Near the station at the "Government reserve" there will be a bank of a little over 20 chains in length, and averaging about 35 feet in height. The material to form this bank, as will be seen by the plan, is close at hand, as the line has been surveyed along the edge of the bank, thereby affording the means of obtaining the material without incurring any great expense either in excavation or haulage.

Kahautara River.—The site of this bridge is also near the track of the dray-road across the river, and at the narrowest part that can be found. The dray-road has evidently been constructed in connection with this crossing of the river so as to take advantage of the side hill in rising on to the high terrace as shown upon the plan.

As will be seen by the section, the cutting on the east side of the river is a very deep one, but this is unavoidable, as the top of the terrace must be reached, and, although this is the case, yet it is as low, if not the lowest point that can be found.

The river upon the south side of the bridge as far as the bend, and where the Greenburn joins it about a mile and a half distant, increases in width the whole way, whilst the bank becomes higher until it merges into a high hill, situate at the above-mentioned bend. To attempt to cross the river higher up on the north side is entirely out of the question, as it very soon forms the junction of three or four tributary streams, as shown upon the plan, and more plainly still upon the index map.

From the top of the high terrace to the crossing of the Little Linton the line is favourable in every respect. As the Little Linton, although it has high banks, is but a stream, draining but a small district of country, it would be far cheaper, and equally effective, to cross it by two brick masonry arches of 30-feet span, and fill up with the earth from the cutting on the east side, similar to the crossing at the Greenburn.

The Big Linton, about a mile further on, is wider and partakes more of the character of a river, and will therefore require open bridging, but which need not exceed 15 to 20 feet in height, as no timber of large dimensions is brought down from the hills, nor are there any large trees growing along its banks in the valley. There is a gentle and gradual fall, and but little earthwork between the big Linton and Cribb Creeks.

An examination of a line was first made from the Kahautara River, crossing the two Lintons and Cribb Creek higher up under the hills and passing near to Swincombe Station to the crossing of the Kowhai River; but owing to the width of Cribb Creek at that high crossing, and the velocity of the water so close under the hills, it was abandoned in preference to the surveyed line, which is a far better one, and equally short as regards distance. The bridge across Cribb Creek, although lengthy, need not be of any great height, and the same remark made in this respect in connection with the crossing of the Big Linton is also applicable to this river.

The line from Cribb Creek, after passing over a low saddle, is of a uniform rise for about 3½ miles to the crossing of the Kowhai River, with but a small amount of earthwork the whole way.

I may here remark that, should the diversion of the Kowhai River ever take place, the railway line can without injury of any kind be easily removed higher up under Limestone Hill, so as to procure an easy crossing of the new course.

The crossing of the Kowhai River has been principally determined upon by the position of the bluff upon the east side of the river, as affording a protection to the bridge, which does not occur at any other place along its banks. Higher up would give too high a level for the general section of the line (see index section), whilst lower down would throw us on to ground subject to inundation.

We are now getting into the locality of the timbered hills, and, although this is the case, a high bridge is not necessary at this crossing, as the timber that floats down the river from the hills is not of large growth. The line for the first mile from the river crossing is over rather rough ground, but the section shows alternate cutting and embankment, which, being nearly equalized, will not for that reason be costly in construction.

The line for the next 7½ miles around the base of Mount Fyffe, namely from the 15th mile to the River Hapuka at 22½ miles, is over very favourable ground, with but a small amount of waterway to provide for, and a section showing but little earthwork to be done; and as soon as the site of the station for Kaikoura shall have been decided upon, the line along this length can be located, so as to have but 3 or 4 feet of bank or cutting the whole way.

The crossing of the Hapuka River near its junction with the Buibui is by far the most difficult, in an engineering point of view, of any of the rivers before mentioned. It is not only of equal length with the Kowhai, but the bridge will be subject to disturbance by the floating timber that comes down the river, sometimes in large quantities and with great force during heavy floods. To cross the river higher up and above the junction of the Buibui would not improve it in any way, as the water becomes too rapid, the line considerably lengthened, the section much worse, and the Buibui still to be crossed, so that the length of the two crossings would be fully equal to, if not greater than, the present one. A survey was made up the river for a considerable distance for the express purpose of seeking for a better crossing, but with no favourable result. To cross it lower down would cause the bridge to be lengthened very considerably, and as there are no defined banks to protect the

abutments the approaches would be in constant danger of being washed away. There is therefore no alternative line of crossing, and the only protection I can see is to have the spans as wide and as high as the circumstances of the case will admit.

This river, unlike that of the Kowhai, is in no way connected with the seaward Kaikoura Range, but takes its rise from among a group of low hills covered with timber and contiguous to the sea: hence the absence of any "periodical" floods caused by the melting of the snow on the high ranges. There has been no flood in the river for over twelve months, nor does every flood bring down timber with it. The rains therefore being entirely local that affect the river, there would be no difficulty in anticipating a flood, which, on that account, would enable the bridge to be closely watched at the time. There would be no difficulty in protecting the piers from the floating timber, and the height of the bridge will probably not have to exceed that shown upon the trial section.

The remaining 2½ miles are comparatively easy. The only place of any importance is at 23 miles 50 chains, where the line crossos for a short distance over a rather high spur.

An alternative line was surveyed around the end of the spur (as shown upon the plan) which gives a better section, but, as the cutting through the spur is but short, I think it would be scarcely worth while to divert the course of the line for that purpose, as the difference in distance would entail other expenses, that would, in amount, equal if not exeeed the first cost of cutting through the hill. This survey, as will be seen by the plan, ends on a terrace at the beach, around which the course of the line will be continued.

Lengths of principal Bridging.

Rivers.	Ch.	lk.
Conway	7	0
Charwell	5	50
Kahautara	10	50
Big Linton	10	0
Cribb Creek...	13	50
Kowhai	18	0
Hapuka	17	0
Total	81	50

I have, &c.,
THOMAS M. FOY,
Resident Engineer

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