

# FURTHER PAPERS

RELATING TO

## THE CONSTRUCTION OF TRAMWAYS (SOUTH ISLAND).

- I.—MALVERN HILL TRAMWAY.
- II.—OXFORD TRAMWAY.
- III.—EYRETON TRAMWAY.

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PRESENTED TO BOTH HOUSES OF THE GENERAL ASSEMBLY, BY COMMAND OF  
HIS EXCELLENCY.

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WELLINGTON.

—  
1871.

SCHEDULE OF CORRESPONDENCE.

No.	Date.	From.	To.	Subject.
1	1871. August 8	W. B. Bray ...	...	Report and Estimate—Malvern Hills Tramway.
2	Ditto ...	Ditto ...	...	Ditto ditto Oxford Tramway.
3	Ditto ...	Ditto ...	Assistant Engineer- in-Chief.	Ditto ditto Eyreton Tramway.

## FURTHER PAPERS RELATING TO THE CONSTRUCTION OF TRAMWAYS.

### I.—MALVERN HILLS TRAMWAYS OR RAILWAYS.

#### No. 1.

REPORT by Mr. W. B. BEAY.

Christchurch, 8th August, 1871.

It having been proved beyond a doubt that workable coal of good quality exists in various parts of the Malvern Hills in sufficient quantity to supply the consumption of the population of Canterbury, the construction of a railway is advisable to bring this coal to the consumer at a moderate cost, and to stop the drain of £25,000, sent annually out of the Province to purchase fuel.

From the analysis made at the Laboratory at Wellington, the quality of Canterbury coal compares very favourably with Newcastle or Grey River coal.

	Carbon.	Volatile.	Water.	Ash.	Total Combustible.
Newcastle ... ..	57·20	31·78	2·88	8·14	88·98
Grey River ... ..	62·37	29·44	1·99	6·20	91·81
Hart's ... ..	73·94	16·60	3·60	5·86	90·54
Jebson's ... ..	46·02	26·99	21·66	5·33	73·01

The total quantity of coal imported in 1870 was 20,968 tons. The workings of either Hart or Jebson are in a state to furnish 80 to 100 tons of coal each per diem as soon as there is a railway to take the coal to market; but the expense of carting on ordinary roads makes this coal more costly in Christchurch than imported coal, which is supplied at from 43s. to 48s. per ton, whereas the Malvern coal might be brought by railway and sold at little more than half that price. If the coal were accessible by railway, not only would the wants of the Province be supplied at this lower rate, and consumption be thus increased, but coal might be furnished to steamers frequenting the Port of Lyttelton.

Besides the two collieries above named, good coal is found and worked by Mr. Hill on the south side of the Selwyn, and it doubtless underlies all the intervening land between Hill's and Hart's and the surrounding country, to an extent yet unexplored. Other beds of coal have been found, both at Hart's and Jebson's workings, which may be opened out whenever the demand requires it. The production of 200 tons per diem from the beds now wrought is estimated to take about 14 acres per annum, or 2 square miles in about 90 years; but the other beds would largely increase the yield per square mile.

The coal field occupies many square miles, but its full extent is yet unknown.

Lines of railway having been reserved from Rolleston Station, on the Southern Railway, to both these collieries, reconnaissance surveys have been made along both lines.

The Northern Line proceeds from Rolleston Station for twenty-nine and a quarter miles towards the north-west, then turning due west for two and three-quarter miles, reaches the banks of the Kowai at thirty-two miles from Rolleston Station.

The coal found on the banks of the Kowai is of excellent quality—90·96 per cent. of combustible matter; but the great dip has prevented the coal being got with advantage, and the workings have been discontinued. There is therefore no prospect of coal being supplied here to the tramway in sufficient quantity. But at twenty-two and a half miles from Rolleston Station this line passes near to Mr. Jebson's workings, where 100 tons per day may be had, which is considerably more than the present quantity of coal imported. This coal, however, is not so well adapted to every purpose, and being a lignite, contains a large proportion of water, shown by the analysis to be 27 tons of water and ash to 73 tons of combustible matter in 100 tons.

The Southern Line branches off from the Northern at ten and a quarter miles from Rolleston Station, near Colonel Brett's, and runs nearly due west for fourteen and three-quarter miles to Surveyor's Gully, where the reserve terminated.

The first Colliery Line would have to be carried up this gully, but Hart's coal is four miles further up the Selwyn, and on the same side of the river. It would furnish 80 to 100 tons of coal per diem, containing by analysis 90½ per cent. combustible matter.

The railway might be carried with advantage two and a half miles further up the river, and would then terminate a mile and a half from Hart's coal on the north side of the Selwyn, and rather less from Hill's coal on the south side of the river. The railway need not be carried beyond this by the Government if power is given to the coalowners to construct tramways and bridges, under proper regulations as to making and using and toll-paying by other parties.

The distance from Colonel Brett's, by the Northern Line, to Jebson's coal is twelve and a quarter

miles; but this distance would be increased only to thirteen and a half miles by using the Southern Line for five and a half miles, and then taking a branch eight miles long along the telegraph line, saving four and a quarter miles of tramway, and only adding one mile and a quarter to the haulage.

The lines of tramway above recommended, amounting to thirty-five and a half miles, would give access to collieries capable of supplying four or five times the quantity of coal now consumed in Canterbury. If more coal is required, by extending the Northern Line thirteen and a half miles beyond Jebson's, it would be brought near (three miles) the Big Ben Coal Field, where there is a seam 4 feet 7 inches thick cropping out on the hill side, shown by analysis to contain 86 per cent. of combustible matter, and capable of yielding 100 tons per day for many years.

Coal is known to exist in various other parts of the Province, but these are nowise accessible from these tramways to the Malvern Hills.

Appended is the estimate for the lines of railway recommended as above.

I have, &c.,  
W. B. BRAY.

### Enclosure 1 in No. 1.

#### STATEMENT of Messrs. HART and JEBSON.

MR. HART states that his coal lies on section 3,918 and adjoining sections, on the left bank of the Selwyn River.

The strike of the coal is N.E., and dips to the S.E. The seam now worked is 2 feet 3 inches thick, but twelve other seams are seen on the face of the hill, varying from 2 inches to 18 inches thick. The present 2 feet 3 inch seam only showed a few inches at the surface, but increased in thickness as the workings advanced, and still increases.

At about 100 feet below the 2 feet 3 inch seam is another 3 feet seam found by boring, the shaft towards which has been sunk 80 feet. Coal has been found by the rods at 100 feet below the 3 feet bed, but with so great an amount of water that it cannot be available until pumping-engines are provided.

The present drive is 5 feet 6 inches high and 5 feet wide; six men only are now employed, and turn out two tons each per day; the daily supply is twelve tons. There is room for twenty or thirty, or more, to work.

Mr. Hart has at least ninety acres of land above the level of the present workings, which, at 2 feet 3 inches thick or 3,600 tons per acre, would yield 324,000 tons from one bed, or say 224,000 tons of available coal.

The present price is 20s. per ton at the mouth; but if 60 to 100 tons per day were taken, it could be supplied at 10s. to 12s. Limestone, fireclay, and ironstone are found in the vicinity.

Mr. Jebson states that his coal workings are on Mr. Sheath's section, No 3,715. The bed is 4 feet thick, and yields 4,800 tons per acre; two men now get three tons per day, or two men and one horse will get four tons per day; the present price is 16s. at the pit. Fifty men could be employed, and would get 100 tons per day, which then costs only 10s. to 12s. per ton. This rate of production would use six acres per annum, but Mr. Jebson can work on 600 acres, and there is plenty more to be had. This coal would be brought to the railway at about twenty-two and a half miles from Rolleston Station.

The Kowai coal is at the end of the proposed railway, dips very rapidly, and, without further investigation, he cannot say anything as to its probable yield. It is not worked now; therefore there is no present inducement to bring the railway to this point.

If the railway were extended five miles further up the Kowai, it would be about three miles from Big Ben Coal Seams, which may be worked by a tunnel under the saddle, so as to get an outlet for water. This coal is 4 feet 7 inches thick, and would be more easily worked than the other; forty men might get 100 tons per day, at 8 to 10 per acre.

Mr. Jebson's estimate of the extent of this coal is 1,000 acres.

### Enclosure 2 in No. 1.

#### ESTIMATE of MALVERN HILLS COAL MINES.

FROM Rolleston Station to White Rocks, one mile and a half from Hart's Coal Drift:—

	£	£
Earthwork, 27½ miles, at £200 per mile	...	5,500
Bridges and Culverts—		
Seven 3-feet Culverts	245	
Two 6     "	120	
One 10    "	90	
One 15    "	150	
		605
Bridge over River Hawkins, 300 feet	...	2,100
Bridge over Dean's Creek, 90 feet	...	630
27½ miles Permanent Way, at £1,434	...	39,435
		£48,270
Branch to Racecourse Hill, ending near Jebson's Coal Drift—		
Earthwork, 8 miles, at £200	...	1,600
Culverts, 4 miles, at £35	...	140
Permanent Way, 8 miles, at £1,434	...	11,472
		13,212
Carried forward	...	£61,482

Brought forward	...	...	...	...	£61,482
If the line is fenced in, add—					
Fencing, 35½ miles	...	...	...	...	£7,100
Crossings and Gates	...	...	...	...	930
Sidings, 6, say at £1,000 each	...	...	...	...	6,000
					<hr/> 14,030
Total	...	...	...	...	<hr/> £75,512

*Note.*—If fencing were as strong as the Northern Railway it would cost £1,800 more than above.

## II.—OXFORD TRAMWAYS.

### No. 2.

REPORT by Mr. W. B. BRAY.

SIR,—

Christchurch, 8th August, 1871.

The Oxford forest, to which it is proposed to form a tramway, lies on the sides of Oxford Hill, and extends down to the plains, covering an area of sixty-four square miles; but it is estimated that only twenty-five square miles are at present accessible. The quality of timber is various, but black birch prevails.

With the exception of a few small pieces of bush, of inferior timber, near the top of Mount Grey, this is the only accessible timber in this part of the Province of Canterbury.

Above one hundred and seventy square miles of land have been sold north of the River Ashley, and nearly an equal area has been sold between the Ashley and the Eyre.

The timber that formerly existed at Ohoka, Woodend, and Rangiora, having been cut down and used, all this district depends on Oxford Forest for timber for building, fencing, and farming purposes, and for fuel; except such supply as may be brought from the Bays or Banks Peninsula to Kaiapoi or Saltwater Creek. The object of constructing a tramway is therefore to give access to this timber, and bring it by the readiest way to the district requiring it; and, at the same time, to facilitate the export of agricultural produce.

Two lines of tramway have been proposed for this purpose, each giving special facilities to the district through which it passes: therefore, reconnaissance surveys have been made on both these lines.

The Southern Tramway commences at Oxford, at an elevation of 783 feet above high water; follows along the northern side of the Oxford and Rangiora Road, for five and a half miles, then turns along the so-called Oxford Tramway Reserve, and at a distance of twenty-five miles from Oxford joins the Northern Railway at about 3 feet above high water, near Kaiapoi. The last mile and a half of this line is carried through private property. But four miles are over peat swamps, from 5 feet to 2 feet in depth, and indicated by the colouring on the section. In this swampy district, the line has to cross the Rangiora main drain, the Ohoka Stream, and several mill streams. The central part of this line runs about a mile and a half from the Eyre River, through a gravelly district, not yet brought into cultivation, and with a scanty population.

The Northern Tramway commences at the same point, 783 feet above high water, and follows the northern side of the Oxford and Rangiora Road to the South Moeraki Downs, skirts the northern foot of the said Downs, along an unused road reserve; then crossing the River Cust, by a bridge of 120 feet opening, it again follows the north side of the Rangiora Road, reaching Rangiora with thirty-one miles of tramway, at an elevation of 93 feet above high water, and joining the Northern Railway there or at South Brook.

		Kaiapoi.	Rangiora.
The distance by the Southern Tramway	...	26½ miles.	30 miles.
The distance by the Northern Tramway	...	27½ miles.	21 miles.

Comparing then the relative facilities afforded by these two lines for the supply of timber to the 340 square miles of purchased land before mentioned, we find that the Southern Tramway takes the timber for Rangiora and the north country down a descent of 780 feet in twenty-five miles to the lowest part of the district, whence it has to be brought back five miles by the Northern Railway, up an ascent of 90 feet, causing much unnecessary expense and labour. Whereas the Northern Tramway descends only twenty-one miles direct to Rangiora, saving nine miles of haulage and 90 feet of ascent, and at the same time requires four miles less tramway to be made. This nine miles of haulage with 90 feet of ascent thus saved is fully one-third of the haulage to Rangiora by the Southern Line.

The distance from Oxford to Kaiapoi for timber is one mile longer by the Northern than by the Southern Tramway. But inasmuch as the corn-growing district of the North Moeraki Downs is three miles further from the Southern Line than from the Northern Tramway, the total distance for agricultural produce from the Moeraki Downs, including cartage, is two miles shorter by the Northern than by the Southern Tramway.

The Northern Line saves the cost of four miles of tramway, one-third of the haulage on timber to Rangiora, and two miles on the export of grain from Moeraki Downs.

To this must be added the consideration that as the Southern Tramway joins the Northern Railway near Kaiapoi, it would necessitate the break of gauge there for timber going north, or the complication of a double gauge to Rangiora; whereas the Northern Tramway would join the line at the end of the broad gauge at Rangiora.

Appended is the comparative estimate for the two lines of tramway.

I have, &c.,

W. B. BRAY, District Engineer.

## FURTHER PAPERS RELATING TO

## OXFORD TRAMWAYS.

*Estimate of Southern Line.*

Oxford to Junction, 5 miles 50 chains.

5 Culverts under Railway	...	...	...	£200
5 miles 50 chains Earthwork, 50 yards, per chain at 1s.	...	...	...	1,125
5 miles 50 chains Permanent Way, Ballast	...	...	...	£200
" " " " Sleepers	...	...	...	300
" " " " Rails, &c.	...	...	...	758
" " " " Laying	...	...	...	176
Per mile	...	...	£1,434	8,067
				<hr/> £9,392

Junction to Peat Swamps, 15½ miles.

2 Creeks with 12 feet bridges	...	...	...	£216
1 " 6-feet bridges	...	...	...	60
1 " 10-feet bridges	...	...	...	90
				<hr/> £366
15½ miles Earthwork, @ £200	...	...	...	3,100
" Permanent Way, @ £1,434	...	...	...	22,227
				<hr/> £25,693

3 miles 73 chains through Swamps.

2 Creeks with 10-feet bridges	...	...	...	£180
Ohoka Mill Race, 20 feet	...	...	...	180
" Creek, 15 feet	...	...	...	140
" Road	...	...	...	50
New Ohoka Mill Race, 10 feet	...	...	...	90
5 Culverts (6-feet)	...	...	...	300
Rangiora Main Drain	...	...	...	360
Rangiora Road	...	...	...	50
4 12-feet Flood-opening	...	...	...	430
				<hr/> £1,780
3 miles 73 chains Earthwork, @ £600	...	...	...	2,347
2 miles Fencing through private lands	...	...	...	400
3 miles 73 chains Permanent Way, @ £1,434	...	...	...	5,682
				<hr/> £10,209

*Recapitulation.*

3 miles 73 chains through Swamps	...	...	...	£10,209
15½ miles from Junction	...	...	...	25,693
5 miles 50 chains at Oxford end	...	...	...	9,392
4 Sidings @ £1,000, and 2 Stations @ £1,500	...	...	...	7,000
				<hr/> £52,294
To this must be added cost of third rail to Rangiora, if laid on the narrow gauge	...	...	...	2,000
Total	...	...	...	<hr/> £54,294

*Estimate of Northern Line.*

Oxford Junction, 5 miles 50 chains.

Same as Southern Line	...	...	...	£9,392
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Junction to Rangiora, 15 miles 30 chains.

4 Culverts, 3 feet	...	...	...	£140
1 do. 5 feet	...	...	...	50
1 do. 6 feet	...	...	...	60
1 do. 10 feet	...	...	...	90
1 main Drain, 24 feet	...	...	...	216
Bridge over Cust, 124 feet	...	...	...	744
12 small Culverts at Downs	...	...	...	84
				<hr/> 1,384
12 miles 30 chains Earthwork, @ £200	...	...	...	2,475
3 miles Earthwork, @ £400	...	...	...	1,200
15 miles 30 chains Permanent Way, @ £1,434	...	...	...	22,048
				<hr/> £27,107
Carried forward	...	...	...	

Brought forward	...	...	...	£27,107
5 miles 50 chains, Oxford to Junction	...	...	...	9,392
4 Sidings, at £1,000; and 2 Stations, at £1,500	...	...	...	7,000
				<hr/> £43,499
If the Waipara Line does not pass through Rangiora, 1 mile 50 chains would have to be laid to the Southbrook Station; this is estimated at	...	...	...	3,000
				<hr/>
Total	...			£46,499

## III.—EYRETON TRAMWAY.

## No. 3.

REPORT by Mr. W. B. BRAY.

SIR,—

Christchurch, 26th October, 1871.

In accordance with the instructions given me in your letter of the 14th September, 1871, I have had a survey made of the proposed line of Eyreton Tramway along the line marked by a dotted red line between the points A and B, in the tracing enclosed to me, but with two deviations from said line, namely:—At B, the line was dotted through private sections of the town of Kaiapoi, for which very high prices have been asked, where taken for the Northern Railway; therefore I have had the survey taken for nearly half a mile up an adjacent street to avoid expensive purchases.

Further on, after crossing the Waimakariri, the line was to have followed the road along the north bank of the river, but since the plan was made (from which the tracing furnished me was copied), the river, which in times of high floods sets directly over and across this bank, has washed away many acres of private land as well as considerable length of the road, leaving wide overflow channels as well as forming itself a narrow channel through a freehold section. The survey has therefore been taken through private sections.

I now have the honor of forwarding you the plan and section taken along the line thus amended, together with the report and estimate of the line from B to A, prepared by Mr. A. V. Macdonald. I must at the same time point out that this line, from B to A, forms part only of the entire line to Eyreton, which, according to the first tracing sent me on the 2nd September, was to have continued  $5\frac{1}{2}$  miles further west, to the Rangiora and Waimakariri Road.

Assuming that this line is intended for a horse tramway for the agricultural district of Eyreton, which would work the line and guarantee interest and sinking fund on its cost, and that it would have to be made on the 3 feet 6 inch gauge, with its own stock of waggons and carriages, it will be necessary to form a terminal station for the tramway adjacent to the Northern Line, and where the transferring grain and produce between narrow and broad gauge waggons may be effected. If such station were formed at the point B, where land is valued at £400 per acre, it would require a fresh station to be formed on the Northern Railway. Therefore it appears to be better to extend the horse tramway along Fuller Street to the North Road, and form the tramway terminus on the site of the Ferryman's Arms, where the Tramway Company would have their sheds for transhipment of produce, and where produce could be discharged and stored until waggons were brought to reload it on the broad gauge.

The point thus raised involves the principle that horse tramways cannot be carried safely along locomotive railways, and that, under 79th clause of Public Works Act, there is a penalty of £50.

By forming the tramway station at the spot I have suggested, and having a warehouse to receive produce, instead of leaving it on the narrow waggons till the broad waggons are ready, a smaller stock of waggons may suffice, and during the busy thrashing season the tramway waggons may be worked night and day if necessary. Such warehouse would be under the sole control of the tramway authorities.

Considering that the tramway would have to be lengthened half a mile at Kaiapoi, and five and a half miles beyond the point A towards Eyreton, and that station accommodation would have to be provided at both ends and sidings, I consider that at least £15,000 for these purposes should be added to the amount of Mr. Macdonald's estimate for a single line from B to A. This increases the estimate for ten miles to £26,300, exclusive of land and rolling stock.

I have, &amp;c.,

W. B. BRAY,  
District Engineer.

J. Blackett, Esq., Wellington.

## Enclosure in No. 3.

Mr. A. V. MACDONALD to Mr. W. B. BRAY.

THE line of the proposed Eyreton Tramway which I have been instructed to survey, is indicated by a dotted red line between the points A and B on the accompanying plan. It leaves the Great Northern Railway in the town of Kaiapoi at the point B, and following the line of several roads up the island with curves of 7 chains radius at the several elbows, reaches the bank of the north branch of the Waimakariri, and crossing the river by a bridge of 231 feet in 7 spans just below an elbow of the river, it reaches the north bank at a part much threatened by the river, and where a considerable portion of land has been carried away.

The line, therefore, has to be taken through private property for 25 chains until beyond the overflow channels, and for a further distance of 35 chains, where the road has been washed away, and a deep elbow formed by the river, after which it rejoins the line of road on the river bank proposed for

the tramway which it follows until it reaches the line of the Oxford Tramroad which it follows 50 chains to the point A.

The ground on this line is generally sound excepting the last 55 chains, when it passes through peat swamp from 1 to 2 feet in depth, which swamp continues along the Oxford Tramroad for a further distance of 65 chains beyond the point A.

The portion of the town of Kaiapoi where the proposed tramway leaves the Northern Railway was in February, 1868, flooded to a depth of three feet, which extended with diminishing depth for 15 chains along the island road, but beyond this very little appears to have been flooded south of the river. There is, however, a deep gully or flood channel near the River Waimakariri which would have to be crossed by a bridge of 66 feet in two spans.

On the north of the river the line, though following the ordinary banks, lies directly across the current of freshes which in high flood sets with force across this land and forms a wide sea, but as no marks of the height of the water are left, and there are no houses, no precise information was obtainable.

There are here two deep channels cut from the river into the freehold land; at the mouth of the second channel, which is almost in the centre of the main line of flood, there is a quantity of shingle left by the flood. Beyond this the current sets with such force on this shore as to cut the new channel shown on the plan out of section No. 1,021. These flood channels will each require a bridge of 100 feet in length in spans of about 33 feet.

The several turns on this line of tramway may be formed with curves of 7 chains radius, which will require the purchase of about 10 acres of land, and the portion of line through freehold on the north side of the river will require the purchase of about fourteen acres.

The length of this line from B to A is 3 miles 73 chains, and I have estimated the cost at £11,277 12s. including the bridges, the line being for a horse tramway.

The estimate is exclusive of rolling stock, stations, and land.

Mr. W. B. Bray.

A. V. MACDONALD.

#### ESTIMATE EYRETON TRAMWAY, Part of Southern Line from Kaiapoi to Oxford.

Distance 3 miles 75 chains.

	£	s.	d.
Fencing, 160 chains, at 30s. per chain	240	0	0
Culverts	630	0	0
Bridges, 286 feet, at £8	2,288	0	0
Bridges, 231 feet, at £7 10s.	1,732	10	0
Earthwork, 2,084 cubic yards, at 1s.	104	4	0
Forming, 321 chains, at 30s.	481	10	0
Ballast, 7,376 cubic yards, at 1s. 9d.	645	8	0
Sleepers, 7,376, at 3s.	1,106	8	0
Rails, Spikes, &c., 276 tons, at £12	3,312	0	0
Laying, 7,376 yards, at 2s.	737	12	0
	£11,277	12	0

Exclusive of rolling stock, stations, and land.

Add for extension of line  $\frac{1}{2}$  mile in Kaiapoi, and  $5\frac{1}{2}$  miles towards Eyreton, according to Mr. Bray's Report of 26th October, 1871

15,000 0 0

And we have a total for about 10 miles of  
Exclusive of land and rolling stock.

£26,277 0 0

A. V. MACDONALD.