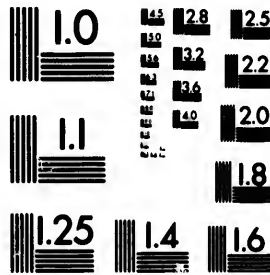


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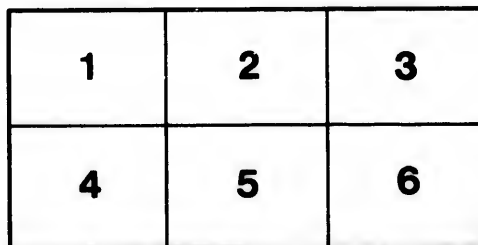
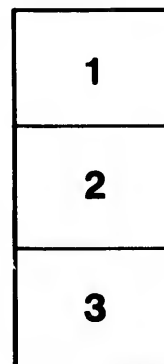
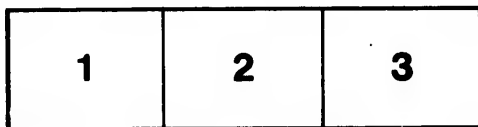
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NEWFOUNDLAND RAILWAY.

SANDFORD FLEMING, ENGINEER-IN-CHIEF.

REPORT

OF

PRELIMINARY SURVEY

AND

EXPLORATIONS OF 1875.



ST. JOHN'S, N.F. :
ROBERT WINTON,
PRINTER TO THE HON. HOUSE OF ASSEMBLY.

1876.

THE UNIVERSITY OF CHICAGO

1924

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

THE UNIVERSITY OF CHICAGO

GENERAL REMARKS.

The quantities and estimates in this report are,—1st.—
For a single line, first class road of the ordinary or four feet
eight and a half inch gauge, with a width of roadbed of
seventeen feet on embankments, and twenty-two feet in
cuttings and masonry structures.

2ndly.—For a similar road with timber structures.

These estimates embrace the construction of the road up
to formation level.

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NEWFOUNDLAND RAILWAY.

OFFICE OF THE CHIEF ENGINEER,
OTTAWA, April 11th, 1876.

The Hon. E. D. SHEA,
Colonial Secretary, Newfoundland.

SIR,—In March, last year, I had the honor to receive from you a communication requesting me to take in hand the preliminary surveys for a Railway across Newfoundland, from the east to the west.

I wrote you on the 26th April last, expressing my regret that I could not, on account of onerous official duties here, give my personal supervision to the work you had in view; but that I had been fortunate enough to obtain the services of Mr. A. L. Light, an engineer of long experience and high standing, to visit Newfoundland in my stead, and see the survey properly commenced.

At the same time I informed you that I had organized a staff of engineers to accompany Mr. Light, and to carry out such directions as might be given to them through him.

On the 24th April, 1875, I furnished Mr. Light with instructions respecting the survey, pointing out generally my views with regard to the mode of conducting it.

Mr. Light, after commencing the survey, was obliged to return to his duties at Quebec. His report on the organization of the various surveying parties, together with copies of the detailed instructions which he furnished the engineer of each party to guide him in his work, I transmitted to you on the 10th August last year.

It was intended that Mr. Light should return to Newfoundland sometime during the summer or autumn, to give farther attention to the survey, but he was unable to leave, and the duty fell upon Mr. Alexander Murray, the provincial geologist, to communicate farther instructions to the engineers in charge.

The field work of the several surveying parties was completed before the close of the year. The engineers in charge furnished Mr. Murray with a good deal of information, to enable him to submit to the Government reports of a preliminary character with respect to the survey in the interior, and also with regard to the survey through the peninsula of Avalon.

Having finished the work of survey in the field, the parties were disbanded, and the staff proceeded to Ottawa, in order that they might prepare their plans and other documents under my supervision.

The office work is now completed, and I forward to you complete plans and profiles of the whole line surveyed.

The engineers in charge have prepared full reports, giving a detailed description of the country passed through, having regard not alone to its adaptability for railway construction, but also for lumbering, farming and other purposes.

These documents, together with the interesting reports of Mr. Murray, already laid before the Government, render it unnecessary for me to dwell on the subjects alluded to.

The engineers in charge have prepared very full tables of distances, grades, quantities and estimates in connection with the work, on each respective section. From these summaries have been compiled for the whole line from St. John's to St. George's Bay, which I herewith submit.

The estimates of quantities and cost must of course be taken as only approximate, as the data obtained from a preliminary exploration, although of great value, is not sufficient to base exact calculations on.

This much may, however, be confidently stated: the survey has established that there are no serious obstacles in the way; and that a Railway may be constructed from one side of Newfoundland to the other at a moderate cost.

The prosecution of the survey was, as you are aware, attended with difficulties of various kinds. These, however, were overcome by the perseverance and exertions of those concerned.

I feel confident that the greatest economy, consistent with the vigorous prosecution of the work in hand, has been exercised by those under my directions, both in the field and in the completion of the office work, and I believe the people of Newfoundland will have no reason to regret an expenditure which has so largely added to the knowledge of the country they inhabit, and which, as a forerunner of a great public undertaking, is, I trust, the harbinger of an era of progress.

The general advantages which would result from the opening of Railway communication across Newfoundland, in connection with transatlantic traffic are generally understood; and my own views with respect to them are so well known, that it is unnecessary for me to repeat them. The local

advantages which the construction of Railways confers, would be especially felt in Newfoundland.

I am justified in commending the gentlemen whom I selected to carry out the survey. They were each previously well known to me, and I felt well assured that they would allow nothing to prevent them carrying out the important service in as satisfactory a manner as possible. In this I have not been disappointed.

It is only due to Mr. Alexander Murray that I should express my high appreciation of his services in connection with the survey, but for his knowledge of the country and his advice with regard to the best means of reaching the interior with men and supplies, it would have been impossible to have done so much, so satisfactorily, and within so short a time. I feel under personal obligation to Mr. Murray for his able assistance in directing the work of survey during the absence of Mr. Light and myself from Newfoundland.

I regret that circumstances prevented me from visiting the island last season. I trust, however, to be able to do so at some future period.

I have the honor to be, Sir,

Your obedient servant,

SANDFORD FLEMING.

NEWFOUNDLAND RAILWAY.

EXPLORATORY SURVEY, 1875.

The accompanying reports are as follows:—

REPORT OF SURVEY, DIVISION A.

- (1.) Western Interior.
- (2.) Central Avalon.

REPORT OF SURVEY, DIVISION B.

- (1.) Central Interior.
- (2.) West Avalon.

REPORT OF SURVEY, DIVISION C.

- (1.) Eastern Interior.
- (2.) East Avalon.

NEWFOUNDLAND RAILWAY.

EXPLORATORY SURVEY, 1875.

List of plans and profiles furnished :—

1. General Plan, with report
2. General Section.
3. (No. 1) East Avalon Plan.
4. { " East Avalon Section on traverse line.
- { " East Avalon profile of approximate location.
5. (No. 2) Central Avalon Plan.
6. " Central Avalon Section on traverse line.
7. " Central Avalon profile of approximate location.
8. (No. 3) West Avalon Plan.
9. " West Avalon Section on traverse line.
10. " West Avalon profile of approximate location.
11. (No. 4) East Interior Plan.
12. " East Interior Section on traverse line.
13. " East Interior profile of approximate location.
14. (No. 5) Central Interior Plan.
15. " Central Interior Section on traverse line.
16. " Central Interior profile of approximate location.
17. (No. 6) West Interior Plan.
18. " West Interior Section on traverse line.
19. " West Interior profile of approximate location.

No.

NEWFOUNDLAND RAILWAY.

GENERAL TABLES.

- No. 1. Statement of distances.
2. Statement of grades.
3. Average earth and rock quantities per mile.
4. Statement of masonry structures.
5. Statement of timber structures.
6. Approximate total quantities with masonry.
7. Approximate total quantities with timber.
8. Estimates for one average mile, masonry and timber.
9. Total estimates, with masonry and timber.
10. Total quantities and estimates.
11. } List of principal bridges.
12. }
13. Table of bridge openings.

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGES BAY.

STATEMENT OF DISTANCES.

Number of District.	Name of District.	By Traverse.	By approximate loca- tion.	By air lines.	By air line.
		Miles.	Miles.	Miles.	Miles.
1	East Avalon.....	50·39	50·83	33·73	St. John's to St. George's Bay.
2	Central Avalon...	41·02	37·75	28·09	
3	West Avalon.....	21·00	20·60	18·03	
4	East Interior.....	85·22	80·68	68·75	
△	Incomplete.....	.....	16·00	15·00	
5	Central Interior..	85·53	87·31	72·48	
6	West Interior....	67·89	67·30	59·26	
	Totals.....	367·05	360·52	295·	275·
				Miles.	Per cent.
Approximate location longer than air line				85·52	31·09
Approximate locat. shorter than traverse..				6·53	1·78
“ Length of tangents				229·48	63·68
“ Length of curves...				131·04	36·35

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF GRADES.

Number of District.	Name of District.	Level.	0.50 per 100 and under.	Over 0.50 per 100 and under 1.00 per 100.	1.00 per 100.	1.20 per 100.	1.30 to 1.60 per 100.
		Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	East Avalon.....	17.38	5.78	2.09	10.24	10.84	4.51
2	Central Avalon...	2.65	6.00	13.09	5.85	4.22	5.94
3	West Avalon.....	4.15	1.52	2.38	0.89	11.66	
4	East Interior.....	30.28	11.14	5.45	11.38	22.43	
Δ	Incomplete.....	5.50	2.50	1.00	2.50	4.50	
5	Central Interior..	20.48	10.05	17.32	13.10	26.36	
6	West Interior....	6.77	34.76	.....	24.88	0.95	
Totals.....		87.21	71.75	41.33	68.84	80.96	10.05

PER CENTAGE OF EACH GRADE TO WHOLE LINE.

Per cent.....	24.	20.	11.	19.	23.	3.
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NEWFOUNDLAND RAILWAY,

ST. JOHN'S TO ST. GEORGE'S BAY.

AVERAGE EARTH AND ROCK QUANTITIES PER MILE.

Number of District.	Name of District.	Earth.	Rock.	Number of miles.	Per cent. of whole.
		C. yds.	C. yds.		
1	East Avalon.....	24,098	10,804	50·83	14
2	Central Avalon...	34,000	4,000	37·75	11
3	West Avalon	34,660	14,213	20·00	6
4	East Interior.....	13,860	6,168	80·68	22
△	Incomplete.....	13,860	6,168	16·00	4
5	Central Interior..	13,250	1,000	87·31	24
6	West Interior....	20,000	5,000	67·30	19
AVERAGE ON } WHOLE LINE }		21,881	5,492	360·00	100

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF MASONRY STRUCTURES.

Number of District.	Name of District.	MASONRY.			Trestlework in Fills. L. feet.	Howe Truss. L. feet.
		1st Class. C. yds.	2nd Class. C. yds.	Paving. C. yds.		
1	East Avalon.....	1,800	15,000	350	620	160
2	Central Avalon...	3,900	6,400	1,800	.....	100
3	West Avalon.....	3,000	4,500	200	.....	40
4	East Interior.....	7,422	18,718	726	.....	640
5	Incomplete.....	1,380	3,480	135	.....	400
6	Central Interior..	10,400	13,200	704	.....	790
6	West Interior....	8,100	18,900	1,350	.....	980
	Totals.....	36,002	80,198	5,265	620	3,110

NEWFOUNDLAND RAILWAY.
ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF TIMBER STRUCTURES.

No. of District.	Name of District.	QUANTITIES.							
		Cribwork and stone filling.	Timber.	Wrought Iron.	Cast Iron.	Softwood plank.	Hardwood plank.	Howe truss.	
		C. yds.	L. feet.	Lbs.	Lbs.	B. M.	B. M.	L. feet.	
1	East Avalon.....	1,850	282,200	23,790	3,070	41,370	6,450	160	
2	Central Avalon.....	5,000	132,000	14,200	2,250	29,000	6,000	100	
3	West Avalon.....	1,000	161,840	12,750	1,950	20,000	3,000	40	
4	East Interior.....	8,502	357,400	44,374	7,261	55,000	10,000	640	
5	Incomplete.....	1,500	63,000	8,250	1,350	15,000	1,875	400	
6	Central Interior.....	8,800	190,880	22,550	3,450	44,000	4,400	790	
6*	West Interior.....	5,000	136,840	20,650	3,100	50,000	8,000	980	
	Totals.....	30,740	1,324,160	147,240	22,750	254,370	39,725	3,110	

*NOTE.—No. 6 retains a considerable quantity of masonry in the larger bridges.

Totals.....	30,740	1,524,160	141,240	25,500
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* NOTE.—No. 6 retains a considerable quantity of masonry in the larger bridges.

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

APPROXIMATE QUANTITIES WITH MASONRY STRUCTURES.

No. of District.	Name of District.	Clearing.	Close Cutting.	Grubbing.	Fencing.	Earth Excavation.	Rock Excavation.	Under Drains.	1st Class Masonry.	2nd Class Masonry.	Paving.	Riprap.	Howe Truss.	Timber.	Road crossings and divisions.	Wrought Iron.	Cast Iron.
		Acres.	Acres.	Acres.	L. feet.	C. yds.	C. yds.	C. yds.	C. yds.	C. yds.	C. yds.	C. yds.	L. feet.	L. feet.	\$	Lbs.	Lbs.
1	East Avalon...	660	51	101	25,415	1,225,000	549,167	50,830	1,900	15,000	350	1,525	160	17,790	1500	2010	356
2	Central Avalon	300	38	56	.....	1,434,400	151,000	56,600	3,900	6,400	1,800	1,200	100	.....	5	.....	.....
3	West Avalon...	269	1	2	217,516	714,000	202,788	20,600	3,402	4,500	200	412	40	608	412	.....	.....
4	East Interior...	1049	81	202	8,068	1,118,225	497,634	121,020	7,422	18,718	736	2,420	640	3,227	2259	.....	.....
5	Incomplete.....	195	15	37	1,500	207,900	64,704	22,500	1,380	3,480	135	450	400	600	420	.....	.....
6	Central Interior	1148	265	88	.....	1,170,000	88,000	44,000	10,400	13,200	706	6,160	790	2,000	.....	.....	.....
	West Interior...	942	67	168	113,000	2,019,000	336,500	101,000	8,100	18,850	1,550	2,350	980	.....	.....	.....	.....
	TOTALS.....	4562	518	654	365,499	7,868,525	1,979,853	416,550	30,002	80,198	5265	14,517	3110	24,225	4596	2010	356

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

APPROXIMATE QUANTITIES WITH TIMBER STRUCTURES.

No. of District.	Name of District.	Clearing.	Close Cutting.	Grubbing.	Fencing.	Earth Excavation.	Rock Excavation.	Under Drains.	Riprap.	Timber.	Softwood Plank.	Hardwood Plank.	Wrought Iron.	Cast Iron.	Cribwork.	Howe Truss,	Road crossings and divisions.	Masonry.
		Acres	Acres	Acres	L. feet.	C. yds.	C. yds.	L. feet.	C. yds.	L. feet.	B. M.	B. M.	Lbs.	Lbs.	C. yds.	L. ft.	\$	C. yds.
1	East Avalon....	660	51	101	25,415	1,225,000	549,167	50,830	1,525	282,200	41,370	6,450	23,790	3,670	1,016	160	1500	
2	Central Avalon	300	38	56	.....	1,434,400	151,000	56,600	.....	132,000	29,000	6,000	14,200	2,250	5,000	100	5	
3	West Avalon....																	
4	East Interior...	1049	81	202	8,068	1,118,225	497,634	121,020	2,420	357,400	80,680	10,085	44,374	7,261	8,552	640	2259	
5	Incomplete....	195	15	37	1,500	207,900	64,704	22,500	450	63,000	15,000	1,375	8,250	1,350	1,580	400	420	
6	Central Interior	1148	265	88	.....	1,170,000	88,000	44,000	6,160	190,880	44,000	4,400	22,550	3,450	8,800	790	.....	4,000
	West Interior...	942	67	163	113,000	2,010,000	336,500	101,000	2,350	136,840	50,000	8,000	20,000	3,100	5,000	980	.....	8,400
	TOTALS	4562	518	654	365,499	7,888,525	1,979,853	416,550	14,517	1,324,160	254,376	36,725	147,240	22,750	30,740	3110	4260	12,400

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

ESTIMATE PER MILE.

Number of District.	Name of District.	Extremity of total length.	Cost with Masonry.	Cost with Timber.	Length of Districts.
1	East Avalon.....	14	27,988	25,988	50·83
2	Central Avalon.....	11	25,217	22,804	37·75
3	West Avalon.....	6	42,503	40,406	20·00
4	East Interior.....	22	23,607	20,899	80·68
4	Incomplete.....	4	23,607	20,899	16·00
5	Central Interior.....	24	13,198	10,257	87·31
6	West Interior.....	19	26,862	23,872	67·30
	Mean cost per mile...		23,589	20,937	360·

By use of timber the reduction is \$2,652 per mile, or 11·24 per cent. of the whole cost.

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

TOTAL ESTIMATE.

Number of District.	Name of District.	Cost with Masonry.	Cost with Timber.	Per centage. Length of district to total length.
1	East Avalon.....	1,422,223	1,321,070	14
2	Central Avalon.....	951,942	860,850	11
3	West Avalon.....	874,562	832,363	6
4	East Central Interior.,	1,904,612	1,686,121	22
△	Incomplete.....	377,712	334,384	4
5	Central Interior.....	1,165,515	905,805	24
6	West Interior	1,807,812	1,607,632	19
	Total	8,504,378	7,548,226	100

The use of timber would on the entire line cause a reduction of \$956,152, or 11.24 per cent.

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

TOTAL QUANTITIES AND ESTIMATES.

Description.	Price.	Masonry.	Timber.
Clearing, acres.....	4,562	4,562
Close cutting, acres.....	518	518
Grubbing, acres.....	654	654
Fencing, lin. feet.....	365,499	365,499
Earth excavation, c. yards..	7,888,525	7,888,525
Rock excavation, c. yards...	1,979,853	1,979,853
Under drains, lin. feet	416,550	416,550
1st class masonry, c. yards..	36,002	
2nd class masonry, c. yards	80,198	
Paving, c. yards.....	5,265	
Riprap, c. yards.....	14,517	14,517
Timber, lin. feet.....	24,225	1,324,160
Wrought iron, lbs.....	147,240
Cast iron, lbs.....	22,750
Softwood plank.....	254,370
Hardwood plank.....	39,725
Cribwork.....	30,740
Howe truss, lin. feet.....	3,110	
Road crossings and divisions		
Totals.....			

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF BRIDGES OVER 45 FEET SPAN.

Number.	Party.	Name of Stream.	Number of Spans.	Span in Feet.
EAST AVALON.				
1	C.	Manuel's River.....	1	80
CENTRAL AVALON.				
2	A.	Hodge Waters.....	1	50
3	"	Dildo River.....	1	50
EAST INTERIOR.				
4	C.	Come-by-Chance River.....	1	50
5	"	Clode Sound River.....	1	60
6	"	Rich Pond Narrows.....	1	60
7	"	Terra Nova River, south branch...	2	100
8	"	Terra Nova River, north branch...	1	100
9	"	Gander River.....	4	100

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF BRIDGES—(Continued.)

Number.	Party.	Name of Stream.	Number of Spans.	Span in feet.
CENTRAL INTERIOR.				
10	B.	Noel Paul's brook, S. Branch.....	1	60
11	"	Helen's Pond brook.....	1	60
12	"	Morrison River.....	1	60
13	"	No Name brook	1	50
14	"	Noel Paul's brook	1	80
15	"	Victoria River.....	1	200
16	"	Cook's brook	1	200
WESTERN INTERIOR.				
17	A.	Red Indian River.....	1	180
18	"	Otter brook.....	1	50
19	"	Bottle brook.....	1	60
20	"	Paddle Lake Narrows.....	1	60
21	"	Cache brook.....	1	60
22	"	St. George's river.....	1	180
23	"	St. George's river, S. Branch.....	1	60
24	"	Barachois river.....	1	160

NEWFOUNDLAND RAILWAY.

ST. JOHN'S TO ST. GEORGE'S BAY.

STATEMENT OF SPANS OF BRIDGES.

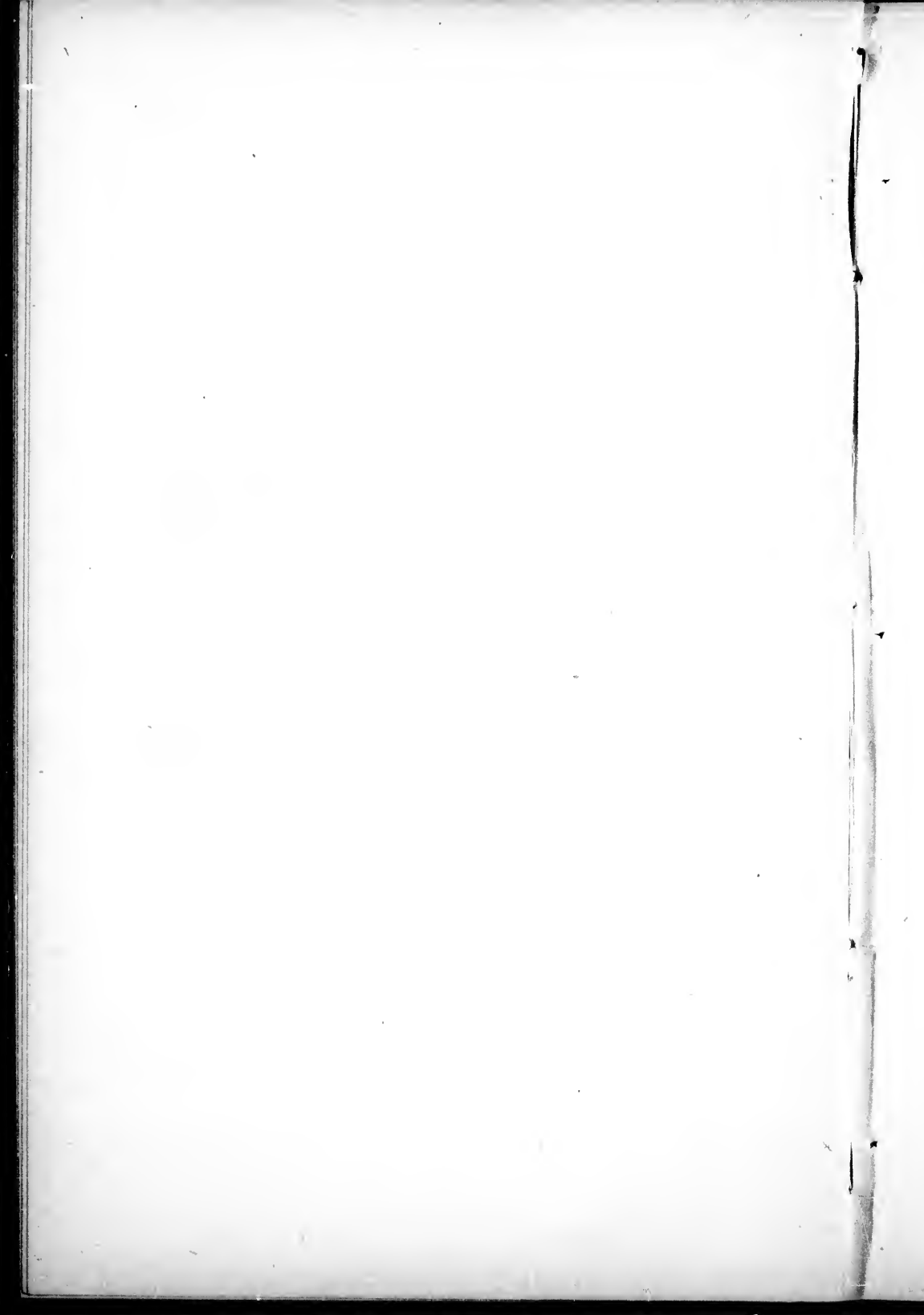
16	Spans with an opening of	20 feet
10	“	30
5	“	40
5	“	50
9	“	60
2	“	80
7	“	100
1	“	160
2	“	180
2	“	200
59	Total number of Spans	

NEWFOUNDLAND RAILWAY SURVEY.

PRELIMINARY REPORT OF PARTY C.

Interior and Avalon Districts.

JUNE TO DECEMBER, 1875.



NEWFOUNDLAND RAILWAY SURVEY.

St. JOHN's, December 20th, 1875.

SANDFORD FLEMING, Esq.

SIR,—I beg to lay before you the following detailed report of the summer's work of Party C, on the Newfoundland Railway Survey.

INSTRUCTIONS.

By instructions received from A. L. Light, Esq., the work allotted to Party C was as follows:—To start from the centre of the Isthmus between Trinity and Placentia Bays, find the best practicable route through the North Harbor, Black River and Clode Sound hills, and across the interior to a point on the Gander River, where a junction was to be effected with Party B. Finally, to bring the party back by the best route that might suggest itself, making such further explorations north or south of the line run as might be possible. I was also furnished with a copy of the report of the late Mr. Bellairs, and Mr. Murray's notes on the country traversed by his proposed route.

Through the most difficult portion of the country a good line has been obtained; but I regret to say that shortness of

provisions obliged me to stay at, and leave unfinished about fifteen miles of country to the east of the Gander River. The unfortunate concurrence of events all tending to bring about this result, viz., insubordination of the men, sickness, and finally the failing to reach me of fresh supplies I sent for, all of which matters I treated at large in my summary reports to A. L. Light, Esq., of September 28th and previously, have no doubt been laid before you, and I shall not now further allude to.

START.

The necessary provisions and camp equipment being procured, and all preparations completed, I left St. John's on the 7th of June with my men, twenty-seven in all, in schooner *Voyager*, for Bay of Bulls Arm, Trinity Bay, calling at Heart's Content to pick up my staff, who had preceded me that far by another route. At the former place we arrived and disembarked at mid-day on the 10th of June, having been becalmed, and had to man the boats and tow the schooner no inconsiderable portion of the way. Here tents were at once pitched on the beach, and all hands employed in arranging loads and making preparations for packing. Whilst exploring, and gaining a knowledge of the general geographical features of the country in the neighborhood, a traverse and levels were run on the old telegraph line, between the head of Bay of Bulls Arm, Trinity Bay, and the mouth of the Come-by-Chance river, Placentia Bay, thus connecting the surveyed line with well defined points on Mr. Murray's map of Newfoundland on both bays. The datum of levels through this section of the survey is H.W.M., Trinity Bay, and the height of land on the Isthmus is two hundred and fifty feet, being considerably higher than anticipated.

COME-BY-CHANCE.

By my instructions, a certain elevation being necessary at the starting point to meet the requirements of the section running south-east, I chose a point at an elevation of one hundred and sixteen feet as suitable to both. Had no such requirements been necessary to the south-east, I should have preferred starting at but little above the elevation of the Come-by-Chance River, as giving an easier section and improved grades.

The Come-by-Chance River averages about fifty feet in width, has but little water in the dry season, but rises considerably during spring freshets. About nine miles above its mouth it flows out of a lake of the same name, from three hundred to six hundred feet wide and about a mile long. The valley is narrow and the hills rise abruptly on both sides, though there is generally sufficient flat land on the bank of the stream for construction purposes.

Having to start the surveyed line at a comparatively high level, I followed, where possible, the watershed of Trinity and Placentia Bays, in order to avoid the steep slopes of the hills, till obliged to descend and cross the river at the narrows and rapids below the lake. This crossing offers a favorable bridge site with rock foundations, and would require a span of not over fifty feet. Rising gently, the line then skirts Lake Come-by-Chance till, rounding off to the westward at the foot of the northern slope of the Powder Horn Hills, the watershed of the Come-by-Chance and North Harbor rivers is reached at station five hundred, and reduced level two hundred and thirty feet.

POWDER HORN HILLS.

The Powder Horn Hills are an isolated chain, consisting of three peaks, and attain an elevation of nearly one thousand feet. Their slopes are in many parts well wooded with birch, spruce and larch. From their summits a fine view of the surrounding country is obtained, wild and picturesque in the extreme, rugged and hummocky, abounding in rocky peaks, lakes, woods and marshes; but especially rough that portion to the west lying between the Powder Horns and the North Harbor and Black River hills.

MR. BELLAIR'S LINE.

So far the line recommended by the late Mr. Bellairs was followed; beyond, after a more detailed examination of the ground than had been possible to him, I found a considerable lengthening of the line through a difficult and very broken country would attend a passage through the hill ranges by any of the more southern passes.

The double descent to the North Harbor and Black Rivers, with the ascent to pass over the hills of the same names, would necessarily imply increased length to obtain suitable grades, much in excess of the northern route, where the Black River and Piper's Hole hills, both complex in their structure to the south, are merged in one, and their passage effected with a minimum of both grades and section,

NORTH HARBOR HILLS.

The passage of the North Harbor range presents the greatest engineering difficulties of any portion of the line surveyed by Party C, and the elevation attained in doing so is seven hundred and thirty-five feet, and in excess of the summit

levels by the Southern passes. The watershed of North Harbor and Random Sound being however gained by an easy ascent, the rise is relatively less than would be required to attain the summit of the southern passes from the much lower level of the North Harbor river. For these reasons I continued a northerly course, ascending the North Harbor Valley till the watershed of Random Sound was reached at station seven hundred and forty and reduced level four hundred and thirty, and not more than four miles from the head of the south-west arm, Trinity Bay. Here commences the ascent proper of the North Harbor hills, the summit being reached by my first line, with grades chiefly of one per hundred and an easy section, at station one thousand and fifty and reduced level seven hundred and ninety-five. At the summit a heavy cutting is necessary and the descending grades exceed one per one hundred in places, shewing at the same time heavy work, unfavorable for both construction and working, being on side-hill ground, much exposed to snow drifts as well as to the predominating winter winds. Being dissatisfied with this portion, and having more fully explored a lower pass to the north, which I had at first considered impracticable to reach, I took up the line again from the summit of this latter pass, at a reduced level of seven hundred and thirty-five feet, and ran back with grades of one-twenty per hundred to station eight hundred and ninety-four, shortening the distance to a common point by about four miles and passing by a less exposed route. The angle made at its junction by the alternative with the first line being too small to allow of proper curvature, some distance would be lost in locating, but by employing grades of one-twenty per hundred from near the Random watershed, this pass can be reached without difficulty and a great saving in length effected.

A third line with grades not exceeding one per hundred could perhaps be found by mounting and crossing the Random watershed at station 740, till a sloping plateau of barrens is reached, crossed diagonally, and line No. 2 joined about one mile from the top of the pass. At least two sharp curves would be required on this line, which I did not deem it advisable to delay and make an instrumental survey of; my provisions at the time being well ahead.

DESCRIPTION OF COUNTRY.

The country so far passed through presented generally but little attraction for agriculture or lumbering. In the valley of the Come-by-Chance river and on the slopes before mentioned of the Powder Horn hills, are some fair tracts of land and some good timber, though not of very large size. The general features are marshes and rocky knolls, thickly grown over with dwarf spruce, knotted, gnarled and trailing, throwing their roots into the interstices of the rocks and around the multitude of granite boulders with which the surface is nearly everywhere covered. Of soil there is little or none except in the river bottoms, even the peat rising for the most part on the solid rock without any intermediate formation. The bed rocks are granite, gneiss, trap, basalt, and a small quantity of slate, the latter chiefly in a belt four miles wide in the Come-by-Chance River.

BLACK RIVER VALLEY AND CLODE SOUND HILLS.

Descending from the North Harbor Hills with easy grades, the Black River Lake is reached and rounded to the north station one thousand two hundred and eighty and reduced level five hundred and ninety-three: then passing between this lake and the Upper Black River or Tit Lake, and skirting the latter to the south, the summit of the

Clode Sound Hills is reached with easy grades at station one thousand four hundred and one and reduced level six hundred thirty-eight feet. The descent to the south-west branch of the Clode Sound River is then made in two-and-a-half miles with a grade of one per hundred, on the side of a spur of the main hills, and through somewhat heavy woods of spruce, larch and birch. Both north and south of this summit pass and north of Black River Lake, the country is especially rugged and precipitous; the peaks to the north rise to a height of twelve hundred feet and form a divide between the waters of Random Sound, Trinity Bay, Clode Sound, Bonavista Bay, and Black River, Placentia Bay. To the south the peaks rise about one thousand feet, and at but a short distance the hills divide and spread themselves out into the North Harbor and Black River ranges. The length of line run to this point is twenty-seven miles by the shorter line, though measuring but eighteen miles on an air line, thus giving an increased length of one-third in rounding and passing over the several ranges of hills.

WOODLAND.

The nature of the woods from the summit of the North Harbor Hills to Black River Pond is the same as that previously described; after passing the lake the quality improves, the larch and birch being of larger size and better growth.

CLODE SOUND RIVER.

On reaching the foot of the Western Hill slope, the general character of the country alters, the hills through which the line had hitherto passed changing to the more uniform rolling marshes and rocky barrens of the interior.

From station one thousand five hundred and eight the crossing of the south-west arm of the Clode Sound River to

station one thousand eight hundred, the crossing of the north-west arm of the same river, is the most level portion of country traversed, presenting a gradual incline, with a fall of but forty feet in six miles, where a reduced level of four hundred and forty-five feet is reached, being chiefly over barrens and marshes, with many small ponds and patches of woods. Bridges of forty and sixty feet spans respectively will be required for the above crossings. The river is a succession of rapids and steadies, these latter often throwing out long back-water arms, extending half a mile to a mile into the marshes, and causing a deviation of the line to avoid them, their bottoms being muddy and soft, and in places of considerable depth.

SCARCITY OF PROVISIONS.

When the work had progressed thus far (the 2nd August); our provisions were much reduced, and I calculated would not suffice beyond the 24th of August. To have put the party on rations would, I felt sure, after the manifestations I had already had, have been equivalent to giving the signal for a retrograde movement. Previously I had, beginning with myself and staff, reduced camp equipage and clothing to a minimum, and nothing remained but to push forward with all possible speed, whilst I despatched an Indian to the nearest Post Office and Telegraph station to forward a request to the Government for additional supplies, stating the quantity required, and how they might be forwarded. Under these circumstances, I decided from here forward to run as straight a line as possible, whilst avoiding the many large lakes; crossing the several ridges by the most expeditious routes, going round the larger patches of woods where the chopping would have delayed, and making at the same time such notes as would enable me to modify the actual profile run, and

bring it within the conditions of maximum grades indicated by my instructions.

BEAR RIDGE.

On passing station one thousand eight hundred, the Bear Ridge is encountered, its summit being reached at station two thousand and thirteen, and reduced level seven hundred and fifty-four. This ridge consists of moss barrens and spruce scrub, and forms the divide between the waters of Clode Sound and Pipers Hole rivers. A line with good grades may be obtained by keeping to the south, leaving the surveyed line about station one thousand eight hundred and sixty, and rejoining again about station two thousand two hundred and seventy. Beyond this to station three thousand five hundred, an easy section with light grades was obtained; the only noteworthy features of the country passed over being the many large and innumerable small ponds met with. A fair growth of timber generally exists round the larger sheets of water, especially on their northern shores, and some isolated groves contain fair sized birch. The first of these large ponds, called

RICH POND,

is reached and crossed at Narrows, at station two thousand two hundred and twenty-one, and reduced level six hundred and forty-four; these narrows are but sixty feet wide and six feet deep in the centre, with rock bottom, and offer an excellent bridge site. North and south of the narrows the point extends in a noble stretch of water for five miles or more; the bottom appears to be slate rock, and there are several rocky islets covered with a small growth of timber.

PARTRIDGEBERRY HILLS.

At station two thousand six hundred and sixty the summit of the Partridgeberry Hills is attained at an elevation of seven hundred and sixty-seven feet. These hills also form a divide between the waters of Clode Sound and Piper's Hole rivers; they are composed of granitic rock, and much broken up by lateral ravines. Patches of woods and scrub brush, interspersed with moss barrens, fill the ravines and cover the slopes. To the north of the line these hills rise to a height of one thousand and fifty feet, the summits being of bare rock covered with loose stones and many large-sized boulders, the latter piled in the most fantastic forms. Descending these hills a still more wild and rocky country is entered, thickly covered with wooded hummocks, huge boulders and lakes of all sizes and shapes, many throwing out arms both long and tortuous. These lakes, not usually of great depth, are too deep to ford and occupied much time in packing round, there being no wood in their vicinity suitable for rafts. Passing many ponds of considerable size, but nameless, the Clode Sound Brook ponds are reached at station three thousand and forty and reduced level six hundred and fifty; they consist of a string of irregularly-shaped ponds, varying from a mile to a mile and a half in length, connected by shallow necks or narrows, over which in the dry season little or no water passes; the ponds then acting as natural reservoirs, and only assuming their functions as tributary streams after heavy rains or freshets.

ROCKY POND.

At station three thousand one hundred and sixty-seven and reduced level six hundred and sixty-two, "Rocky Pond,"

a fine expanse of water some four miles long, is reached. It well merits its name, both by its rugged shores and islands of rock; from the character of the surrounding country it is probably in some parts deep. Continuing through a similar country the north west arm of Clode Sound Brook is reached at station three thousand three hundred and sixty-four and reduced level seven hundred and five, but being so near its source it is of little importance and would require but a small-sized structure.

LAKE MEHLPEGH.

For the next four miles the line skirts the shores of Lake Mehlpegh: a lake, wide-spread, crooked and complicated in its shore line, filled with many islands, and resembling from the adjacent heights rather a cluster of lakes than one expanse of water. The area covered by its numerous arms and isles cannot be less than fifty square miles, perhaps much more. Its shores are rocky and thickly covered with small woods, chiefly dwarf spruce. It empties its waters on the one hand through the Terranova river into Bonavista Bay, on the north east coast, and into Long Harbor, Fortune Bay, on the south,

TERRANOVA RIVER.

At station three thousand seven hundred and sixty, reduced level six hundred and fifty-nine, the south branch of the Terranova river is crossed not far from its outflow from Lake Mehlpegh. This portion of the river is a series of rapids and steadies, and though low, at the time crossed by the survey, still passed a large volume of water, whilst its banks shew signs of a heavy flow of ice and water in spring freshets. A bridge of two spans of one hundred feet each will be required here. About a half a mile below the line crossing, the river runs into a lake about four miles long, and from six

hundred to eight hundred feet wide; this lake is nearly divided about its centre by a narrow rock, through which I propose the modified line to pass.

Immediately on leaving the river the ground rises rapidly, nearly one hundred feet in twenty-two stations, up a rocky and well wooded slope; it then falls gently to

PORTAGE LAKE

at station three thousand eight hundred and reduced level seven hundred and thirty-five. This lake is about one mile in length and breadth, with several wooded islands; on both its north and south shores the slopes of the hills are heavily timbered with birch, spruce and larch. The Indians reach this lake with canoes from the south coast, by way of Salmon River, Fortune Bay, passing through a series of large lakes encircling Mount Sylvester; they sometimes portage across and descend the Terranova river to Bloody Bay, Bonavista Bay, on the east coast.

RIDGES.

Leaving Portage Lake, another rapid rise occurs on to a second Bear ridge at station three thousand eight hundred and seventy, and reduced level eight hundred and sixty. Crossing this ridge, many parts of which rise over one thousand feet, groves of well grown birch are met with, as also a smaller quantity of spruce and larch, the chief portion of the ground is, however, covered by soft moss barrens, some of considerable depth. Running transversely over this ridge the line descends rapidly to the westward, reaching station four thousand, with a reduced level of seven hundred and sixty-seven. Easier grades and an improved line can be obtained by leaving the surveyed line at station three thousand seven hundred and forty, running through the neck before

mentioned, and passing by a chain of lakes about a mile to the north, rejoining about station four thousand. At station four thousand and fifty, and reduced level eight hundred and twenty-one, another smaller ridge is passed, followed by a rapid descent to station four thousand and eighty, and reduced level seven hundred and thirty. Here again a departure to the north will give a better line. After half a mile of a somewhat level country the ground again rises, attaining an elevation of eight hundred and fifteen feet, at station four thousand one hundred and seventy, but falling again to seven hundred and forty-five at station four thousand two hundred. This is succeeded by a rise to eight hundred and twenty-six feet at station four thousand two hundred and thirty-five, the ground then falling to the north branch of the

TERRANOVA RIVER

at station four thousand three hundred and five, and reduced level six hundred and seventy-two. The river where here crossed would require a bridge of one hundred feet span, but on the modified line, which should leave the line surveyed about station four thousand one hundred, keeping to the south and skirting the shore of a large lake, this river would be crossed about two and a half miles to the south, where a span of sixty feet would be sufficient. The river valley contains a narrow belt of timber and some small interval lands of good quality.

MIDDLE RIDGE

commences to rise from the banks of the Terranova river and attains at station four thousand five hundred, the furthest distance and highest point reached, an elevation of nine hundred and ninety-four feet; whilst a mile to the south the ridge rises to eleven hundred feet. In ascending on the modified route;

the line will mount diagonally in a north-westerly direction after crossing the Terranova river, and, following one of the lateral ravines, cross the surveyed line and pass over the ridge a little north of station four thousand five hundred, at an elevation of nine hundred and sixty feet; this appearing the most favorable place for crossing.

The character of the country traversed continued to the top of Middle Ridge to be the same as previously, though looking forward towards the Gander river, at an estimated distance of fifteen miles, the country presents an improved aspect, being more uniformly and more heavily wooded than any passed through on the survey. The lakes also appeared fewer in number, but those visible were mostly of large dimensions.

The Middle Ridge, I learnt from the Indians, extends across the island from near Salmon River, Hermitage Bay, to Freshwater Bay, Bonavista Bay, where it rises in the forks of the Gambo river.

DISTANCES.

The distance by the line to the terminal point on Middle ridge is eighty-five miles, but measuring only sixty-nine miles on an air line.

MIDDLE RIDGE TO GANDER RIVER.

Though not surveyed, I must say a few words descriptive of the country lying between Middle Ridge and the Gander River, the result of observation coupled with information afforded by the Indians. Had the line been continued to the Gander river, on descending the Middle Ridge about one hundred feet, a valley would be crossed to the south of a large lake flowing to the northwest into the Gander River. Next succeed the two Wigwam ridges with their intermediate valley, containing the great Gull Pond and valley of the same name.

The second of these Wigwam ridges is joined at its northern extremity to the Berry Hills (or Droque Hills), thus forming a fork from which flows a stream to the south-west, also falling into the Gander River. From the top of the Berry Hills the ground is said to fall all the way to the Gander, a distance of six miles. The line, if continued would have passed to the south of the Wigwam ridges, and, following the stream to the south-west already alluded to, have thus reached the Gander River.

Considering the relative levels of the passage of the Middle Ridge, and that of the Gander River, where established by Party B, together with the apparent nature of the intervening country, it is probable some difficulty might be encountered in reaching the point of junction with Party B with ordinary grades.

RETURN.

On the 6th September provisions being exhausted, except sufficient to take the party to the next depôt, the march homeward commenced. On the 7th I gave charge of the party to my first assistant, with instructions to take it back by the line to the Black River Valley, and then descending that valley to meet me at Black River Telegraph station, picking up provisions at the various depôts, as well as such superfluous instruments and other things as had been left behind, when every available pound was dispensed with to forward our advance. I also instructed him to take soundings of the marshes and such extra topographical notes as might be necessary. These instructions were carried out successfully, the party arriving safely at the appointed rendezvous on the 15th September.

MOUNT SYLVESTER.

Leaving the party on the 7th, I proceeded with one of the Indians to explore a belt of country to the south. My course was first directed to Mount Sylvester, an isolated granite hill, rising about one thousand two hundred and seventy-five feet above sea level and six miles south of Portage Lake. From its summit a fine view of the surrounding country is obtained; on all sides it appears rough and irregular, though the ridges and hummocks are on a smaller scale and more frequent than in the country to the north traced by the survey. The immense extent of country covered by water is displayed from this summit, and I should estimate the entire surface of the eastern interior to be one-third water. The peak of this hill is of bare granite polished and slippery, and but of small area, not being over one hundred and twenty feet long by forty wide at the top.

Camping for the night on the lower slopes of Mount Sylvester, a hill indeed only once before visited by the white man (Cormack in 1825), we next day started for Black River, following a general direction for another isolated hill called the "Tolt," and situated about twenty-five miles from Black River. This course led through a country parallel and about twenty miles south of the surveyed line, and in its general characteristics very similar, but even more sterile, rocky and devoid of timber. About ten miles east of the Tolt, the

BLACK HEAD HILL

is reached, and the coast belt of hills entered. A complete change takes place; hill succeeds hill, whilst rocky crags crown their brows. The scenery is bold and beautiful, the soil and timber much improved, the spruce, larch and pine being

of useful size, though not usually exceeding fifteen inches in diameter.

LAKES.

Throughout this journey the lakes much impeded the rapidity of travelling, it being constantly necessary to make wide detours to avoid them; so much so that on a long day's walk we seldom advanced over six miles straight, and sometimes less. Huge boulders everywhere cumbered the ground, and the rocks appeared to be of a granitic nature throughout.

BLACK RIVER.

On the evening of the 14th September I arrived at Black River station, and at once made arrangements for moving the party to St. John's. A few hours after their arrival, a fishing schooner came from Placentia in response to my telegram. By her we sailed to Great Placentia, and thence reached St. John's by road, arriving there on the 21st September.

RESUME.

In *resumé* of the results of this portion of the survey, I may state:

1st.—The line surveyed from Come-by-Chance to the Clode Sound River passes over ground the best available for location through the hill country, and presents no great difficulty of construction.

2nd.—The line from this point to the Gander River does not recommend itself as suitable for a location, for though a good profile with favorable grades can be obtained, the character of the rock, the deficiency of soil, and the scarcity of timber, offer no facilities of construction or advantages for settlement.

3rd.—From a distant view of the country north, and from

the accounts given by my Indians, it would appear that it is well timbered and the soil good. The general direction of the ridges appear also to lay more favorably, and it would seem probable that by a northerly deviation, after passing the Clode Sound Hills, an advantageous and even a shorter line may be obtained, being less subject to contouring the ridges than on the air line.

SNOWFALL.

Before leaving this portion of my report, I will add a few general remarks relating thereto.

From information received from the Indians, the only source of knowledge regarding the interior country, coupled in some cases by observation, I have reason to believe that the snowfall in the interior is not excessive, probably less than that of Quebec, and some portions of New Brunswick. Strong winds are said to be prevalent in winter, which renders the high ground almost devoid of snow, while all obstacles forming a barrier to the drifting masses speedily become buried. In many instances I found the tops of the trees broken or peeled of their bark by snow, at heights of from eight to thirty feet from the ground. The woods being generally small and in isolated patches, afford but little shelter, and in some cases only serve as the nucleus of a gigantic mound of drift. Several groves were pointed out to me, which give fair camping ground in summer, but in winter are completely filled, and in some cases covered with snow. For these reasons light woods should in all cases be avoided in locating a line in these parts; where it is necessary to pass such woods, advantage might be taken of the numerous lakes, for the most part shallow, and where embankments raised but little above the water line would prevent all possibility of accumulation of drift. By crossing these lakes culverts only of small

size would be required ; the brooks both above and below them are subject to a large increase of volume during freshets, whilst the surface only of the lakes is affected, the flow being imperceptible.

WEATHER.

The weather during the summer was favorable, and I have attached a comparative meteorological statement of observations taken by myself in the interior, and those made in St. John's during the same period. It will appear from this that no great climatic difference exists.

Fogs, after leaving the coast belt of hills, were less frequent and lost much of their intensity. The almost total absence of thunder is remarkable, and said not to be peculiar to the present season. The continued winds served much to moderate the temperature and were an inestimable boon in decreasing the torment of flies.

FIRES.

Fires in the woods were prevalent near the coast this summer. Considering the facility with which the dry moss ignites, we were fortunate, even with all the precautions taken to escape them, especially so as any large conflagration would have imperilled our depots of provisions, and formed a serious difficulty.

DISCONTENT.

Shortly after starting the survey, a spirit of discontent manifested itself amongst the men ; packing, a species of work quite new to them, they disliked, finding the work expected of them much harder than they anticipated. One of the Indians also fostered their fears of the unknown interior, by stories of the dangers and difficulties there existing. To allay as far as possible this feeling, I decided to leave depots

of provisions at suitable distances on our tract, thus insuring a safe retreat.

PACKING.

In the packing forward of provisions for so long a period, without relays, consisted the great difficulty of the survey, and for a considerable period all hands had to be employed packing and the line work stopped two or three days per week. Long before our return the hard and constant work told visibly on the men, and many shewed signs of being unable to endure the fatigue much longer, notwithstanding that loads and distances travelled had been much reduced.

INVALIDS.

Two or three men were constantly on the sick list, and the more serious cases had to be sent out to the nearest coast settlement, entailing not only the loss of their services, but also those of guides to accompany and help them out.

PRIVATIONS.

Privations and hardships unavoidable in such work, but in the present case far less than might have been anticipated, joined with the other feelings alluded to, on more than one occasion seemed on the point of culminating in open mutiny, and a refusal to proceed farther. This was throughout a cause of great anxiety, and only combatted by some firmness and a large amount of patient forbearance.

REORGANIZE.

Immediately on my return to St. John's, I commenced re-organising and making the necessary preparations for continuing the survey, according to instructions, in the district of Avalon, starting from St. John's.

Tents and other equipment, though considerably the worse for a rough summer's campaign, were again brought into use, and every attention paid to economy, only such articles being renewed as were totally unfit for use.

COMMENCE WORK IN AVALON.

On the 29th, after consulting with Alexander Murray, Esq., I recommenced field work, beginning at Riverhead, Saint John's. On account of the lateness of the season and the desire to complete, without fail, the survey through the Avalon district before winter set in, it was not thought desirable to spend time in determining the best terminal location in the immediate neighborhood of St. John's.

TERMINAL LINES.

Three distinct alignments are, I believe, practicable at this terminus, on which grades of one per hundred need not be exceeded. They are,—

1st.—To start from Long Bridge, Riverhead, at high water mark, to follow the north branch of the brook on the north side, till the rise of the stream becomes too rapid, then to cross the brook and run round the point of land between the two branches, following the south branch till the height of land is reached, and a junction made with the present surveyed line.

2nd.—To start from a point on the north side of the brook, sufficiently elevated to enable the height of land to be reached by the most direct line, and with moderate grades. This would be the line proposed by the late Mr. Bellairs.

3rd.—To start from high water mark at or near Galway wharf, on the north side of the harbor, and east end of the town; to run through a low neck of land into the Quidividi valley, thence behind and to the north of the town, and

finally joining the line surveyed at or beyond the height of land.

Leaving these various alignments open for future consideration, I started the present survey from the Long Bridge, Riverhead ; high water mark at that point being the datum for the levels. Following the south-side of the brook, this side being chosen to avoid running through the more valuable property, in dwellings and gardens situate on the north, and also following the south branch above its forks, the

HEIGHT OF LAND

is reached in six and a half miles, at an elevation of five hundred feet. On this the most direct route grades of one-tenth to one-seventieth are required. The country is chiefly farming lands as far as the sixth mile, where the limit of settlement in this direction is reached.

MANUEL'S BROOK.

From the height of land to Manuel's Brook, at station seven hundred and fifty and reduced level five hundred and twenty-five, a good section and grades were obtained, followed by one and a half miles of grades of one-twenty per hundred, but this might be reduced by keeping the line more to the north.

WATERSHEDS.

At station one thousand one hundred and thirty-eight a watershed is crossed at an elevation of seven hundred and sixty-three feet, and shortly after, at station one thousand two hundred and five the watershed of Conception and Witless Bays is reached, at reduced level seven hundred and twenty-five, both grades and profiles being favorable.

At station one thousand three hundred and forty another summit is passed, at a height of eight hundred and sixteen

feet, being the highest point traversed in this section of the country. Here the country assumes a more rugged aspect as the Hawk Hills are approached and rounded, and the watershed of the Holyrood waters reached.

HAWK HILLS.

The Hawk Hills are an isolated range running in a northeasterly direction, about six miles long and one hundred feet high, with peaks running up to one thousand one hundred feet.

The country in this neighborhood is difficult, and several routes appear to be available, the special merits of each of which can only be determined by actual instrumental survey. The route selected on the present survey, being the shortest practicable, descends rapidly on the western slope of the Hawk Hills, chiefly on steep side hill ground, with a grade of sixty feet per mile, and two and a half miles long, it being necessary to make a complete sweep with the line, where a cross range occurs, and thus gain the natural slope of the country.

BIG RIVER.

At station one thousand nine hundred and seventy and reduced level three hundred and seventy, the Big River, Holyrood, is crossed, a descent of three hundred feet being made in about four and a half miles. The level of the river being reached the most difficult portion of the country is passed, the chief obstacles beyond consisting in the numerous and deep ponds, many of large size. The profile, heavy in places, can be reduced by a judicious location, but only at cost to its length.

POST ROAD.

At station two thousand two hundred and twenty and reduced level four hundred and twenty, the Salmonier and Holyrood road is crossed, near the eighth mile post from the latter place. From this crossing to the

JUNCTION

with Party A, at station two thousand six hundred and sixty-six and reduced level four hundred and ninety, the numerous ridges run at nearly right angles to the line, and with the lakes lying between them give a somewhat heavy profile, though favorable for construction, the hauls being in all cases short. On this part the traverse profile shows two tunnels, one of six hundred the other of two thousand feet in length, both of which can be avoided by a detour to the north.

ROCKS.

The character of rock in this section of the country is chiefly slate, but granite crops up in several places. A loamy gravel is plentiful south of Holyrood, and westward to the junction with Party A.

SOIL.

A fair quality of soil exists throughout, except in the vicinity and eastward of Cochrane's Pond, and again near the Witless Bay line, where marshes and rocky hills extend for about eight miles. On Manuel's Brook there is fine interval land, consisting of a rich dark soil and covered with a luxuriant growth of weeds and grasses.

TIMBER.

Good timber grows to the west of Cochrane's Pond for

about ten miles. After passing the Hawk Hills the growth again improves, and is best west of the Salmonier Road. The woods are composed of spruce, larch, white and yellow birch.

PONDS.

The numerous ponds in the majority of cases admit of draining, either partially or totally. No expensive bridge structures would be necessary on this section, one span of sixty feet over Manuel's Brook being the largest. The Big River and Colinette River being crossed near their sources, only smaller structures would be required.

WEATHER.

The months of October and November proved this year most unfavorable for work. Heavy gales of wind and rain continued with but slight intermission till replaced by sleet and snow. Fogs were constant and thick, much interfering with exploring. Fortunately severe frost set in late in November, closing the ponds, and greatly facilitating the work, and enabling soundings to be taken in the different lakes, and a knowledge of their depths and the nature of the bottom gained.

FINISH.

Before a junction with Party A was made, the snow was from eighteen inches to two feet deep, and travelling very laborious. The last stake was driven on the 4th December, when I at once returned to St. John's with the party.

STAFF.

In conclusion, I cannot speak too highly of my assistants, Messrs. Cadman and Mitchell, who at all times exerted themselves to forward the work, and aided me to their utmost to

allay the discontent among the men during the summer, and who carried on their instrumental work in the Avalon district under very disagreeable climatic disadvantages.

ACKNOWLEDGMENTS.

I must also express how much I am indebted to Alexander Murray, Esq., for his kindness and untiring energy in assisting the prosecution of the survey in many ways, and in imparting a knowledge of the geography of the country which he had himself gained in the course of his arduous and laborious explorations.

To John Delaney, Esq., Postmaster General, I am indebted for copies of the excellent meteorological notes which he keeps in St. John's, and copies of which I attach, for the years 1872-3-4 and 5, as they may be useful for reference and comparison.

To all the members of the Government and officers with whom I was brought in official contact, my best thanks are due for their courtesy and assistance.

I remain, Sir,

Your obedient servant,

FRANCIS J. LYNCH,

SANDFORD FLEMING, Esq.,
Chief Engineer,

COMPARATIVE METEOROLOGICAL STATEMENT OF OBSERVATIONS
 MADE BY PARTY C (TRINITY BAY TO GANDER RIVER) OF THE NEWFOUNDLAND RAILWAY SURVEY.
 WITH ST. JOHN'S REGISTER, 1875.

	JUNE.		JULY.		AUGUST.		SEPTEMBER.	
	Railway Survey.	St. John's Register.	Railway Survey.	St. John's Register.	Railway Survey.	St. John's Register.	Railway Survey.	St. John's Register.
Mean temperature	Degrees. 56.	Degrees. 52.6	Degrees. 63.1	Degrees. 56.	Degrees. 62.2	Degrees. 58.6	Degrees. 56.	Degrees. 49.7
Maximum temperature.....	72.	79.	81.	78.5	86.	80.	68.	73.
Minimum temperature.....	43.	23.	46.	39.	44.	38.5	38.	34.
Mean maximum temperature	61.	64.	70.8	65.1	68.9	67.7	61.	59.1
Mean minimum temperature.....	51.4	41.3	55.4	46.9	55.6	49.6	51.	40.3
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Mean barometer	29.79	30.14	29.78	30.00	29.84	30.16	29.69	29.89
Maximum barometer	30.55	30.52	30.19	30.49	30.17	30.36	29.94	30.41
Minimum barometer	29.38	29.77	29.33	29.71	29.46	29.76	29.30	29.50
Maximum daily range.....	0.92	0.41	0.22	0.21	0.30	0.32	0.20	0.39
Prevalent winds.....	S.	.....	S.	.....	N.E. & S.W.	N. & S.	S.W.	S. & W.
Number of days of rain	8	.....	12	.....	10	11	8	8
Number of days of fog	10	.....	10	.....	5	7	1	4
Rainfall .....	.....	2.56	.....	3.05	.....	3.06	.....	3.56

NOTE.—The observations by Party C were only partial in June and September, excluding the first part of the former month, and the last part of the latter.—F. J. L.

METEOROLOGICAL REGISTER.

ST. JOHN'S, NEWFOUNDLAND, 1872.

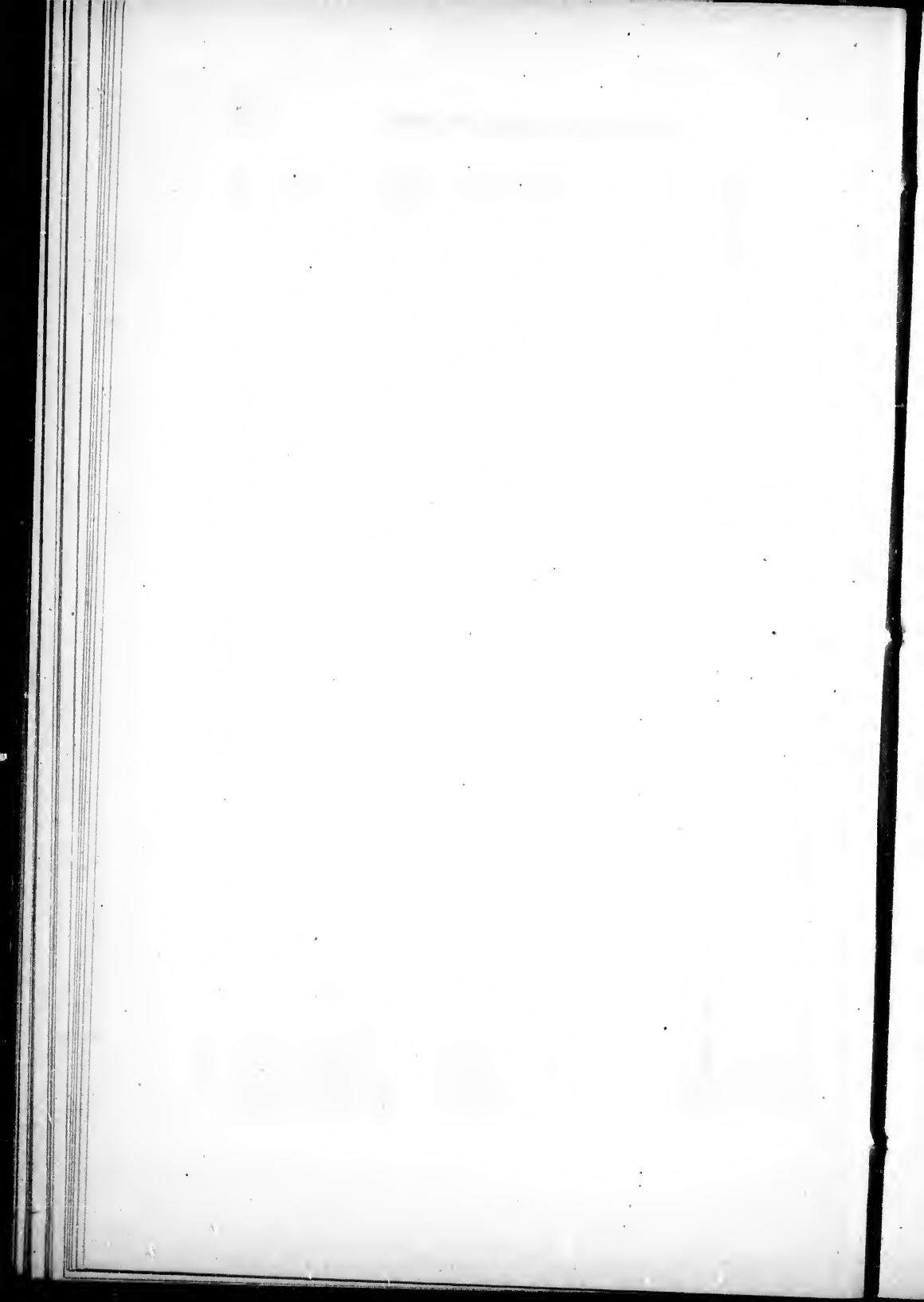
	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
Mean temperature.....	Degrees. 25.4	Degrees. 24.5	Degrees. 28	Degrees. 35.5	Degrees. 46.3	Degrees. 51.8	Degrees. 59.6	Degrees. 58.5	Degrees. 56.3	Degrees. 49.9	Degrees. 37.	Degrees. 34.6
Maximum temperature.....	44.5	38	42	50.5	70	78	79	78.	76	67.	61.	50
Minimum temperature.....	3.5	3	4	22.5	24.5	37	40.5	42.	36	29.5	19.5	10.5
Mean maximum temperature.....	32.2	39.2	32.8	40.7	49.5	59	68.6	66.4	63.7	54.8	42.7	34.6
Mean minimum temperature.....	18.9	18.5	19.5	30.4	34.5	42.8	50.6	50.6	48.8	.....	31.2	22.3
Mean barometer.....	Inches. 29.752	Inches. 29.642	Inches. 29.651	Inches. 29.810	Inches. 30.046	Inches. 30.038	Inches. 29.870	Inches. 30.010	Inches. 30.017	Inches. 30.039	Inches. 29.890	Inches. 29.769
Maximum barometer.....	30.556	30.297	30.288	30.256	30.456	30.552	30.199	30.376	30.388	30.477	30.325	30.240
Minimum barometer.....	28.934	28.840	27.901	28.883	29.630	29.582	29.614	29.472	29.375	29.437	29.382	28.726
Maximum daily range.....	0.690	0.822	1.804	0.483	0.887	0.345	0.300	0.450	0.886	0.485	0.650	1.360
Number of days of snow.....	6	9	18	7	2	.....	.....	.....	.....	.....	.....	.....
Number of days of rain.....	8	3	4	6	11	7	9	5	9	11	9	10
Number of days of fog.....	.....	14	10	14	13	9	6	3	6	13	8	12
Snow in inches.....	7	26.2	70.5	9.5	3	.....	.....	.....	.....	.....	.....	.....
Rain and snow melted.....	4.29	7.72	10.40	587	8.61	505	6.17	4.86	4.24	9.65	4	44.75
Prevailing winds.....	S.&S.W.	S.S.W.	N.N.E.	N.E.&E.	S.&N.W.	E.	S.W.&W.	S.E.&S.W.	V.S.W.	S.A.S.E.	E.A.S.W.	N.W.

7-20	9-65	5-10	7-20
N. V.	E. & S. W.	E. & S. W.	N. V.
4-29	4-24	4-86	4-24
S. & S. W.	S. S. W.	S. & S. E.	S. & S. W.
7-72	10-40	5-87	8-61
S. S. W.	N. N. E.	N. E. & E.	S. & N. W.
10-2	9-9	5-05	5-05
10-40	5-87	S. W. & W. S. E.	S. W. & W. S. E.
7-72	10-40	5-87	8-61
S. S. W.	N. N. E.	N. E. & E.	S. & N. W.

METEOROLOGICAL REGISTER.

ST. JOHN'S, NEWFOUNDLAND, 1873.

	JANUARY.	FEBRUARY,	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
Bain and snow melted.....	4-29	7-72	10-40	9-9	5-87	8-61	5-05	5-05	6-17	4-86	4-24	9-65
Prevailing winds.....	S. & S. W.	S. S. W.	N. N. E.	N. E. & E.	S. & N. W.	S. & N. W.	S. & N. W.	S. & S. E.	S. W. & W. S. E.	S. & S. W.	S. & S. E.	E. & S. W.
Mean temperature.....	23.5	22.7	20.9	34.3	42.1	50.4	60.3	60.3	54.1	43.1	39.3	25.2
Maximum temperature.....	47.5	39.	46.	51.	68.	81.	80.	80.5	74.5	70.	68.	54.
Minimum temperature.....	-1.	-7.	16.	24.	26.	33.	41.	41.	30.	29.4	14.	6.5
Mean maximum.....	30.9	27.5	35.6	38.6	49.3	59.	68.7	68.4	60.6	54.5	44.7	32.4
Mean minimum.....	15.7	17.9	24.3	30.	34.2	41.3	52.	52.3	47.7	41.8	33.9	18.2
Mean barometer.....	29.576	29.779	29.695	29.829	29.882	29.927	29.624	29.736	30.104	30.348	29.815	29.987
Maximum barometer.....	30.555	30.327	30.219	30.833	30.205	30.327	30.325	30.370	30.457	30.712	30.461	30.510
Minimum barometer.....	28.911	29.126	29.027	29.227	29.408	29.101	29.421	29.608	29.657	29.754	29.984	29.187
Maximum daily range.....	0.954	0.533	0.397	0.430	0.308	0.347	0.332	0.210	0.373	0.291	0.733	0.751
Prevailing winds.....	N. W.	N. E.	S. W.	S. E.	N. E. & E.	N. E.	S. & S. W.	S. S. E.	S. & S. W.	S. S. W.	S. & S. E.	W. N. W.
Number of days snow.....	8	15	7	9	3	8	8	7	8	9	5	4
Number of days rain.....	6	5	8	7	6	8	8	8	9	13	10	8
Number of days fog.....	10	12	11	12	13	10	7	8	9	13	10	8
Snow in inches.....	24.07	62.75	16.25	11.50	4.02	2.05	3.70	2.16	2.51	2.02	13	65.25
Ice in and melted snow.....	4.51	8.70	4.60	2.86	2.57	2.05	3.70	2.16	2.51	2.02	8.14	8.75

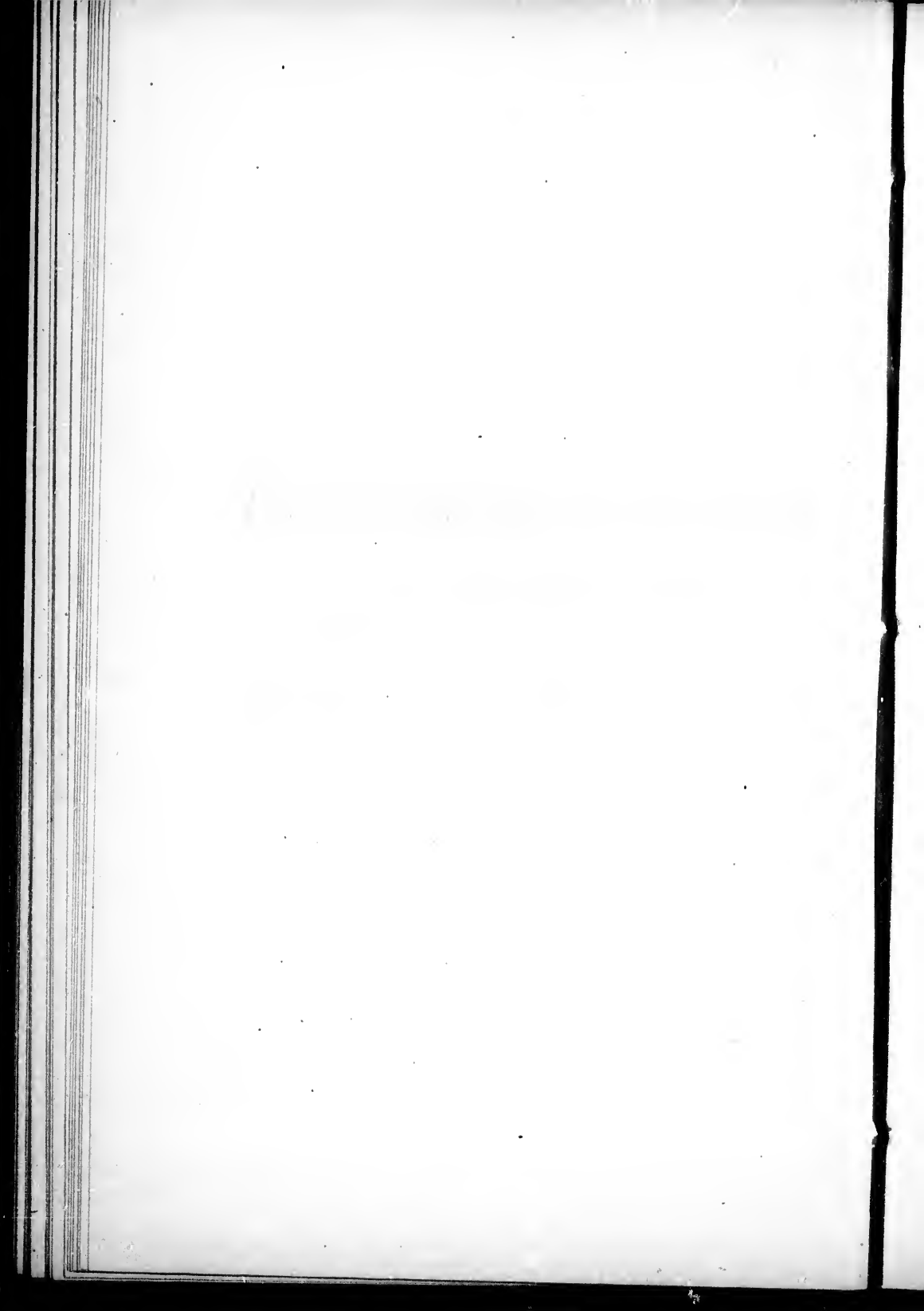


NEWFOUNDLAND RAILWAY SURVEY.

FINAL REPORT OF PARTY C.

Eastern Interior and Eastern Avalon Districts.

ENGINEER-IN-CHARGE—FRANCIS J. LYNCH, CIVIL ENGINEER.



NEWFOUNDLAND RAILWAY SURVEY.

OTTAWA, March 25th, 1876.

SANDFORD FLEMING, Esq.:—

SIR,—The plans and profiles of those portions of the Newfoundland Railway Survey under my charge being now completed, I beg to lay before you my final report, together with the tabulated statements of grades, quantities and estimates attached.

An approximate location has been laid down on the plans, deviating from the original line of the traverse where required for the improvement of the profile, or necessitated by the laying off of the curves. From this approximate location and the traverse, an approximate and modified profile has been plotted, shewing the probable section to be obtained in locating a line, following as near as practicable the survey of the past summer.

The two portions of the survey on which my party were engaged, viz., in the Eastern Interior and East Avalon, being entirely distinct in their geographical situations as also in the general character of the country, I have treated separately throughout.

Taking these portions in the actual order of the survey, I will state in a few words the results arrived at by a careful examination of the plans and calculations regarding quantities.

EASTERN INTERIOR.

This portion of the survey extends from the Bay of Bulls Arm, Trinity Bay, to Middle Ridge in the interior, about fifteen miles east of the Gander River, in latitude North $48^{\circ} 21' 56''$, and longitude West $55^{\circ} 14' 48''$.

DISTANCES.

The distance between these points is on an air line 68.75 miles, but the actual line run is 85.22 miles, or a lengthening of 16.47 miles. The length of the approximate location is 80.68 miles, being a shortening of 4.54 miles on the line surveyed.

The lengthening of the approximate location over the air line, amounting to nearly twelve miles, is principally caused by the deviation to the north and the sinuosities found necessary in crossing the hill country lying between the Come-by-Chance and the Clode Sound Rivers.

GRADES.

In no case has a grade of one-twenty per hundred feet, or 63.36 feet per mile, been exceeded; but it has been found necessary to use it freely, the total length of such grade amounting in the aggregate to nearly twenty-eight per cent. of the whole distance. The longest unbroken grade of this sort is used in mounting the North Harbor Hills, where a continuous length of nearly five miles exists. On the other hand a level grade extends over thirty-eight per cent. of this

division of the work, whilst a further considerable portion of the grades do not exceed twenty-six feet to the mile.

CURVES.

The maximum curve adopted for this division is four degrees or a radius of one thousand four hundred and thirty feet. The nature of the ground, especially on the hills, has required a constant recourse to this curve, and it has also been employed in the avoidance of lakes and other obstructions in the interior. The proportion of straight to curved portions, on the total distance, is nearly as two to one, or sixty-eight per cent. of the whole.

EARTHWORKS.

In arriving at the estimated quantities of earth and rock, a formation width has been taken of seventeen feet for fills and twenty-two feet for cuttings. After taking out the quantities of average miles of section in various parts, I have divided the whole distance into light and heavy work in their due proportions, which I found in this case to be nearly equal. The light work averages sixteen thousand cubic yards to the mile, whilst the heavier is over twenty-four thousand cubic yards, giving a mean in the district of twenty thousand cubic yards per mile in the proportion of two-thirds earth and one-third rock. These quantities will, I believe, be found a fairly correct average of a located line, for should it be thought desirable to raise the grades and reduce the quantity in rock cuttings, yet the fills being largely increased would compensate, and the actual cost per mile would not materially vary.

MASONRY.

The bridging is light, owing chiefly to the fact that for a considerable distance the line follows the height of land. The culverts though numerous in the hill country are mostly of small size. The total number of structures is two hundred and eighty-four, of which seven only are bridges of over thirty feet span. I have prepared two statements of structures, one with masonry bridges and culverts, the other with trestle culverts and cribwork abutments and piers to the bridges. In the masonry statement I have for economy excluded all arch culverts, using corbelled box culverts of various dimensions, up to six by six feet. Beam bridges have all been considered first class work. These conditions give total quantities, as follows :

First class masonry, seven thousand eight hundred cubic yards.

Second class masonry, nineteen thousand eight hundred and twenty-seven cubic yards; and paving seven hundred and sixty-nine cubic yards.

TIMBER.

In the statement of quantities in timber structures I have followed the drawings of trestle work culverts used on the Canadian Pacific Railway, all the larger structures having their abutments and piers of cribwork and stone filling.

For the superstructure of bridges the Howe truss has in all cases been supposed to be used.

QUANTITIES.

Schedules of approximate quantities for the whole distance are attached, with both masonry and timber structures.

ESTIMATE.

The final tables in connection with the interior section are estimates of cost per mile, with both masonry and timber structures. In the schedule of prices, which may at first sight appear high, I have taken into due consideration the nature of the earth and rock, and the difficulty of obtaining suitable timber in immediate proximity to the line of road, as well as many other difficulties attending the execution of work in an unsettled country. The total cost per mile I find to be, with

Masonry structures, per mile.....	\$23,607
Timber structures, per mile.....	20,899

being a saving of two thousand seven hundred and eight dollars in favor of timber. That the saving is not larger is to be attributed to the satisfactory foundations which exist for masonry, as also the absence of any very high embankments whereby the quantity of masonry would be largely increased.

AVALON.

The surveyed line here starts from the south end of the Long Bridge, Riverhead, St. John's, and follows the river of that name to the height of land; thence, following for the most part the watershed of the country, the Salmonier and Holyrood road is crossed at eight miles from the latter place, and a junction made with Party A at station 2660-66, at a distance of 50.39 miles by the traverse.

DISTANCE.

On the approximate location this distance is increased to 50·83 miles, whilst on an air line it measures but 33·73 miles: This great lengthening, as will be clearly seen by a reference to the map, is principally caused by the necessary detour in rounding the head of Conception Bay, and keeping inside the rugged belt of country which characterises the shores of this Bay, and which is developed to a greater or less extent all round the Island.

GRADES.

In mounting the Riverhead Valley a grade of one-sixty per one hundred or 84·45 feet to the mile was found necessary; but this may be reduced, as mentioned in my report of December last, when the precise position of the St. John's terminus shall be decided on.

With the above exception the maximum grade is one-twenty per one hundred. Grades of one per one hundred and upwards form fifty per cent of the whole in this district; but the longest unbroken grade, with the exception of that of the Riverhead Valley, is two and a quarter miles on the western descent of the Hawk Hills.

CURVES.

At the foot of this descent, a curve of six degrees or nine hundred and fifty-five feet radius is necessary, and extends round an arc of over 200°. Such extreme curvature is objectionable, especially situated as it is on a grade of one twenty per one hundred; it is however unavoidable on the present alignment.

Attention was called to this part of the survey in my December Report, and I have marked on the plan an alignment

which might not improbably prove superior in both grades and curves.

In this portion of Avalon the straights represent fifty-nine per cent. of the whole, the curvature being increased eight per cent. over that obtaining in the East Central District.

QUANTITIES.

The average quantities per mile are:—

Earth, twenty-four thousand and ninety-eight cubic yards, and rock ten thousand eight hundred and four cubic yards,—largely in excess of the average in the East Central District. The very broken nature of a large portion of this country, and the general direction of the line crossing the drainage of the country, is the chief cause of the high average quantities. The excavation being more favorable for working than the interior, these increased quantities do not cause the large increase in expenditure which might be at first inferred from a casual inspection of the relative quantities.

MASONRY.

The total number of masonry structures in this district is one hundred and thirty-eight, comprising two trestlework fills of one hundred and twenty and five hundred feet in length, respectively, one bridge of eighty feet span, and four smaller ones. The aggregate number of cubic yards in bridges and culverts is :

First class masonry, cubic yards.....	1,800
Second class masonry, cubic yards.....	15,000
Paving, cubic yards.....	350

TIMBER STRUCTURES.

With timber instead of masonry, two hundred and eighty two thousand two hundred lineal feet of square timber would be required, with proportionate quantities of wrought and cast iron, particulars of which appear in the tabulated statement of timber attached.

Attached are schedules of total quantities, as also estimates of the cost per mile of road with masonry and with timber structures. The prices are considerably decreased for some items under those in the estimate of the interior district. This is caused by the greater facility of approach throughout Avalon, where the line can be tapped by roads or paths at various points, and the distance from the sea, where heavier materials could be landed, is never over a few miles.

The absence, with some exception, of granitic rocks, and the facility for procuring a certain proportion of the timber on the ground, all tend in the same direction.

COST PER MILE.

The cost per mile is thus found to be :

With masonry structures, twenty-seven thousand nine hundred and eighty dollars.

With timber structures, twenty-five thousand nine hundred and eighty-eight dollars, or a saving of one thousand nine hundred and ninety-two dollars in favor of timber.

The economy effected by the use of timber is here again but small, the conditions being less favorable to its use than are often found.

CULVERTS.

The heaviest of the trestle culverts occur in crossing lakes, where the depth of fill is considerable and the quantities of timber required correspondingly large. Culverts for the

same places I have supposed to be built in the solid ground, on the margin of the lakes, where the height of embankment is much less and where culverts of small size will serve all the requirements of the case, viz., that of keeping the waters of the lake on the two sides of the embankment in equilibrium. The greatest economy will probably be found, on construction, in the use of timber or masonry in each particular locality, according to the nature of the site of structure and the facility of procuring material may suggest.

NO TUNNELS.

The tunnels necessary on the traverse line I have avoided on the approximate location, by procuring higher ground on all approaches and increased length, thus enabling the grade to run higher and pass over the hills in open cutting.

TABLES.

Having now referred to the general results in the East Central and East Avalon districts, the attached tables, numbered one to seven, for each district, will give more precise details.

CONCLUSION.

In conclusion, I must state that the length of survey left incomplete, through the failure of supplies, is ascertained, now that plans and calculations are complete, to comprise a distance of fifteen miles, as previously estimated.

I remain, Sir,

Your obedient servant,

FRANCIS J. LYNCH, C.E.

LIST OF TABULATED STATEMENTS FOR BOTH
INTERIOR AND AVALON.

- 1.—Statement of distances.
- 2.—Statement of grades.
- 3.—Statement of average quantities.
- 4.—Statement of masonry structures.
- 5.—Statement of timber structures.
- 6.—Statement of approximate total quantities with masonry.
- 7.—Statement of approximate total quantities with timber.

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

STATEMENT OF DISTANCES.

Bay of Bulls Arm, Trinity Bay, to Middle Ridge.	Length in chains.	Length in miles.	Per centage.
Length on air line.....	3,630	68·75	
Length by traverse.....	4,500	85·22	
Length on approximate loca- tion	4,260	80·68	
Air line shorter than traverse...	869	16·47	19·32
Approximate location shorter than traverse	240	4·54	5·327
Length of straight on approxi- mate location	2,904	55·	68·
Length of curves on approxi- mate location	1,356	25·68	32·

NOTE.—Maximum grade 1·20 per 100, or 63·36 feet per mile. Maximum curve 4° , or radius of 1,432 feet:

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

STATEMENT OF GRADES ON APPROXIMATE LOCATION.

Station 0'00 to Station 4260. Bay of Bulls Arm, Trinity Bay, to Middle Ridge.	LENGTH.		Per centage of total length.
	Chains.	Miles.	
Level	1599	30.28	37.53
0.50 per 100 and under	588	11.14	13.80
Over 0.50 and under 1.00 per 100	288	5.45	6.76
1.00 per 100 or 52.80 feet per mile	601	11.38	14.11
1.20 per 100 or 63.36 feet per mile	1184	22.43	27.80
Totals.....	4260	80.68	100.
		Chains. Length.	Feet. Rise.
Rising Grades.....	1697	1680	
Falling Grades.....	994	839	

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

AVERAGE EARTH AND ROCK QUANTITIES.

Number of Miles.	Bay of Bulls Arm, Trinity Bay, to Middle Ridge.	Earth.	Rock.
40	{ The first 30 miles after leaving the Bay of Bulls Arm, Trinity Bay, will average.....	15,750	8,374
40.68	{ The whole of the East Central portion, except 10 miles of heavy work at various points included above.....	12,000	4,000
80.68	{ The average for the whole distance will be..... (Rocks chiefly granitic.)	13,860	6,168

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

STATEMENT OF MASONRY STRUCTURES:

Bay of Bulls Arm, Trinity Bay, (80 ⁰⁰ / ₆₈ miles) to Middle Rdge.		Masonry.						
No. of Structures.	Description.	Size.	1st Class.	2nd Class.	Paving.			
115	Box Culvert.....	3x3	}	18,099	749			
10	Box Culvert.....	3x4						
86	Box Culvert.....	4x4						
11	Box Culvert.....	4x5						
1	Box Culvert.....	4x6						
15	Box Culvert.....	5x5						
3	Box Culvert.....	5x6						
1	Box Culvert.....	6x5						
15	Box Culvert.....	6x6						
6	Double Box Culvert....	4x5						
2	Double Box Culvert....	4x6						
3	Beam Culvert.....	8				} 1,100	}	20
1	Beam Culvert.....	10						
4	Bridge.....	20	} 5,650					
4	Bridge.....	30						
3	Bridge.....	40						
2	Bridge.....	60						
2	Bridge.....	100						
284	Total.....	7,800	19,827	769			

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION G.

STATEMENT OF TIMBER STRUCTURES.

Day of Bulls Arm, Trinity Bay, to Middle Ridge, (80.68 miles.)				Quantities.						
Description.	Ft.	No. of Structures.	No. of Bents.	Timber.	Wroughtiron	Cast iron.	Soft wood plank.	Hard wood plank.	Cribwork.	Excavation.
				L. ft.	Lbs.	Lbs.	B. M.	B. M.	C. yds.	C. yds.
Trestle Culverts...	2	53	106	21,200	2,650	530	.....	.....	.....	1,060
Trestle Culverts...	4			32,340	6,000	990	.....	.....	.....	1,518
Trestle Culverts...	6	48	192	50,880	9,600	1,440	.....	.....	.....	2,352
Trestle Culverts...	8	60	240	66,000	12,000	1,800	55,000	10,000	.....	3,300
Trestle Culverts...	10	41	246	72,980	8,200	1,230	.....	.....	.....	3,936
Trestle Culverts...	15	17	136	45,560	3,400	510	.....	.....	.....	2,380
Trestle Culverts...	20	8	64	27,200	1,600	240	.....	.....	.....	1,280
Trestle Culverts...	25	3	30	13,740	600	90	.....	.....	.....	750
Trestle Culverts...	30	5	50	27,500	1,000	150	.....	.....	.....	1,250
Trestle Culverts...	35	Span								
Bridge...	20	4								
Bridge...	30	4								
Bridge...	40	3		Howe Truss Superstructure				8,500	2,000	
Bridge...	60	2								
Bridge...	100	2								
Totals.....				357,400	45,650	6,980	55,000	10,000	8,500	19,826

Paving.

749

20

769

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

APPROXIMATE QUANTITIES.

Station 0·00 to Station 4260—80·68 miles. Bay of Bulls
Arm, Trinity Bay, to Middle Ridge.

Masonry Bridges and Culverts.	Quantities.	Remarks.
Clearing, acres.....	1,049	Allowance for open ground; clearing taken 182 feet wide.
Close cutting, acres.....	81	
Grubbing, acres.....	202	Including ditches.
Fencing, lin. feet.....	8,068	Required near Come-by-Chance River.
Earth excavation, c. yards..	1,118,225	
Rock excavation, c. yards...	497,634	Chiefly granitic rock.
Under drains, lin. feet	121,020	
Riprap, c. yards	2,420	
1st class masonry, c. yards..	7,422	
2nd class masonry, c. yards	18,718	
Paving, c. yards.....	726	
Howe truss, 3 spans of.....	40 ft.	
" 2 spans of.....	60 ft.	
" 3 spans of.....	100 ft.	
Timber, lin. feet.....	3,227	
Road crossings and divisions, cattle guards, &c....	\$2,259	

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, No. 4, DIVISION C.

APPROXIMATE QUANTITIES.

Station 0·00 to 4260—80·68 miles. Bay of Bulls Arm,
Trinity Bay, to Middle Ridge.

Timber Bridges and Culverts.	Quantities.	Remarks.	
Clearing, acres.....	1,049	Partial allowance for open ground.	
Close cutting, acres.....	81		
Grubbing, acres.....	202	Including ditches. Possibly required near Come-by- Chance River.	
Fencing, lin. feet.....	8,068		
Earth excavation, c. yards..	1,118,225		
Rock excavation, c. yards..	497,634	Chiefly granitic rock.	
Under drains, lin. feet.....	121,020		
Riprap, c. yards.....	2,420		
Howe truss, 3 spans of....	40 ft.		
" 2 spans of....	60 ft.		
" 3 spans of....	100 ft.		
Cribwork and stone filling cub. yds.....	8,552		
Timber (all sizes) lin. feet.	338,856		Sizes—18x12, 12x12, 8x12.
Plank—larch, spruce and pine, b. m.....	80,680		
Plank—hardwood, b. m....	10,085		
Wrought iron, lbs.....	44,374		
Cast iron, lbs.	7,261		
Road crossings, and cattle guards, &c.	\$2,259		

NEWFOUNDLAND RAILWAY.

EAST AVALON No. 1, DIVISION C.

COMPARATIVE STATEMENT OF DISTANCES.

St. John's to Westward. 0.00 to 2684.	Length in chains.	Length in miles.	Per centago.
Length on air line.....	1781	33.73	
Length on traverse.....	2660.66	50.39	
Length on approximate loca- tion	2684	50.83	
Air line shorter than traverse	879.36	16.66	33.06
Approximate location longer than traverse.....	23.34	0.44	0.87
Approximate location, straights	1588	30.04	59.16
Approximate location, curves..	1069	20.78	40.84
Maximum grade near St. John's—1.60 per 10,000, 84.48 per mile.....			
Maximum grade in other cases —1.20 per 100, or 63.36 per mile.....			
Maximum exceptional curve— 6° or 955 ft. R.....			
Maximum in other cases—4° or 1432 ft. R.....			

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

STATEMENT OF GRADES ON APPROXIMATE LOCATION.

St. John's to Westward. 0'00 to 2684.	LENGTH.		Per centage of total length.
	Chains.	Miles.	
Level	918	17.38	34.22
0.50 per 100 feet and under...	305	5.78	11.33
Over 0.50 per 100 and under 1.00 per 100	110	2.09	4.11
1.00 per 100. 52.80 feet per mile	541	10.24	20.16
1.20 per 100. 63.36 feet per mile	572	10.84	21.31
1.60 per 100. 84.48 feet per mile	238	4.51	8.87
Totals	2684	50.83	100.00
		Chains. Length.	Feet. Rise.
Rising Grades		1084	1137
Falling Grades		680	705

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

AVERAGE EARTH AND ROCK QUANTITIES, PER MILE.

No. of Miles.	St. John's to Westward (50·83).	Earth.	Rock.
10	Heavy work.....	40,000	20,000
20	Medium work.....	26,666	13,333
20·83	Light work.....	14,000	4,000
80·68	Average for East Avalon..... Rock principally slate, but some granite in places.	24,098	10,804

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

STATEMENT OF MASONRY STRUCTURES.

St. John's to Westward.		Masonry.			
No. of Structures.	Description.	Size.	1st Class.	2nd Class.	Paving.
10	Box Culvert.....	3x3	}	15,000	350
48	Box Culvert.....	3x4			
30	Box Culvert.....	4x4			
6	Box Culvert.....	4x5			
7	Box Culvert.....	4x6			
2	Box Culvert.....	5x5			
10	Box Culvert.....	5x6			
2	Box Culvert.....	6x4			
3	Box Culvert.....	6x5			
8	Box Culvert.....	6x6			
2	Box Culvert.....	6x8			
1	Double Box Culvert.....	4x6			
1	Double Box Culvert.....	5x6			
1	Double Box Culvert.....	6x6			
4	Bridge, span	20			
1	Bridge, "	80			
1	Trestle work	120			
1	Trestle work	500			
138	Total.....	1,800	15,000	350

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

STATEMENT OF TIMBER STRUCTURES.

St. John's to Westward.				Quantities.						
Description.	FILL.	No. of Structures.	No. of Bents.	Timber.	Wrought iron	Cast iron.	Soft wood plank.	Hard wood plank.	Cribwork.	Excavation.
				L. ft.	Lbs.	Lbs.	B. M.	B. M.	C. yds.	C. yds.
Trestle Culverts...	2	17	34	6,800	850	170	.....	.....	.....	340
Trestle Culverts...	4			14,700	3,000	450	.....	.....	.....	690
Trestle Culverts...	6	15	60	15,900	3,000	450	.....	.....	.....	785
Trestle Culverts...	8	15	60	19,800	3,800	540	.....	.....	.....	990
Trestle Culverts...	15	29	174	51,620	6,400	870	40,664	6,353	.....	2,084
Trestle Culverts...	20	9	72	24,120	1,800	870	.....	.....	.....	1,260
Trestle Culverts...	25	10	80	34,000	2,000	300	.....	.....	.....	1,600
Trestle Culverts...	30	7	70	32,060	1,400	210	.....	.....	.....	1,750
Trestle Culverts...	35	8	100	44,000	1,600	240	.....	.....	.....	2,000
Trestle Culverts...	40	3	36	21,000	600	90	.....	.....	.....	900
Bridge.....	20	4	.....	.....	.....	.....	.....	.....	600	251
Bridge.....	80	1	.....	.....	.....	.....	.....	.....	250	
Trestle Work.....	120	1	.....	3,200	140	20	706	97	.....	.....
Trestle Work.....	500	1	15,000	400	60		
Totals.....	188	758	.....	282,200	23,700	3670	41,370	6,450	850	12,600

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

APPROXIMATE QUANTITIES.

0·00 to 2684—St. John's to Westward—50·83 miles.

Masonry Bridges and Culverts.	Quantities.	Remarks.
Clearing, acres.....	660	
Close cutting, acres.....	51	
Grubbing, acres.....	101	
Fencing, lin. feet.....	25,415	
Earth excavation, c. yards..	1,225,000	
Rock excavation, c. yards...	549,167	
Under drains, lin. feet	50,830	
1st class masonry, c. yards..	1,800	
2nd class masonry, c. yards	15,000	
Paving, c. yards.....	350	
Riprap, c. yards.....	1,525	
Timber, lin. feet.....	17,790	
Wrought iron, lbs.....	2,010	
Cast iron, lbs.....	356	
Howe trusses, 4 spans of...	20 ft.	
" 1 span of....	80 ft.	
Road crossings and diver- sions.....	\$1,500	

NEWFOUNDLAND RAILWAY.

EAST AVALON, No. 1, DIVISION C.

APPROXIMATE QUANTITIES.

0·00 to 2684—St. John's to Westward—50·83 miles.

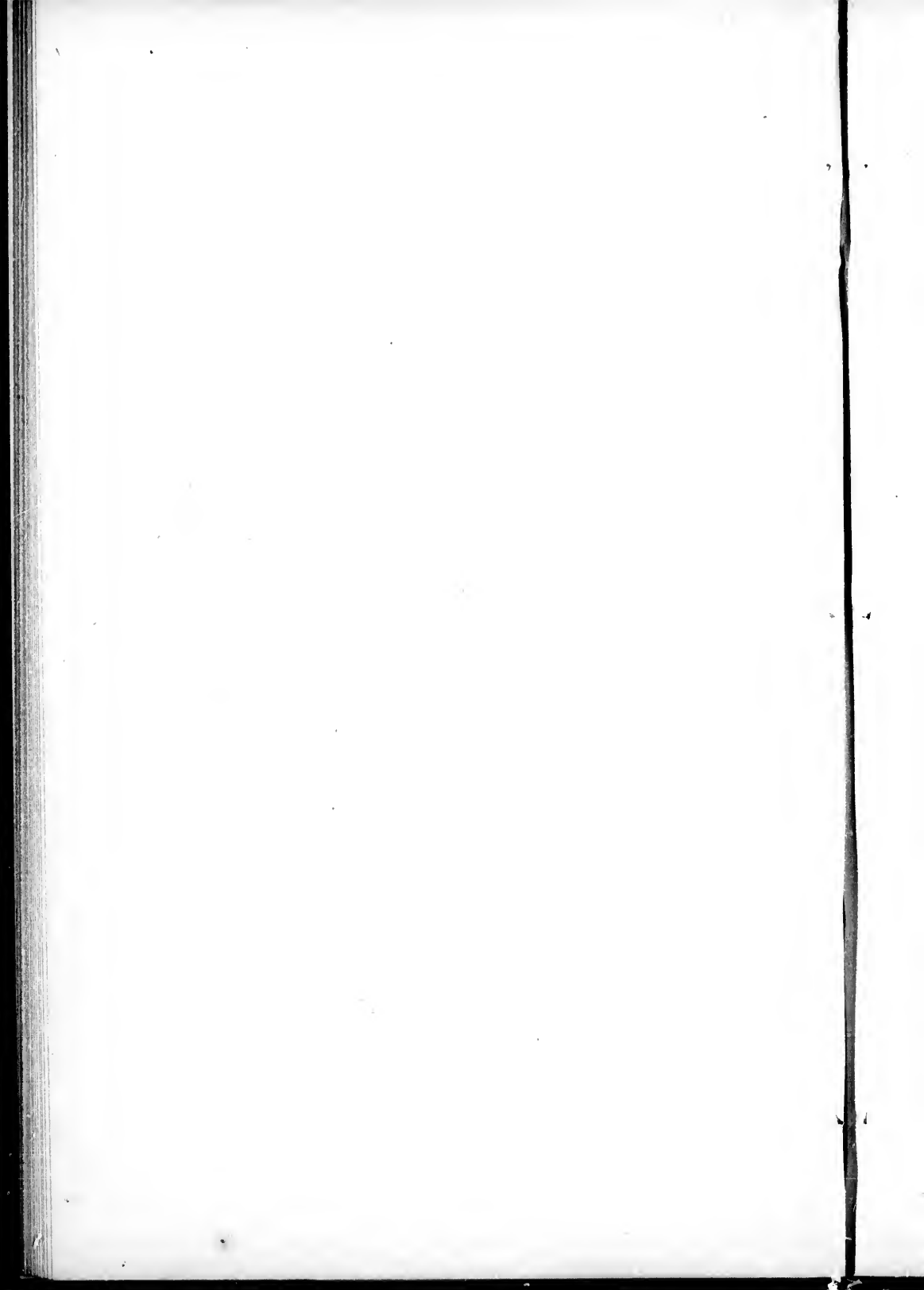
Timber Bridges and Masonry.	Quantities.	Remarks.
Clearing, acres.....	660	
Close cutting, acres.....	51	
Grubbing, acres.....	101	
Fencing, lin. feet.....	25,415	
Earth excavation, c. yards..	1,225,000	
Rock excavation, c. yards..	549,167	
Under drains, lin. feet.....	50,830	
Riprap, c. yards.....	1,525	
Timber, lin. feet.....	282,200	
Wrought iron, lbs.....	23,790	
Cast iron, lbs.	3,670	
Cribwork, c. yards.....	1,016	
Softwood plank, b. m.....	41,370	
Hardwood plank, b. m.....	6,450	
Howe truss, 4 spans of....	20 ft.	
" 1 span of....	80 ft.	
Road crossings, and diver- sions.....	\$1,500	

NEWFOUNDLAND RAILWAY SURVEY.

REPORT OF PARTY A.

Central Avalon District.

ENGINEER-IN-CHARGE—THOMAS RAMSAY, CIVIL ENGINEER.



NEWFOUNDLAND RAILWAY SURVEY.

OTTAWA, April 5th, 1876.

SANDFORD FLEMING, ESQ.

SIR,—In my report, dated April 3rd, 1876, I stated that the party under my charge left Saint George's Bay on the 25th of September. I now beg to further report upon the subsequent operations of that party and the result of its labours.

After a rather dangerous voyage the party arrived at Saint John's on the 2nd of October, and, after refitting and re-organizing, left on the 8th, under advice and instructions from Alexander Murray, Esq., head of the Newfoundland Geological Survey, its destination being Chapel Arm, Trinity Bay, to prosecute the survey through the district of Avalon.

After a somewhat troublesome journey, by land and by water, with provisions and camp material, the party encamped at Chapel Arm on the night of the 10th of October.

I went round by Brigus to examine the country, and did not reach the party till the night of the 12th.

My instructions were to work as far westward as I should judge necessary, leaving what work Party B might be able

to finish by about the same time that the other parties would complete the work to the eastward.

There is a telegraph station at Chapel Arm and four or five with families living there; the people depending mostly upon fishing. The little land that is cleared appears to be pretty good, but good land does not extend far either east or west. There is perhaps a mile along the telegraph line eastward of fair land and well wooded, but steep. There are two brooks coming in from the south, divided by a ridge, and their banks, as far as can be seen from the telegraph line, are well wooded. I saw a quantity of spruce and some yellow birch on the shore brought down the valley of one of these brooks for ship building. The largest trees would be from twelve to fourteen inches diameter.

There being a path along the telegraph line, we began the levels at the tideway, traversing and levelling along the path. About half a mile from the shore the timber became scant and dwarfish, and at a mile the country is a high open barren. At two and a half miles we were five hundred and fifty feet above the sea, and we kept above five hundred feet for another mile.

The country then began to descend rapidly, the water still falling north to Trinity Bay, and as we got into the valley, or rather broad irregular flat, we found it filled with lakes in all directions. At about seven miles from Chapel Arm we met a lake directly in our course, and extending both right and left; I named it Murray lake; I estimated it to extend two miles to the southward. We traversed its shore northwards about a mile, and found that its waters ran south to Placentia Bay, and that within a few hundred feet of its northwest angle the ponds were emptying towards Trinity Bay. This lake is only three hundred and forty feet

above the tide, and having land so much higher eastward, I considered this divide must be a fixed point. I therefore put in a post, marked it B, and began a new chainage. I continued the line westward about six miles, over an irregular broken country, full of ponds, where it seemed impossible to tell whether the water ultimately emptied north or south without traversing them round. The line is generally near the watershed, but near where we stopped work in this direction it crossed a brook ten or twelve feet wide, running south into Placentia Bay, and northward was a range of not very high, but very rugged and broken hills.

At station three hundred and six by eighty from post B, we put in another post for the western bounds of the Avalon centre division of the work. The measurements on the approximate location marked on the plan as before, with a heavy red line, begin at this post, and are marked in red figures. The measurements on the traverse are marked in the direction in which they were chained and in black figures, but the miles marked on the traverse section are the miles from Come-by-Chance River, and include the mileage on sections numbers two and three.

I now returned to the post B, and ran eastward, having to descend still lower than this point to cross the outlet or rather the foot of a large lake I have named Waugh Lake. This is at station three hundred and forty-four on the approximate location, the height of the grade being three hundred and twenty-eight feet, and that of the water three hundred and eleven feet.

This descent might be avoided by keeping south instead of north of Waugh Lake, and it is possible the ground might be smoother, but it would require a very sharp curve near the

foot of the lake, and cause a loss of distance of about half a mile.

At station five hundred and ten on the approximate location, the line gained a summit of four hundred and ninety-eight feet above tide, and it will require heavy work and a grade of one twenty per hundred to attain it.

This summit is on a ridge extending west of south and east of north, which forms the west shore of Chapel Arm Harbor on one side, and Long Harbor on the other. It will probably range from five hundred to seven hundred feet above the sea; and there is no lower available point for crossing it than where the line now is.

This summit is nearly ten miles from our starting point, and thus far there is no timber except a few spots on hill tops, where there is a little scrub spruce from four to six inches diameter. The ground has been in many places covered with short scrubby spruce, but most of it has been killed by fire.

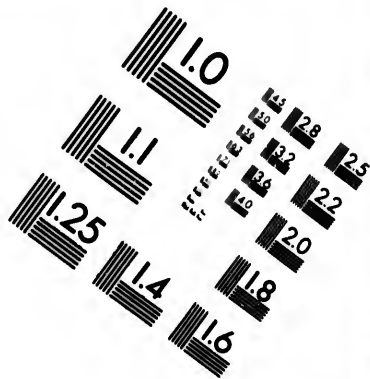
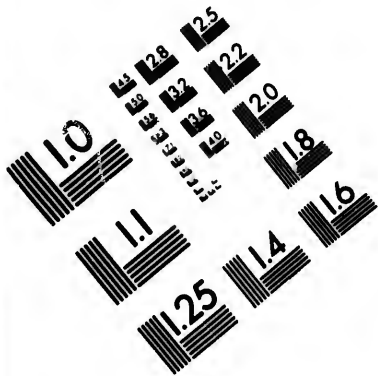
In some places the rocks are merely covered with a thick matting of roots and moss, in other parts they are covered with peat, which is in some places pretty deep. I am in hopes that under the peat, in places at least, will be found clay or gravel sufficient to cover the road to protect it from fire, as there is nothing in view but either peat or rock to make the road of.

From this summit the waters are descending rapidly into Long Harbor, Placentia Bay. I endeavoured to keep the line round the heads of these waters, but I eventually found that there is low ground east of the before described ridge, extending quite across the peninsula, the waters of Long Harbor being within four miles of Chapel Arm, and those of Chapel Arm being within three miles of the tide at Long

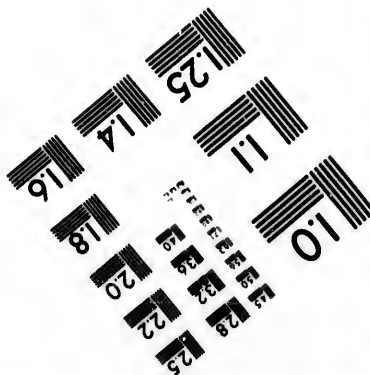
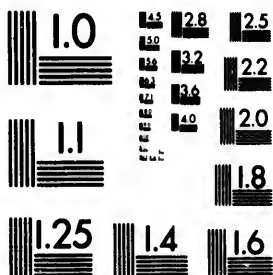
Harbor, and extending two or three miles further south. The highest point on this divide is about three hundred and ninety feet, so that the line must descend one hundred and eight feet, or perhaps more. When I discovered this, I wished to take a more direct line and at a lower level; I ran a portion of this direct line, but we had at this time a week of extremely bad weather, getting only two days fit for work, and I became alarmed that winter might overtake us without making a connection with the party to the eastward. I therefore left about a mile of this line without an instrumental survey. I have drawn the approximate location between the known points, as no difficulty exists. There are the ends of two ridges to pass with a valley between, and the only question is the depth of fill necessary in order to keep a good grade across the valley. I think it may probably be found better than shewn by the approximate section.

About fifteen miles on this division the line crosses a road that has been opened a long time ago; I think I saw a plan of a survey of it forty years old. This survey was from Colliers Bay to Long Harbour and Ship Harbour. The road was afterwards opened to Brigus, and a branch from it has been made to Chapel Arm for the use of the telegraph lines. There is still some work done on it every year. It is a good winter road six miles east from Long Harbour, but from that to the Chapel Arm branch it is partly grown up with bushes. From the forks to Brigus I believe a cart has been through, but it must have been in a very dry season, as there are some deep bogs.

At the crossing of this road the line leaves the Long Harbour waters and gets into a basin of the Chapel Arm waters, following a branch of them to its source, and at



**IMAGE EVALUATION
TEST TARGET (MT-3)**



28 25
2 22
20

10

station eight hundred and eighty on the approximate location it reaches the watershed, at an elevation of five hundred and thirty-five feet. At station nine hundred and fourteen, on the extremity of a ridge beyond the watershed, the height of five hundred and forty-six feet above the sea is reached, this being the highest point on this section. South of this point is a large lake; I have named it Lemoine Lake. It is somewhat triangular in shape, one and a half or two miles on a side, and flowing to Placentia Bay. North of this point the ridge rises and extends a long distance, between two branches of Chapel Arm waters. It is higher than the line till it gets some distance north of Long Harbour road.

Up to this point the line has not passed through any woods but those of a very scrubby dwarfish character. On the higher ground there is a good deal of open barren, but on some of the slopes there are patches of fair spruce and fir. There is little bare rock showing itself, but sometimes the covering is very slight indeed. I saw, where the road had been cast up on the slopes, where there is not much peat, gravel is found that makes a very good road.

At station nine hundred and ninety on the approximate location, corresponding to station eight hundred and thirty on the traverse, the line has reached the divide between water running into Placentia Bay and the Dildo River emptying north into Trinity Bay. This summit is four hundred and eighty feet above the tide, and is the continuation of a ridge of which Spread Eagle Peak is the highest point; and I believe there is no lower ground than where the line crosses until some distance north of the peak is reached.

The last mile of line is rather uneven and difficult ground. About this place there are some knolls with pretty good birch,

the best I have seen on the island ; but they are not of much extent.

Here the deep valley of the Dildo River was just in front, and nearly at right angles to our course ; and in order to get a workable grade the line had either to go up river or down. I considered that down stream was the most favourable route, and made the line in that direction ; but perhaps an opposite course would give equally good results.

The valley of the Dildo cannot fall much here as the lakes extend over a large portion of it. From this summit there are about three miles, with a grade of 1.25 per hundred, or seventy-nine feet per mile, to get to the Dildo River ; and as there is a broad flat at the foot of the grade, it is impossible to gain more distance without running back to the northwest.

When I was at Long Harbor road, I thought it might be possible to get a more northerly and perhaps a more direct line to this point ; but from the appearance on this side, I think that would be impossible—there being three different streams running into Chapel Arm, with high ridges between them, and all these would be nearly at right angles to the proposed course. I cannot positively say there are no breaks or valleys in these ridges, but I know there are none between the line and Long Harbor road.

The line crosses the Dildo River at an elevation of three hundred and twelve feet above the tide, the water level being three hundred and three ; a fifty feet bridge will suffice here, there being a large lake above serving as a regulator for the water. In getting out of the valley to the eastward the grade is moderate and the height only three hundred and forty feet.

At station eleven hundred and ninety the line crosses a brook running southwards, which I suppose belongs to Rocky River, Placentia Bay, but in that I may be mistaken, as I afterwards

crossed the Spaniard's Bay river at a much lower level, and this water may belong to it.

Crossing the Spaniard's Bay river is about the most difficult part of this division, the line crossing at a height of only two hundred and seven feet above the tide (the water being one hundred and ninety-seven), and requiring a grade of 1.30 per 100 for nearly a mile and a quarter. The fill over this river contains nearly one hundred and forty thousand cubic yards.

A more southerly line might improve this, but the Hodge waters are spread out in front or eastward in such a way that it might be difficult to get back to the line again, and a totally new line would have to be looked for.

About two miles east of Spaniard's Bay river the Hodge waters are crossed at the same level as the Spaniard's Bay river, the country between being full of ridges and hummocks, but there is no difficulty about grades, none of the land being high.

After crossing the Hodge waters, the country appearing to be all low, I left away from the river expecting to get a more direct line, but I soon met lakes that forced the line back again; and when I had reached a summit near station one thousand five hundred and sixty, at a height of three hundred and thirty-five feet, it appeared that a line up the river would not differ much in length, and perhaps might be over levelled ground than that on which the line now is; but there will be no difficulty in locating a good track when the line is made.

About ten miles farther, or at station one thousand six hundred and sixty, the line reaches the north end of Big Barren Pond; the height of the pond being two hundred and

seventy-six feet above the tide, and that of grade two hundred and ninety-two feet above the same.

On the last sixteen miles of line the country is about one-fourth open; wherever there is a flat, whether high or low, the land is peaty and clear of wood, but all the sloping land is covered with wood of some kind, chiefly spruce and fir; occasionally mixed with some birch.

From Big Barren Pond there is an up grade of one-twenty per hundred for one and a quarter miles, and heavy work to the summit between this and Goulds River, which summit is three hundred and eighty-five feet above the sea. Thence the descent is rapid but not great, three hundred and twenty-two feet being the lowest point of grade, and I think it can be worked to a grade of 1.00 per hundred.

The waters in this valley are spread out in all directions with high knolls between, so that any direct line would give a very heavy section; but a serpentine line can be followed without more than an average amount of work.

From station one thousand eight hundred and twenty-five the grades keep ascending to station one thousand nine hundred and ninety-three on the approximate location, corresponding with station one thousand eight hundred and fifty-nine on the traverse, when the survey connects with Party C (plan and section number one), at a height by our levels of four hundred and sixty-five feet, but only four hundred and fifty by the levels of Party C.

On the plan I have laid down the Big Barren Pond from a plan on a small scale of, I believe, a survey by some of Mr. Murray's assistants, so that probably the position of the south end is not far from correct. About four miles from our line at the head of the pond; in a south-westerly direction, there appears to be a good crossing place; and the pond seems to

end a mile further south-west. It is probable a line could be found from near station one thousand two hundred, or perhaps by crossing the Dildo up stream, and passing by the south end of the pond, with a very considerable saving of distance. If there is not too much water in the way, that saving might amount to nearly three miles, and I think there can be no difficulty about grades east of the Dildo River; but the country being low, it is probable that a good deal of those parts that are blanks on the plan may be occupied by water; so that it is difficult, I may say impossible, to estimate the length of a changed line without a survey. But this point is of too much importance not to be attended to when any thing further is being done regarding the location of the road.

This is the only place, I think, a deviation from the general route surveyed can be made with advantage.

The sections show that the grades on this division, although not so long as on the St. George's Bay division, are steeper and the quantities are larger. This arises from the fact that on the St. George's Bay division I was able, as a general rule, to follow the direction of the water courses where I was able to find a fair line, when it would have been utterly impossible to cross the country at all in an opposite direction. In the present division the course of the line is at right angles to the formation of the country, and the line has to cross every ridge and stream instead of going in the direction in which they go. There is also another serious loss arising from being forced to run across the ridges and valleys, viz.: as the tables shew, the very large increase in length of over thirty-four per cent. of the approximate location over the air line. On this twenty-eight miles of air line we have now taken fifty miles of levels.

I do not think, upon the whole, there will be much difference in the quality of the work upon this section from that of St. George's Bay. There is a good deal of material on the latter section that is easier to work than any I have seen in this. In the workable character of the rock I am not aware there is much difference, but the means of supplying parties will be better in Avalon.

The timber here is not quite so large and not nearly so tall as in the deep valleys of the western interior section. The supply of ties will, therefore, not be over abundant here, nor so near where they are wanted.

The material that I have seen worked into on the sides of hills makes excellent roads, but it is not easy to work, and I have not seen any where in this division ballast that could be easily worked or got in large quantities.

I may again state that in the estimate of quantities, I have stated the whole amount of embankment without any reference to where it comes from; but in addition I have estimated to pay one dollar and fifty cents per yard for quarrying the rock, thus making its cost, put into the embankment, one dollar and eighty cents. This may not be the mode always adopted, but I hope it will be understood.

The general result of the survey of this division, as well as the estimates, are exhibited on the accompanying sheets in a tabulated form, viz.:

- No. 1.—Statement of lengths and curves.
- 2.—Statement of grades.
- 3.—Statement of embankment and rock excavation.
- 4.—Statement of masonry structures.
- 5.—Statement of timber structures.
- 6.—Approximate quantities with masonry structures.
- 7.—Approximate quantities with timber structures.

Being requested to state every thing of interest, I will add a few words in regard to animal life, which seems to be not very abundant on the island.

Our men caught very few trout, although they frequently tried. There were a few salmon or grilse caught on the St. George's River, about twenty miles from salt water; they were congregated below a fall; we did not see any above. We saw a few wild geese and sea gulls in some of the lakes in the breeding season, but few or no ducks. The party saw four or five beavers altogether. We saw a good many indications of otters, and the men caught one, as also a fox. The marks of bears were occasionally but not often seen. There is no part that we visited but has been hunted over by Indians.

On the western plains we saw three or four flocks of ptarmigan, a pretty bird, resembling the Canadian partridge, except that it is partially white even in summer, and its habits and cry are different. They were plenty in Avalon late in autumn, when there were blueberries. In Avalon the party killed some native hares; they are a beautiful animal, perfectly white in November, and I think quite twice as large as a Canadian rabbit; they are not plentiful.

The cariboo is the game *par excellence* of Newfoundland; these in summer we only saw in single ones, except a doe with a fawn; late in the season they were seen in droves of five or six several times, and everywhere the plains are full of their paths. There can be no doubt but they are more plentiful here than in any other country I have ever been in; but, according to my experience, it would be a great mistake to rely much upon venison for provisioning a party.

In regard to weather, I have no record of temperature, but we found very few days that were inconveniently warm for working or travelling, and I found no day that I was out on

the high open plains that I wished to sit down long without a coat.

When I arrived at Saint George's Bay, 7th of June, I found May-flowers just in season, about as they were in Halifax three weeks before, and there were no leaves on the earliest deciduous trees at that date. I saw snow on the twentieth of June, but the land was twelve or thirteen hundred feet above the sea, and there had been a heavy drift.

I took no notice of frosts until about the 20th of September, and the potato vines at Saint Georges's Bay were green up to that date. We had the first snow on the 27th of October, and about the 24th November the men travelled on the ice on still water.

I think we had thunder only two or three times during the summer, and although we had frequent rains, they were very seldom heavy, only once during the summer that the streams rose much.

The following is, I believe, very nearly a correct list of the number of days on which we had either rain or snow during the survey, viz. :—

June.....	8 days.
July.....	8 “
August.....	9 “
September.....	10 “
October.....	11 “
November	14 “

There was a good deal of very high wind and a great deal of sea-fog in October and November.

I do not like to conclude this report without saying that I found the men of Newfoundland, if not first-class woodsmen, at least first-class laborers. My party behaved remark-

ably well considering the very laborious nature of the services they had to perform. I would be glad to name them individually if it would do them any good.

I am glad to be able to make my acknowledgment and return thanks to J. O. Frazer, of the department of Public Works, for his painstaking in everything connected with supplies and accounts, as well as my personal comfort.

It is not my business to allude to the advantage the service received from the advice and instructions of Alexander Murray, Esq., but it will oblige me much if you will thank him for his courtesy and kindness to myself.

I am, sir,

Your most obedient,

THOMAS RAMSAY.

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

STATEMENT OF LENGTHS AND CURVES OF APPROXIMATE LOCATION.

Deflection per 100 feet.	Radii.	Degrees of curvature.	Degrees per mile.	LENGTH.		Percentage of whole.
				Chains.	Miles.	
Degrees.						
1	57·30	32 $\frac{1}{2}$	32·50	·61	50·57
1 $\frac{1}{2}$	38·20	38 $\frac{1}{4}$	.....	25·50	·48
2	28·65	681	.....	340·50	6·44
2 $\frac{1}{2}$	22·92	80	.....	32·00	·62
3	19·10	1041 $\frac{1}{4}$	.....	347·10	6·57
4	14·33	680	170·00	3·22	49·43
5	11·46	300	.....	60·00	1·15
Tangent		2853	76°	985·40	18·66	
Approximate location.....				1993·00	37·75	34·38
Length of traverse				2166·00	41·02	
Length of air line				1483·50	28·09	
Increase of location over air line..				510·50	9·66	
Percentage of increase						

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A., PLAN AND SECTION No. 2.

STATEMENT OF GRADES ON APPROXIMATE LOCATION.

	LENGTH.		Percentage of whole.
	Chains.	Miles.	
Level.....	140-00	2-65	7-02
0-50 per 100.....	317-00	6-00	15-90
Between 0-50 and 1-00 per 100	691-00	13-09	34-67
1-00 per 100.....	309-00	5-85	15-49
1-20 per 100.....	222-50	4-22	11-17
1-30 per 100.....	313-50	5-94	15-75
Totals.....	1993-00	37-75	100
Length of grade rising eastward.....		Chains. 10-03	
Length of grade falling eastward.....		8-50	
Level.....		1-40	
		19-93	
Total rise eastward.....		893 feet	
Total fall eastward.....		773 "	
Difference.....		120 "	

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

STATEMENT OF EMBANKMENT AND ROCK EXCAVATION.

Road bed 17 feet—base of cuts 22 feet.

Length 37.75 miles.	Miles.	Cubic yards per mile.	Embankment.	Rock.
Light work.....	13	18,000	234,000	
Heavy work.....	24.75	43,500	1,200,400	
Rock excavation.....	37.75	4,000	.....	151,000
Total.....			1,434,400	151,000
Mean.....		38,000	.....	4,000

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

STATEMENT OF MASONRY STRUCTURES.

Structure.	No.	Size.	1st Class.	2nd Class.	Paving.
		Feet.	C. yards.	C. yards.	C. yds.
Box culverts.....	6	3x3			
Box culverts.....	50	3x4			
Box culverts.....	8	4x4			
Box culverts.....	7	4x5			
Arch culverts.....	3	5x6	3,900	6,400	1800
Bridges.....	5	15			
Bridges.....	2	20			
Bridges.....	1	30			
Bridges.....	2	50			
Total.....	84	.....	3,900	6,400	1800

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

STATEMENT OF TIMBER STRUCTURES.

Description.	Fill.	No. of Structures.	No. of Bents.	Timber. L. ft.	Wrought iron	Cast iron.	Soft wood plank.		Cribwork.
							Hard wood plank.	B. M.	
Trestle Culverts.....	2	4	8	1,600	200	50	B. M.	B. M.	
Trestle Culverts.....	4								
Trestle Culverts.....	8	10	40	10,600	2,000	300			
Trestle Culverts.....	12	19	76	21,900	3,800	600			
Trestle Culverts.....	15	20	120	35,600	4,000	600			
Trestle Culverts.....	20	16	160	43,900	3,200	500			
Trestle Culverts.....	25	3	24	10,200	600	100			
Trestle Culverts.....	30	2	20	8,200	400	100			
Bridges	12	3							
Bridges	15	4							
Bridges	25	3							
Totals.....	.....	84	448	132,000	14,200	2250	29,000	6,000	5,000

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

APPROXIMATE QUANTITIES. MASONRY STRUCTURES.

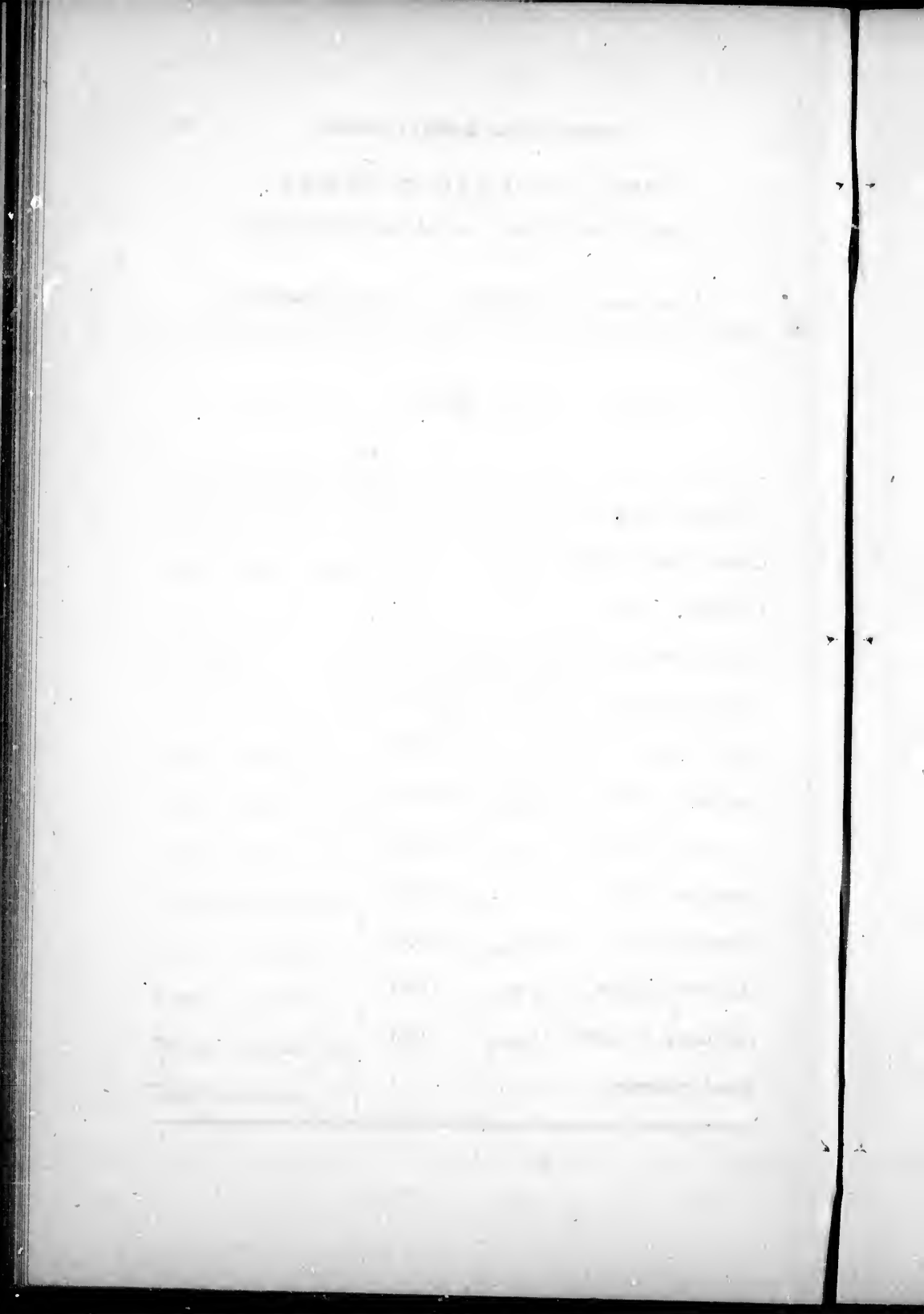
37.75 miles.	Quantities.	
Clearing, acres.....	300	
Close cutting, acres.....	38	
Grubbing, acres.....	56	
Fencing.....	0.00	
Embankment, c. yards.....	1,434,400	
Rock excavation, c. yards...	151,000	
Under drains, lin. feet	56,600	
Masonry, 1st class, c. yards	3,900	
Masonry, 2nd class, c. yards	6,400	
Paving, c. yards.....	1,800	
Riprap, c. yards	1,200	
Bridge tops, lin. feet.....	230	
Road crossings.....	1	

NEWFOUNDLAND RAILWAY.

AVALON CENTRE, DIVISION A.—PLAN AND SECTION No. 2.

APPROXIMATE QUANTITIES. TIMBER STRUCTURES.

37.75 Miles.	Quantities.	
Clearing, acres.....	300	
Close cutting, acres.....	38	
Grubbing, acres.....	56	
Embankment, c. yards.....	1,434,400	
Rock excavation, c. yards..	151,000	
Under drains, lin. feet.....	56,600	
Timber for culverts, lin. feet	132,000	
Wrought iron, lbs.....	14,200	
Cast iron, lbs.	2,250	
Softwood plank, ft. b. m....	29,000	
Hardwood plank, ft. b. m..	6,000	
Cribwork, c. yards	5,000	
Road crossings.....	1	



NEWFOUNDLAND RAILWAY SURVEY.

REPORT OF PARTY B.

West Avalon District.

ENGINEER-IN-CHARGE—W. A. AUSTIN, P.L.S., CIVIL ENGINEER.

THE UNIVERSITY OF CHICAGO

PHILOSOPHY

BY
[Faint text]

NEWFOUNDLAND RAILWAY SURVEY.

WEST AVALON.

AT ST. JOHN'S:

SANDFORD FLEMING, Esq. :

We were detained at St. John's from the 16th of October to the morning of the 28th, making arrangements for our Avalon campaign, getting new tents, stores and cooking utensils, and also paying off and settling with the men.

DEPARTURE.

On the evening of the 27th October I went on board the *Walrus* with my staff, with the intention of sailing the first thing in the morning. At 8 a. m., 28th inst., all the party, some twenty-five in number, were on board, and we started for the Bay of Bulls Arm. We ran till about midnight when, on account of the extreme darkness, we lay in Trinity Bay until daybreak, when we ran for the Bay of Bulls Arm, which we reached before dinner, and began to unload our stuff and provisions, finishing in the afternoon in heavy rain.

MOVED CAMP:

On Saturday and Sunday, 30th and 31st of October, it also rained, and up to midday on Monday, when I began to for-

ward our stuff and moved camp to our starting point, which was the point of departure of Division C (known as Eastern Interior Division). This was some two miles distant from the Bay of Bulls Arm, and about twenty chains east of the Come-by-Chance river. While the party were arranging the camps and advancing the stuff, I explored the country near the starting point and for about four miles ahead, finding no serious obstruction.

November 2nd.—As it rained all day, no line work was begun to-day.

STARTED WORK.

On the morning of the 3rd of November we started the line from the point before mentioned, and ran about a half a mile through difficult cutting; we also advanced all the stuff up to this point, notwithstanding intermittent showers of rain, sleet and snow. Not deeming it necessary to define the exact position of the transit line, I shall refer particularly to the approximate location line which is shown on the plan by a broad red line which generally follows on or near the traverse, and only in one instance is as far as thirteen chains from it.

PLACENTIA WATERSHED.

At a distance of six hundred and seven chains from the starting point, on the approximate location line, a height of land is crossed which divides the Placentia Bay waters from those of Trinity Bay. For the first one hundred chains of this distance the line takes side hill ground and easy grades, then over a more generally level section to the westward of Hill Lake, crossing Hill brook at station two hundred and forty by a bridge of twenty feet span. Thence, going more easterly, principally taking side-hill ground to the height of land.

SOIL AND TIMBER.

The surface is composed of gravel, boulders and clay. There is not much rock on this portion of the line. The timber here is spruce, birch and fir, and very inferior. I have seen some few trees eighteen inches in diameter, but not of any length; the woods short and scrubby, but here and there we found detached groves with trees averaging ten inches in diameter.

From the height of land at station six hundred and seventy to station eight hundred and fifty (where we cross another height of land dividing the waters east and west), we have descending grades. At station seven hundred and forty, we take an easterly course for a mile, to avoid a high and much broken clump of hills, to station seven hundred and eighty-three, thence descending along side-hill to station eight hundred and fifty, the height of land.

WOODS AND SURFACE.

The woods are very inferior scrubby fir, spruce and birch. Some of the timber is fit for telegraph poles. Gravel, boulders, and rock (gneissoid) are on the surface, there being a good deal of the latter in this section.

PLACENTIA BAY WATERSHED.

From station eight hundred and fifty to the end of West Avalon and junction with Centre Avalon, at station 1,087.50, we keep on our general course (S.S.W), passing to the east of Gull Lake (a fine sheet of water, containing about three square miles); thence by side-hill on an up-grade along the ridge bounding Gull lake to the eastward, to the terminating point, which we reached on the evening of the 30th November.

WOODS AND SURFACE.

This last portion of the work has no timber on it, there being nothing but low scrubby spruce, fir and birch. A good deal of rock exists on the surface of this section, mostly gneissoid, and also some gravel, boulders and clay. The soil in Avalon, or the narrow neck on which I was at work, I should deem unfit for agricultural purposes, it being too rocky and barren, with the exception of the harbors, where some little soil may be had, where vegetables are raised.

DEPARTURE.

On the 1st December we went to Chance Cove, and on the 2nd hired a schooner which took us to Hearts Content; thence we went to Harbor Grace and slept there two nights; and on the 4th left Harbor Grace and got to St. John's that evening, per steamer *Cabot*.

Having the same staff that I had on the Central Interior district, I must again mention them favorably. Mr. Costigan, who also joined the party, was of material service to me, being ahead while I was cross-sectioning.

I am, sir,

Your obedient servant,

W. A. AUSTIN, P.L.S., C.E.,

Engineer-in-Charge.

NEWFOUNDLAND RAILWAY.

WEST AVALON, DIVISION B.

COMPARATIVE STATEMENT OF DISTANCES.

Station 0.00 to Station 1088.	Length in chains.	Length in miles.
Length on air line.....	952	18.03
Length on traverse.....	1,100	21.
Length on approximate location.....	1,088	20.60
Air line shorter than traverse	158	2.97
Approximate location shorter than traverse.....	22	0.40
Approximate location, length of straight... ..	660	12.50
Approximate location, length of curves.....	427	8.10
Note.—Maximum grade—1.20 per 100		
Maximum curve, 7° 7° deg....		

NEWFOUNDLAND RAILWAY.

WEST AVALON, DIVISION B.

STATEMENT OF GRADES.

Station 000 to Station 1088.	LENGTH.		Percentage of total length.
	Chains.	Miles.	
Level.....	219	4.15	20.15
0.50 per 100 and under.....	80	1.52	7.36
Over 0.50 per 100 and under 1 per 100	125	2.38	11.50
1.00 per 100.....	47	0.89	4.33
1.20 per 100.....	616	11.66	56.66
Totals.....	1084	20.60	100.00

NEWFOUNDLAND RAILWAY.

WEST AVALON, No. 3, DIVISION B.

AVERAGE EARTH AND ROCK QUANTITIES PER MILE.

No. of Miles.	Station 0'00 to Station 1088.	Earth.	Rock.
7	Very heavy work.....	60,000	30,000
6	Heavy work.....	30,000	10,000
7·60	Light work.....	15,000	3,000
20·60	Average for West Avalon..... (Rocks principally granite.)	34,660	14,213

NEWFOUNDLAND RAILWAY.

WEST AVALON, No. 3.—DIVISION B.

STATEMENT OF MASONRY STRUCTURES.

Station 0'00 to Station 1088.			Masonry.			
No. of Structures.	Description.		1st Class.	2nd Class.	Paving.	
38	Box culvert.....	3x3	}	4,500	200	
3	Box culvert.....	3x4				
15	Box culvert.....	4x4			
4	Box culvert.....	5x5				
5	Box culvert.....	6x6				
3	Beam culvert.....	10	}	3,000		
2	Bridge.....	20				
1	Bridge.....	40				
71	Total.....	.....	3,000	4,500	200

NEWFOUNDLAND RAILWAY.

WEST AVALON, No. 3.—DIVISION B.

STATEMENT OF TIMBER STRUCTURES.

Station 000 to Station 1088.				Quantities.						
Description.	Fill.	No. of Structures.		Timber.	Wrought iron	Cast iron.	Soft wood plank.	Halt Pulleys.	Cribwork.	
			No. of Bents.							
Trestle Culvert.....	2	13	26	5,200	650	130	20,000	3000		
Trestle Culvert.....	4									
Trestle Culvert.....	6	7	28	6,860	1,400	210				
Trestle Culvert.....	8	8	32	8,480	1,600	240				
Trestle Culvert.....	10	8	32	8,800	1,600	240				
Trestle Culvert.....	15	8	48	14,240	1,600	240				
Trestle Culvert.....	20	7	56	18,760	1,400	210				
Trestle Culvert.....	25	7	56	23,800	1,400	210				
Trestle Culvert.....	30	5	50	22,900	1,000	150				
Trestle Culvert.....	35	1	10	5,500	200	30				
Trestle Culvert.....	40	3	36	19,800	600	90				
Trestle Culvert.....	45	1	12	7,700	400	60				
Trestle Culvert.....	50	1	12	8,800	400	60				
Trestle Culvert.....	60	1	14	11,000	500	80				
Bridge.....	40	Span.	1							
Totals.....	31			161,840	12,750	1950	20,000	3000	1000	40

NEWFOUNDLAND RAILWAY.

WEST AVALON, No. 3,—DIVISION B.

APPROXIMATE QUANTITIES. MASONRY BRIDGES AND CULVERTS.

Station 0'00 to Station 1088.	Quantities.	Remarks.
Clearing, acres.....	268	
Close cutting, acres.....	1	
Grubbing, acres.....	2	
Fencing, lin. feet.....	217,516	
Earth excavation, c. yards..	714,000	
Rock excavation, c. yards...	292,788	
Under drains, lin. feet	20,600	
1st class masonry, c. yards..	3,000	
2nd class masonry, c. yards..	4,500	
Paving, c. yards.....	200	
Riprap, c. yards	412	
Timber, lin. feet.....	618	
Howe truss, lin. feet.....	40	
Road crossings.....	\$412	

NEWFOUNDLAND RAILWAY.

WEST AVALON, No. 3. DIVISION B.

APPROXIMATE QUANTITIES. TIMBER BRIDGES AND CULVERTS.

Station 0-00 to Station 1088.	Quantities.	Remarks.
Clearing, acres.....	268	
Close cutting, acres.....	1	
Grubbing, acres.....	2	
Fencing, lin. feet.....	217,516	
Earth excavation, c. yards.	714,000	
Rock excavation, c. yards..	292,788	
Under drains, lin. feet.....	20,600	
Riprap, c. yards.....	412	
Timber, lin. feet.....	161,840	
Wrought iron, lbs.....	12,750	
Cast iron, lbs.	1,950	
Cribwork, c. yards	1,000	
Softwood plank, ft. b. m....	20,000	Board measure.
Hardwood plank, ft. b. m..	3,000	
Howe truss, lin. feet.. ...	40	
Road crossings.....	\$412	



THE STATE OF TEXAS
COUNTY OF [illegible]

[illegible text]

[illegible text]

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NEWFOUNDLAND RAILWAY SURVEY.

REPORT OF DIVISION B.

ENGINEER-IN-CHARGE—W. A. AUSTIN, P.L.S., CIVIL ENGINEER.

NEWFOUNDLAND RAILWAY SURVEY.

OTTAWA, 8th April, 1876.

SANDFORD FLEMING, Esq., *Engineer-in-Chief*,
Newfoundland Railway.

LEFT ST. JOHN'S.

DEAR SIR,—I have the honor to report that, agreeably to the written instructions received from A. L. Light, Esq., dated at St. John's, Newfoundland, 3rd June, 1875, I, on the 7th June, went on board of the steamer *Leopard*, accompanied by Mr. W. Quin, as transitman; Mr. A. G. Morrison, as leveller; Mr. John Morris to act as hind chain, and twenty-three packers and axemen, with the intention of landing at the mouth of the River of Exploits. On account of the immense quantity of ice hindering our progress, we had to lay in Trinity Harbor, Fair Island Harbor, Greenspond and Fogo Harbors. The steamer also ran on a rock while in the ice, which delayed us some hours in getting off, happily without material damage. On the 16th June we landed at Burnt Island, Exploits, some thirty miles distant from the mouth of the river, where I hired a cook. We were compelled to charter a schooner to get to the mouth of the Exploits river, which

we reached on the evening of the 17th June, being eleven days on our passage, which should have been made under ordinary circumstances in two days.

Here my party was increased to thirty-one, by the addition of three Indians. I proceeded to WINSOR & VALLANCE'S mill to procure lumber for the construction of two flat-bottomed boats for the purpose of transporting our provisions, &c., into the interior; the canoes (four) with which we were furnished, not being of sufficient capacity to advantageously advance our stuff, and make use of all my men. We encamped for the night near Peyton's wharf, where, on the morning of the 18th, we landed all our stuff and placed it under cover.

PREPARING FOR DEPARTURE.

All the provisions that were in barrels, *i. e.*, flour, pork, etc., we put into bags to be more easily handled and portaged. I had the canoes overhauled, and they being in a very leaky state, had to be thoroughly gummed and mended to render them serviceable. Having made all arrangements necessary for a start, and having given the men who were to build the boats an idea of the kind of boat that I wanted, I, on the 19th of the month, proceeded up the river Exploits as far as Bishop's Falls, with four canoe loads of provisions, where, the weather turning out bad, we cached at the head of the Portage and returned to camp at the mouth of the river to spend Sunday.

FURTHER ADVANCE.

On the 21st, I proceeded up the river with four more loads of provisions, as far as Great Rattling Brook, the river being generally rapid, and the distance about fourteen and a half miles, leaving Mr. Quin in charge of the remainder of the

party at the mouth, with orders to advance the work there as speedily as possible, and join the party with the boats and the remainder of the provisions. Not deeming it necessary to describe every day's progress here, I will merely allude cursorily to the more important events.

BOATS FINISHED.

On the 25th the building of the boats was completed, when the remainder of the provisions, &c., were advanced, under the superintendance of Mr. Quin. Fearing that something had happened to the party below, I, on the 30th, went down the river with the canoes and men, and met the party at the head of the High Falls, nothing of moment having occurred except that nearly all the men were new at the work, consequently our progress was slow. We all camped together on the island I had left in the morning, with the stuff advanced to that point.

FROST.

On Sunday, July 4th, we had frost, then being about three hundred and fifty feet above the level of the sea.

NOEL PAUL'S BROOK.

On the 8th July we advanced the remainder of the supplies, camp, etc., to an island near the mouth of Noel Paul's brook, near which we had to abandon one of our canoes which, from the difficulty of getting up the rapids, the sharpness of the rocks in the bottom of the river, and the non-intelligence of the persons conducting it, had been rendered totally useless. After having advanced about two-thirds of our provisions further up the river, I detached (on the 12th) seven men under the direction of Mr. Costigau (who had

joined my party for the purpose of seeing the country, and who kindly offered to superintend), to forward provisions up the Noel Paul's brook, a distance of sixteen miles, for the purpose of supplying us when the line should cross the upper waters of that stream.

RED INDIAN LAKE.

On the 13th July, having advanced all our stuff up to the east end of Red Indian Lake, we encamped there, overjoyed at having got thus far towards the starting point of our work.

VICTORIA RIVER.

On the 14th, having proceeded to the mouth of Victoria river, and then having divided our provisions, on the 15th we proceeded with some thirty-three pieces, with the intent of making a cache some fifteen miles to the south of the river's mouth. From the extreme rapidity of the river, and the broken and rocky state of the shores, we, with much difficulty, got up some three miles, and then, its direction being nearly westward, we struck into the woods cutting a trail for the packers; at midday on the 17th we had reached about six miles south, where, to the utmost dismay of most of the party, we found the

WOODS ON FIRE

in the neighborhood of the river behind us; and, the wind blowing fresh, considering it unsafe to proceed, I ordered all the stuff advanced to be brought back to a marsh in the centre of which, on a mound, we built a cache. The following day we returned to the mouth of the river. On account of being wind-bound we did not reach the head of the lake until the evening of the 21st, when we encamped on the right bank of the

RED INDIAN RIVER,

near our point of departure or beginning of the survey. On arriving here most of the men were, as regards health, in good condition, but their shoes and boots were in a wretched state from the hard work they had gone through, wading, towing and lifting the boats and canoes in the extensive shoals and strong currents of the river, where in many places but light loads could be taken, rendering it necessary to go over the same ground two or three times.

TIMBER ON RED INDIAN LAKE AND EXPLOITS RIVER.

Before entering on the portion of this report relative to the survey, I would say a few words on woods met with coming up the river and lake by which we reached this point. I found the banks of the river of Exploits generally well timbered, apparently the same kind of timber on the shores of Red Indian Lake, and extending some miles up the various tributaries. Of the pine family, generally by botanists divided into thirteen generæ, containing a number of species, four of which are indigenous to Newfoundland, or, more properly speaking, to that portion through which I travelled, I noticed, first, the white pine (*pinus strobus*), nearly all along the banks of the Exploits, in some places in groves numbering hundreds of trees, some of which I have seen four feet in diameter, but generally under two and a half feet. In other places they are very scattered, a hundred trees extending over two or even three miles, and at other places again they are totally absent. Second—The black larch of America (*lares pendula*), commonly known as tamarac, hackmatack, and in Newfoundland as juniper, sometimes called Newfoundland oak, is generally sparingly scattered along the river's banks, and, with the

exception of some few localities where they appeared more numerous and of considerable size, average 18. Third—white spruce (*abies alba*) and black spruce (*abies niger*) are generally plentiful, and according to the soil their dimensions will be increased or diminished. I saw some nearly three feet in diameter; the average would be over 15. Fourth—the silver fir (*abies picea*), known in Canada as balsam, and in Newfoundland as fir or var, is generally plentiful and of large dimensions, average eighteen. The other woods, I noticed, were white birch and poplar, the former plentiful on the hills but not of large dimensions, the latter near the mouth of the river and in some localities along its banks. Also white maple, mountain ash, known as the Roman tree. Nut hazel, cherry (cluster and wild), all these of small dimensions. Juniper (*juniperus communis*), a shrub of the pine family and ground hemlock, with many other berry-bearing shrubs similar to those generally seen in Canada.

STARTED WORK.

On the afternoon of the twenty-second of July, the axes being handled and ground, I proceeded up the river some thirty-five chains west of the south-western extremity of Red Indian Lake, where I established a conspicuous boundary and bench mark on the right bank of the Red Indian River. Reduced level of 436.11 feet above sea, assuming the water surface of Red Indian Lake, as per Mr. Murray, four hundred and twenty-eight feet above the sea.

OUR OBSERVATIONS GIVEN.

Station 0.00 in latitude $48^{\circ} 33' N.$, longitude $57^{\circ} 07' 10'' W.$ The variation of the needle is $31^{\circ} 23'$ west, which point of departure of traverse is twenty chains north of station

sixty-six on approximate location line. Having examined and cross sectioned the country to the south of the traverse, taking the northern slope of the high mountains to the south of Red Indian Lake, crossing the Morison river at station one hundred and eighteen by a bridge sixty feet span and forty-five feet above water surface, we cross

COOK'S BROOK AND GULLY

at station two hundred and ninety, by a bridge two hundred feet span, with abutments averaging seventy-five feet in height. Here we endeavoured to run up Cook's brook, but found the ascent so great towards Costigan Lake, that we had to abandon the idea which I had entertained from seeing the side hill country so broken up with deep gullies; also, from knowing that a more level tract existed to the south at Cook's brook. Here I saw indications of black lead (plumbago). The line still hugged the northern slope of the mountains to station five hundred, where, on account of a range of hills one mile and a half distant, lying directly across our course (astronomically cast), which we failed to get over, the line had to follow the valley, extending nearly in a southern direction to station seven hundred and twenty, which is at the top of the hills that skirt the northern bank of the

VICTORIA RIVER.

This river is reached at station seven hundred and seventy by side hill ground, and spanned by a bridge of two hundred feet, with average height of abutments twenty-six feet. Thence generally over a pretty level country to station one thousand and forty, which distance terminates the extent of the southern watershed of Red Indian Lake. Up to this distance the timber met with was chiefly spruce, tamarac,

balsam and birch, and a few white pine in the neighborhood of Red Indian Lake and Cook's Brook, the pine good and of large dimensions, the spruce averaging fifteen inches in diameter, the balsam good and pretty large, the birch not plentiful, and of medium size. But little rock is visible, light and dark sandy loams, gravel and boulders being the general characteristics of the surface.

SOUTH WATERSHED.

At station one thousand and forty a height of land exists between the Red Indian Lake waters and waters flowing southward. Continuing from this in an east north easterly direction, keeping to the south of Quin Lake and north of Rogerson Lake (a fine body of water containing an area of about six square miles), we reach the foot of the Rogerson Hills. We cross these hills in the lowest gap, the highest level of which is another height of land, station one thousand four hundred and eighteen, which divides the waters flowing into the Harpoon Brook, emptying into Exploits River, and those flowing southward.

TIMBER AND SURFACE.

This reach from station one thousand and forty to one thousand four hundred and eighteen, is not so well timbered as the former, half of it being marshes; the surface shewing gravel boulders, sandy loam and some little rock; the woods, spruce, fir, tamarac and birch, averaging over one foot in diameter.

HARPOON BROOK WATERSHED.

Thence to station one thousand seven hundred and ninety includes the upper part of the country drained by the Harpoon Brook, Ambrose Lake here forming the chief catchment basin, being nearly four miles long. From the Rogerson hills the line takes a tortuous course, crossing the traverse in four different places, which materially lengthens it.

GREATEST DISTANCE FROM TRAVERSE.

Passing to the south of Beaver and Ambrose Lakes, generally taking side hill ground, the line passes over a height of land between Ambrose and Louis Lakes, the latter waters flowing southward, apparently into Noel Paul's Brook. This reach is pretty well timbered, some of the largest spruce, poplar and fir on the whole line being here, averaging eighteen inches in diameter. Boulders, loam, clay and gravel, with more rock than before, are seen from the surface; a portion of this distance is rough and broken.

NOEL PAUL'S BROOK WATERSHED.

From this, extending to station three thousand three hundred and two, is the height of land, one thousand feet above the sea, between Noel Paul's Brook waters, Great Rattling Brook waters and the waters flowing to the Bay d'Est. Most of this extent is more level than the preceding reaches. The first part on side hill ground and a down grade along the hills skirting the north bank of the Noel Paul's River to the crossing of the same by a bridge of eighty feet span, with abutments averaging forty-five feet in height; thence up the side hill along the right bank of the brook to the south shore of Lake Helen; thence taking a northerly course on account of

the high range of hills lying in our course, going to the south of Carter Lake and skirting along the northern base of these hills, we get to a portion of some considerable extent, generally more level, but in many places covered with large boulders. We then cross the south-east branch of

NOEL PAUL'S BROOK

in two places, first by a bridge sixty feet span, and secondly, by one of forty feet at low levels. Thence through a slightly broken, barren country, with small groves of scrubby spruce, keeping to the south of Whiteway and Shea lakes, where our course is changed more to the southward. At station three thousand two hundred and forty we get to the north east of a range of hills which run nearly north and south, thus reaching the height of land at station three thousand three hundred and two, before described. The timber in the last extent is generally of inferior quality and size. Some few pine were seen on the banks of Noel Paul's brook; also, spruce, fir, tamarac and birch; the spruce in many places very scrubby. Most of this extent is covered by lakes and ponds, and a portion burnt over. Large boulders, gravel, sandy loam and rock forming the surface.

DIVIDE BETWEEN WATERS FLOWING NORTH AND SOUTH.

After leaving the height of land, the line makes a detour to the southward, passing down the valley of a stream which empties into Gulph Lake, the traverse being about seventy chains to the north, which lengthens the line here about two miles. This deviation is unavoidable, for it is the only ground by which we can get grade or escape the lakes and rough country to the north and south. Thence following the height of land between Atlantic Lake, two and a half miles

long, and Gulph Lake, four miles long (the former discharging its waters by the Great Rattling brook into the Exploits, the latter emptying into the Baie d'Est), on a narrow neck of land three hundred and fifty feet wide. We then rise to the eastward over marshes and barrens, with some timbered land between, to station three thousand six hundred and fifty, where we reach a generally undulating country to the base of

FOX HILLS,

station four thousand and forty, and the centre of a gap in the summit of which we reached at station four thousand one hundred and ten. Most of the timber of this section is short, scrubby spruce, and but little large sized timber exists, but there is also fir (balsam), tamarac and some birch. Marsh and open barrens occupy a great deal of this section. Near station three thousand five hundred and ninety we saw indications of iron ore. The surface here generally is gravel, boulders and sand with rock.

GANDER RIVER.

From the summit of the Fox Hills the line descends diagonally their southern slope, and reaches the base at station four thousand four hundred and twenty, continuing through a marshy descent to the head of the hill leading down to the Gander River, at station four thousand five hundred and ten. Descending this hill to station four thousand five hundred and eighty, we here, on account of the shortness of provisions, ran our traverse to the Gander River. The location line is shewn, run along the side hill to the same distance as the termination of the traverse.

DISTANCE OF UNFINISHED PART OF LINE.

Mr. Costigan, who came through from the end of Mr. Lynch's line to the end of my line, estimates the distance at about sixteen miles, the termination of my line being about five miles above the mouth of Gull Brook, by the valley of which stream he considered Mr. Lynch's line might be connected with mine.

The hills on the north side of the Gander River have a fair amount of timber on them, and also on the southerly side of the Fox Hills: spruce, tamarac, fir and birch average over one foot.

COUNTRY, TIMBERED AND OTHERWISE.

The extent of timbered country passed over was 3362·20 chains—63 $\frac{2}{3}$ miles. Partially timbered, 400·00 chains—7·57 miles; and open marsh and barrens, 914·00 chains—17·31 miles. Having

FINISHED OUR LINE

on the 2nd October, we established a bench mark and planted a large post on the left bank of the Gander River, the distance by traverse from the starting point being 4516·11 chains, or 85·53 miles. The reduced level of the final B. M., No. 207, being 380·62 feet.

STARTED FOR BAY D'ESPOIR.

The third of October being Sunday we rested, and started homeward on Monday, some of the men nearly naked and shoeless, and not having a particle of meat or salt for some days back. We all felt overjoyed to start for Bay D'Espoir, which we reached on the evening of the seventh day. Hav-

ing telegraphed for a steamer to St. John's, we proceeded to Gaultois and from thence by schooner to Harbor Breton, which we reached on the morning of the fourteenth.

GOT TO ST. JOHN'S.

The steamer *Cabot* coming in about midday, we embarked on board and reached St. John's in the afternoon of the fifteenth.

I have much pleasure in mentioning the names of Mr. Quin, Mr. Morison, Mr. Morris and Mr. Stares (my commissariat officer), by whose attention to orders and energy this difficult survey was advanced, forwarded and brought to a successful termination.

I am, sir,

Your obedient servant,

W. A. AUSTIN, P.L.S., C.E.,

Engineer-in-Charge.

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, DIVISION B:

STATEMENT OF DISTANCES:

Red Indian Lake to Gander River.	Length in chains.	Length in miles.
Length on air line.....	3327·00	72·48
Length by traverse.....	4516·11	85·53
Length by approximate location....	4610·20	87·31
Air line shorter than traverse	689·11	12·05
Approximate location longer than traverse	94·09	1·78
Length of straight on approximate location	3310·20	62·61
Length of curve on approximate location	1300·00	24·70
Note.—Maximum grade—1·20 per 100		
Maximum curve, 6°; but one 7°		

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, DIVISION B.

STATEMENT OF GRADES ON APPROXIMATE LOCATION.

Station 0·00 to Station 4610·20. Red Indian Lake to Gander River.	LENGTH.		Percentage of total length.
	Chains.	Miles.	
Level.....	1088	20·48	23·72
0·50 per 100 and under.....	537	10·05	11·50
Over 0·50 and under 1·00 per 100	901	17·32	21·50
1·00 per 100, or 52·80 feet per mile.....	692	13·10	14·81
1·20 per 100, or 63·36 feet per mile.....	1392	26·36	28·47
Totals.....	4610	87·31	100·

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, DIVISION B.

AVERAGE EARTH AND ROCK QUANTITIES.

No. of Miles.	Red Indian Lake to Gander River.	Earth.	Rock.
20	Heavy work per mile.....	24,300	2,700
68	Light work per mile.....	9,500	500
	Average per mile.....	13,250	1,000
88·31	Total Quantities.....	1,170,000	88,360

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT—DIVISION B.

STATEMENT OF MASONRY STRUCTURES.

Red Indian Lake to Gander River.			Masonry.	
No. of Structures.	Description.	Size.	1st Class.	2nd Class.
56	Box culvert	3x3	}	13,200
2	Box culvert	3x4		
43	Box culvert	4x4		
1	Box culvert	4x5		
3	Box culvert	5x5		
3	Box culvert	5x6		
2	Box culvert	6x5		
11	Box culvert	6x6		
1	Box culvert	6x8		
2	Double box culvert.....	6x5		
3	Double box culvert.....	6x6		
5	Beam culvert.....	10		
1	Beam culvert	12		
1	Beam culvert	15		
4	Bridges	20	} 10,400	
3	Bridges 1 of.....	30		
	Bridges 2 of.....	40		
4	Bridges 1 of.....	50		
	Bridges 3 of.....	60		
1	Bridge	80		
1	Bridge	200		
147			10,400	13,200
				704

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT—DIVISION B.

STATEMENT OF TIMBER STRUCTURES.

Red Indian Lake to Gander River.				Quantities.						
Description.	Fill.	No. of Structures.	No. of Bents.	Timber.	Wrought iron	Cast iron.	Soft wood plank.	Hard wood plank.	Cribwork.	Excavation.
Trestle Bridge.....	} 2 4	27	54	10,800	1,350	270	} 4,400	4400		
Trestle Bridge.....		6	23	92	22,540	4,600					690
Trestle Culvert.....	8	14	52	14,840	2,800	420				
Trestle Culvert.....	10	21	84	23,100	4,200	630				
Trestle Culvert.....	15	23	138	40,940	4,600	690				
Trestle Culvert.....	20	17	136	45,560	3,400	510				
Trestle Culvert.....	25	3	24	10,200	600	90				
Trestle Culvert.....	30	5	50	22,900	1,000	150				
Bridge.....	^{Span} 20	4								
Bridge.....	30	1								
Bridge.....	40	2								
Bridge.....	50	1	.....	Howe Truss Superstructure.....						8800
Bridge.....	60	3	.....	820 lin. feet.						
Bridge.....	80	1	.....						
Bridge.....	200	2	.....	Masonry used.						
Totals.....		147		190,880	22,550	3450	44,000	4400	8800	

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, DIVISION B.

APPROXIMATE QUANTITIES.

Station 0·00 to Station 4610·20—87·31 miles Red Indian
Lake to Gander River.

Masonry Bridges and Culverts.	Quantities.	Remarks.
Clearing, acres.....	1148	
Close cutting, acres.....	265	
Grubbing, acres.....	88	
Fencing, lin. feet.....		
Earth excavation, c. yards..	1,170,000	
Rock excavation, c. yards..	88,000	
Under drains, lin. feet.....	44,000	
Riprap, c. yards.....	6,160	
1st class masonry, c. yards..	10,400	
2nd class masonry, c. yards..	13,200	
Paving, c. yards.....	706	
Howe truss, 2 spans.....	40 ft.	
Howe truss, 1 span.....	50 ft.	
Howe truss, 3 spans.....	60 ft.	
Howe truss, 1 span.....	80 ft.	
Howe truss, 2 spans.....	200 ft.	
Timber, lin. feet.....	2,000	

NEWFOUNDLAND RAILWAY.

INTERIOR DISTRICT, DIVISION B.

APPROXIMATE QUANTITIES.

Station 0'00 to Station 4610'20—87'31 miles. Red Indian
Lake to Gander River.

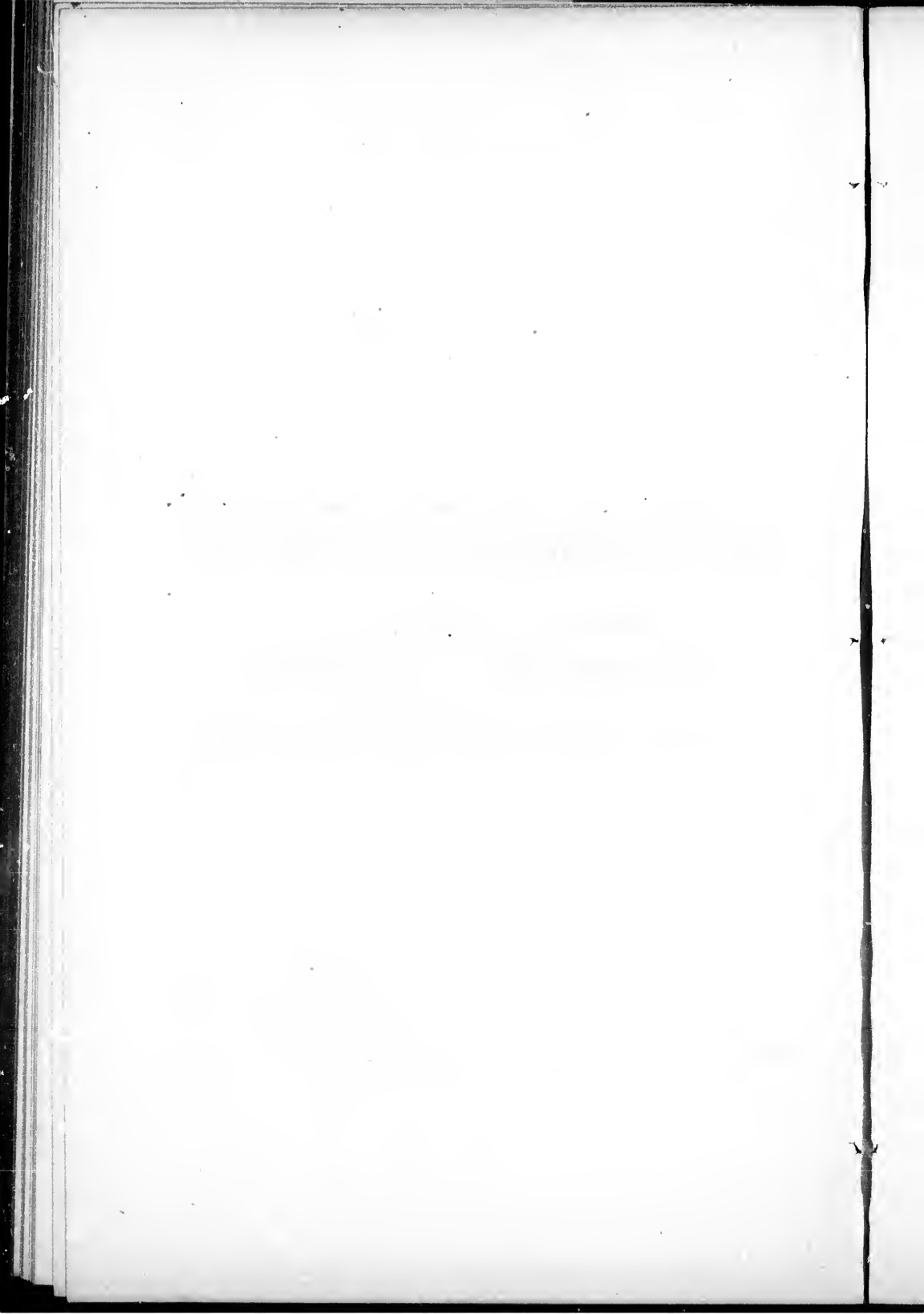
Timber Bridges and Culverts.	Quantities.	Remarks.
Clearing, acres.....	1148	
Close cutting, acres.....	265	
Grubbing, acres.....	88	
Fencing, lin. feet.....		
Earth excavation, c. yards.	1,170,000	
Rock excavation, c. yards..	88,000	
Under drains, lin. feet.....	44,000	
Riprap, c. yards.....	6160	
1st class masonry, c. yards..	4,000	In high bridge.
Cribwork, c. yards	8,800	Including stone filling.
Timber, lin. feet.....	190,880	
Wrought iron, lbs.....	22,550	
Cast iron, lbs.	3,450	
Softwood plank, b. m.....	44,000 ft.	
Hardwood plank, b. m.....	4,400 ft.	
Howe truss, lin. feet.....	820	

NEWFOUNDLAND RAILWAY SURVEY.

REPORT OF PARTY A.

Western Interior District.—St. George's Bay.

ENGINEER-IN-CHARGE—THOMAS RAMSAY, CIVIL ENGINEER.



NEWFOUNDLAND RAILWAY SURVEY.

OTTAWA, April 3rd, 1876.

SANDFORD FLEMING, Esq.,

DEAR SIR,—Having been employed in charge of a party on the Newfoundland Railway Survey during the past summer, and having the plans and sections now completed, I beg leave to submit the following

REPORT.

According to your instructions I reported myself to A. L. Light, Esq., C.E., at Halifax, on the second of May last, and on the first day of June left St. John's, Newfoundland, with a letter of instructions from Mr. Light, to the following effect:—

That I should take my party, then organized, to St. George's Bay, and there commence a preliminary survey for a Railway from St. George's Harbor to the south-west angle of Red Indian Pond by the nearest practicable route, and there, if possible, connect with the work of party B, under Mr. Austin.

That I should keep as near as I could to a country where a line could be located with maximum grades of sixty feet per mile, and curves with a maximum deflection of 5° per hundred feet.

That I should notice every thing of interest respecting the physical features of the country and its adaptability to farming, lumbering, or mining operations, as well as the character of the climate.

And, that after completing this preliminary survey, I should get my party back to St. John's, to assist in completing a portion of the survey that extends through the district of Avalon.

Myself and party arrived at St. George's Bay on the fourth of June, when I found myself at the entrance of what was believed to be a difficult, and, which was to me, an unknown country, without a guide (having failed to get the services of two Indians recommended by Mr. Murray as having some knowledge of the country).

The greatest difficulty in executing the survey I believe to be the supplying the party with provisions, and this induced me to take my supplies at first as far as I could find water to float them, which was the head of the tide at St. George's River, about eleven miles from the Harbour.

The river St. George, as far as I could judge, was the largest stream running into the bay, and probably the most directly in our course, and would be likely to give a longer distance in which to gain the high land than a smaller stream.

I preferred to begin here at the head of the tide, in order that I might get an early connection with the other division of the survey in the long days and fine weather.

Hence we took our departure and followed the St. George's River as far as it kept near our course. In fact there was no possibility of leaving the valley after we were once in it, until within three or four miles of where we did so, and I felt very much relieved to find a pass that would let us out in the direction we wished to go.

After leaving the valley of the St. George, I followed the shore of Paddle Lake about three miles. The water from it runs into Red Indian (or Exploits) river; but the course of this water was very much out of our direction, and, the ground looking favorable, I kept a direct course. This, I afterwards found to be an error, as the ground did not turn out as well as it looked.

By great exertions we reached the banks of Red Indian river on the 14th of August; and here I had the misfortune to lose my leveller, R. N. Light, Esq., through his ill-health. This crippled my operations considerably; still I succeeded in getting a connection with division B on the 18th, four days later, the distance chained being two thousand nine hundred and sixty-five stations, or fifty-six miles.

Part of this first and most direct line being nearly impracticable, I made about sixteen miles of a new line further south, making connection with the first line at station one thousand seven hundred and eighty-two on the traverse at the outlet of Paddle Lake. I also made such other loop-lines and cross sections as the extent of our provision would allow whilst returning to the mouth of St. George's river, where we arrived on the 8th of September.

From the mouth of St. George's river I ran westward a distance of five hundred and eighty chains and terminated at what is called Seal Rocks, but it is marked on the Admiralty chart Turf Point.

Here, while waiting for the boat to take the party back to St. John's, we ran some loop lines and shore traverse. Our total work on this division was ninety-three miles of levels and ten miles of shore traverse.

This was completed on the 25th September, when the party left for St. John's.

On the plan submitted, I have shown the traverse lines by fine red lines, and the distances are marked in black figures, and in the direction in which they were actually chained, some being eastward and some westward. The line of approximate location, as far as my present knowledge would enable me to judge, I have marked by a heavy *red* line, and the distances are written in red both in chains and miles, continuously from St. George's harbor eastward. In this direction I will endeavor to give some description of the country, premising that there are two sets of sections shewing the levels; the one showing the ground where the actual levels were taken has the distances marked in black figures, the other section with distances marked in *red* figures is intended to represent the ground marked by the heavy red line on the plan; but there are no actual levels. The measurements taken enable me to know that the grades represented can be obtained; the quantity of work may vary, but I think the estimate I submit will cover the uncertainty.

Seal Rocks, where I think must be the western terminus of the road, and where our measurements, as marked by the red figures begin, is on the eastern side of the harbour, opposite or south-west from the harbor point. From the position of this point, as given in Norie's Navigation, Seal Rocks is in latitude $48^{\circ} 25' 32''$, and longitude $58^{\circ} 24' 04''$. It is near the anchoring ground, and is said to be the best, in fact the only landing harbour on this shore. West of this the bay is very shallow, and further east it is much exposed to the north-west wind. Where I have marked the line across the cove I purpose the road to be made on a wharf, where I believe the small craft of the shore could land. Of course a deep water wharf would have to extend further into the harbour, and it is not included in the present

estimate, being an item belonging to the whole road, rather than to one division of it. I was informed that the deepest water was not far from this shore, but I took no soundings.

From Seal Rocks the land rises rapidly to a plateau of from sixty to eighty feet above the tide, and this plateau makes out to the shore in a bold slipping bank composed of clay and gravel, and about two miles eastward is cut through by the Barachois River. The railway must either follow the foot of the bank at the edge of the water and be protected by riprap, or else gain the plateau and cross the Barachois River with a high bridge and heavy bank. I have drawn my proposed line on the first named route, but further knowledge may show that on the plateau to be the best. Either is practicable.

After crossing the Barachois River and gaining the plateau the line passes over even but peaty ground, descending easily into the valley of Bog Brook, which valley it follows to its summit, which is five hundred and twelve stations from Seal Rocks and one hundred and seventy-five feet above tide. A further distance of ten miles, with a descent of eighty-two feet over sidelong and some rather uneven ground, brings us to the bank of the St. George's River.

A lower line might be found by following the shore, but it is not so direct, and I am inclined to think it would not be so cheap.

For eight miles after crossing the Barachois River the land through which we passed, and south as far as I could see any thing of it, as well as north to the bay (or river), was generally free from rocks, and what was not peaty could be fairly cultivated, although I could not call it good land.

There had been many pine trees on the higher ridges, but the timber has all been burnt, and there is now little of value.

The St. George's river, at or near its mouth, is a stream of from two to four hundred feet wide; the first four miles are too shallow and rapid for boats, making an ascent of one hundred and sixty feet in that distance. The next eight miles only rises sixty-eight feet, or eight and a half feet per mile, and has fair boating at a good pitch of water, but the channel is wide and soon gets very shallow.

Up to this point, although the land on either side of the river, within a mile of its shore, and often much less, attains an altitude of eleven hundred or twelve hundred feet; still there is flat ground enough for a road between the stream and the steep bank.

At sixteen miles from its mouth the river has attained an elevation of three hundred and fifty feet above the sea, and the next seven and a quarter miles has a mean rise of one in a hundred, attaining an elevation of seven hundred and thirty-five feet above tide. Here the banks are rough and jutting out into the river, sometimes making it difficult to maintain a grade at the required height; this is the worst part of the line.

Above this the river still continues to rise rapidly, but the shores are more level, and at twenty-six miles from its mouth we find the river issuing out of Silver Lake, a sheet of water about two miles long and half a mile wide, being eight hundred and twenty feet above the sea.

On the first ten or twelve miles from the mouth of the river there are some small pines, from fifteen to eighteen inches or perhaps more in diameter, growing on the slopes; they are not numerous, and above this they disappear.

The shores of the river all the way, except a few spots on the last three miles before reaching the lake, are covered with wood, the spruce and balsam, with a few white birches, ranging from four to eight inches diameter, rarely exceeding that; quite tall near the river, but decreasing in length as the altitude increases, the top of the country being generally bare.

The extent of wooded ground rarely reaches a mile from the river, and sometimes not more than half that distance.

There are a few spots of alluvial land, but they are so small and difficult to get at that they are of little value.

The valley of Stag Brook, by which we left the river St. George's wa'er, is so steep that I had to mount the side-hill ground all the way round Silver Lake, to enable me to reach the summit with a reasonable grade. At station two thousand one hundred and thirty-five from Seal Rocks we reached the summit which, after allowing for a cut of twenty-five feet, will be one thousand and eighty-seven feet above the sea—having, in seven hundred and fifty stations, made an ascent of seven hundred and fifteen feet. This very long continuous grade forces the line into rougher ground than might be found in the valley lower down.

From the summit, thirty-six feet of a descent, after allowing for the cut, brings the line to the shore of Paddle Lake, a sheet of water about four miles long and half a mile wide. The line follows the south shore to the outlet, having high broken ground to the right. This outlet, at about station two thousand three hundred and fifty, is the point of junction of the two lines previously referred to. The last line follows near the south shore of the next (Cache) lake. It is about three miles long and nearly one and a half miles wide. The shore is tortuous and the land high, requiring a very

curved line and heavy work. There is nearly half a mile of river connecting Cache and Bottle lakes. The line crosses this river, following the north shore of the first Bottle lake, recrossing at the narrows between the two Bottle lakes, and following the south shore of the second Bottle lake.

A line on the north of the second Bottle lake would either have to lose distance or pass over higher ground than the present line between Bottle lake and Gooseberry brook. But it is possible that a line might keep south of first Bottle lake without much increasing the distance, and save two bridges as well as some heavy work.

Thus far the line has followed the waters of Red Indian river ten and a half miles, and only made a descent of ninety-five feet. The course of the water is, I may say, the only practicable route the country affords, and there is not much choice of ground, or rather the choice is confined to very narrow limits.

In these ten and a half miles the country is thickly wooded, but the wood is almost confined to spruce and balsam. Between this point and the head of St. George's River there appears to be a good deal of wooded country, but the wood is all of the same character; the best of it will make sleepers, but it will require the best. The land is hard and stony with scant soil, indeed in many places none.

From the outlet of the second Bottle Lake there is nearly two miles of partially open ground, but this is all, except a few small spots from the mouth of St. George's River to Red Indian Lake.

Gooseberry Brook, coming in from the north, makes a rather deep valley between Bottle Brook and Red Indian River, and will require a pretty heavy fill and a crooked line. A further exploration might improve the line, but I think

it is necessary to get it on the face of the bank of Red Indian River as soon as possible, in order to attain a low level before reaching Otter Brook, which is the only serious break in the bank from where the line strikes the river to the narrows, where I propose to cross it.

The traverse line runs almost square down the bank to the shore of the Red Indian River, and follows the north bank, sometimes on flat ground and sometimes on the beach, when it ought to have been on the side of the bank; but my stay here being limited by the amount of provisions I had, I preferred to gain what knowledge I could of the general features of the country rather than delay by going too much into detail.

After following the north shore of the river for about eleven miles, the survey crossed where the river was broad and shallow; but lower down the high rocky banks approach each other within a little over one hundred feet, and although the direction is bad, I think it may be possible to cross with a span of not more than one hundred and eighty feet. It will be necessary to have the bridge high in order to get a practicable approach without very heavy rock cutting. Indeed the river is so straight and the banks so high, it makes it difficult to get an approach at all.

A little over a mile from the narrows we found the post left at the beginning of division B, at the still water of Red Indian Lake.

This post is by the first line we chained:

From Seal Rocks.....	3544.5	chains.
By the second line.....	3585	"
By air line N 8° 20' E.....	3529	"
By the approximate location....	3557	"
Increase over air line.....	428	"
Increase per cent. of air line....	13½	

Taking Norie's latitude and longitude of the Seal Rock, and our traverse, it would make the latitude of this post $48^{\circ} 33'$, and longitude $57^{\circ} 7' 10''$.

The Red Indian River, or that part of it followed by our line, is remarkably straight. On this stretch it will average over three hundred feet wide. It is a fair river to boat on in rainy weather, but must become difficult in a dry season; judging from the ice marks, both it and the St. George's River must be subject to high freshets in the spring, and sometimes ice jams. Its banks rise from three hundred and fifty to nine hundred feet above the stream. The foot of the bank on the south side is generally very close to the water, and is in some places too steep to bear timber. The north bank is well wooded with the usual species of spruce, fir, and white birch and some pine. Near the river it is very tall, decreasing in height towards the top of the bank, but it is no where large. The pine does not grow beyond the top of the bank, but there would be enough, I should think, for the purposes of the Railway construction in that vicinity. There appears to be nothing of value on the south side. I could see the mural face extending up river ten or more miles above the highest point of our line, and from the top of the bank the country looking southward was the hardest I had seen.

The road must follow on the slope of the north bank about five and a half miles. No doubt this will give pretty heavy quantities, but the next six and a half miles will be easy, so that I think the station on the Red Indian river will not give a much higher average than the other portion of the line, at least not much more than the general average of the St. George's river.

On the first line I ran from station one thousand seven hundred and eighty on the traverse (corresponding to two

thousand three hundred and fifty from Seal Rocks), to two thousand six hundred and fifty at Red Indian river. I have made a dotted line on the plan indicating where I think a possible line might be found, but it would pass over a summit about one thousand three hundred feet above the sea, and that summit is only five miles from Red Indian river, which at that point is but five hundred and twenty-five feet above tide.

On that line I think smoother ground would be found on the north side of Paddle Lake than on the south, and some heavy work would be saved at the summit between St. George and Red Indian waters; and I think a fair line might be found to the highest summit; but from that point I believe the best that can be done would be to obtain a grade of eighty feet per mile for seven miles, and then a grade of 1.00 per 100, or fifty-three feet per mile, for five miles more to the bridging place.

Otter Brook, which this line would follow, runs in an upstream direction for some distance, coming into the main river at a very acute angle, in which angle is Red Indian Look-out, a peak one thousand five hundred and fifty feet above the sea, and its top only about a quarter of a mile from the stream. It would thus require both a very long curve of small radius, and very heavy work to get on to the side bank in a direction to go down river.

On this line and to the north and west of it, there is much open ground, and in places I think it must attain an altitude of from one thousand six hundred to one thousand eight hundred feet above the sea; but south of this line, and up to our south or adopted line, the land that is not covered with water seems to be covered with woods of the common description. There are doubtless some openings, though un-

observable from any position from which I could get a view of the country.

Although this line did not turn out so favorable as I could have wished, yet the survey has added to our knowledge of that section. It has proved beyond dispute, that no line north of the Valley of Paddle and Bottle Lakes can be found so good as the line in that valley; and I think it has shown that a passage could be found here between the Red Indian River and the Humber, if it was wanted. The lowest summit on this passage would be by the way of Bottle Lake and passing between Cache and Gull Lakes, but it would be very much longer to Red Indian Lake than by way of Otter Brook.

The general character of the rocks is the same on the whole of this division: a hard quartzite rock, but I think generally not a true granite; it will be hard to work, without being good for building purposes. Although the rock is almost always near the surface, it is not much exposed, except where a fire has been, being generally covered with peat, moss or debris.

We saw no indications of mineral, except that the compass needle was much affected for a distance of six or eight miles.

As to the question of general route between the given points, Seal Rock and south-west angle of Red Indian Lake, I think it is hardly possible that a better line can be found than that indicated on our plan (No. 6). That it is the most direct, there can be no doubt. There is a watershed crossed by our first line, near station one thousand nine hundred and fifty on the traverse; it is some feet lower than our actual summit, but I think it connects with the Humber and is that above referred to. If these waters should be found to belong to St. George's River (which I do not think possible), about thirty or forty feet in summit height

might be saved, but it must make a large increase of distance to get back to Bottle Lake, or else contend with all the difficulties on the line by Otter Brook.

It may be barely possible that the valley of the Barachois River is smoother than that of the St. George's River, but the Red Indian River could not be reached from the Barachois without crossing the head of the St. George, thereby having two summits in place of one; and I do not think it possible to find any summit between St. George and Red Indian River and south of our line as low as that passed over. Hence, it being impossible to shorten the distance, and hardly within the range of possibility to improve the grades, there is but small chance of being able to improve the general route, although room for "any amount" of labour and skill in detail.

There is good *ballast* about the Barachois river, on the St. George's river about six miles from its mouth, and about nineteen miles from the mouth of the river. It is all on the south side. I have no doubt some will be found on Red Indian river, near the stream, but I saw no indications anywhere on the high land, so that the chances are that ballast will have to be hauled up hill, and sometimes probably long distances.

Ties of spruce and fir (balsam) will be found generally not very far from where they are wanted. I saw no tamarac worth speaking of, and the timber is generally too small for any other purpose than ties and the temporary work of construction.

It is said, and my own observations confirm it, that on the higher plains the snow drifts very much and forms high banks on the bushes or woods that it meets. Along a good deal of this line the woods are tall enough to form a shelter;

while they can be preserved; but I fear if the woods are killed or taken away it may be difficult to protect a road in those deep valleys. I suppose the snow would be blown from the plains into the bottom of them. It might make a great difference on which side of the valley the road was located, but on the Red Indian River there is absolutely no choice, and the St. George is not a great deal better.

I have great difficulty in forming an estimate both of work and cost, upon which I can myself put faith. The country is new to me, and I could not form so good a judgment as in a country I was more accustomed to. There is also great difficulty in getting a service road into the country; I feel doubtful about getting a summer road at all.

I have used my judgment in getting the best average I could of quantities, and I have used all the care possible, but the work must depend a good deal upon the grades and curves adopted. The grades that I have put upon the sections are 1 per one hundred (52·8 feet per mile), except in one place where it is 1·20 per one hundred. Less grades than this cannot be got; but in some places, by making them steeper, the work might be lightened. Going eastward the total rise is one thousand three hundred and forty-two feet, and the total fall eight hundred and twenty-four feet. The length of up grade in the same direction is 36·74 miles; of falling grades 23·84 miles, and of level 6·77 miles.

I have put in 5° curves (radius, one thousand one hundred and forty-six feet) in a few places where it will be nearly impossible to avoid them. There are a good many 4° curves, and the total amount of curvature of 7° per mile is very large, but the amount of tangents, 2094 chains (39·66 miles), or nearly 59 per cent, is more than I expected to find in such a country, and is not likely to be increased.

A series of tables, one to eight, are annexed, in which the various matters of estimate are given together. I have charged thirty cents per cubic yard for embankment, which is high, but I think not too high for the work and country. The cuttings are made light to avoid deep rock cuts as much as possible. The rock is hard and likely to be expensive; I have put it at \$1.50 per cubic yard, but I have not deducted it from the total embankment, which is thirty cents more, making \$1.80 per rock taken out of the road and put into bank.

The culverts of masonry I have marked and estimated large in size, thinking that the water must sometimes come down in large quantities.

In the tables there is an estimate for the cost of a road with culverts of masonry, and also for a road with trestle work in place of masonry; but there are three large bridges, two of them high (fifty feet), for which masonry is estimated in both cases. The use of timber only gives a saving of not quite \$3000 a mile.

The road with masonry culverts being \$26,862
 And with timber culverts..... 23,892

There is so little timber serviceable for structures to be found near where it would be wanted, no roads, and no means of getting it but by hauling long distances, that I can hardly think the use of timber to be recommended except very sparingly.

According to the above estimate per mile, the 67.3 miles from St. George's Harbour to the end of my division is,—

With all masonry..... \$1,807,812
 With timber culverts..... 1,607,632

This distance of 67.3 miles ends at station three thousand five hundred and fifty-seven on my approximate section,

which would be some distance at right angles to the general course of the line from Mr. Austin's post where his traverse began, but would correspond with station sixty-six on the approximate section of division B.

The plan and section of this division A are marked No. 6 in the series, being the most western division.

The general results of the survey of this division, as well as the estimates, are exhibited on the accompanying sheets in a tabulated form.

I purpose to further report at the earliest possible day, giving the results of the survey in the district of Avalon in the meantime.

I am, Sir,

Your most obedient,

THOMAS RAMSAY.

LIST OF TABULATED STATEMENTS FOR WESTERN
INTERIOR DISTRICT.

- No. 1.—Statement of lengths and curves.
2.—Statement of grades.
3.—Statement of embankment and rock excavation.
4.—Statement of masonry structures.
5.—Statement of timber structures.
6.—Approximate quantities with masonry structures.
7.—Approximate quantities with timber structures.
8.—Statement of streams crossed.

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF LENGTHS AND CURVES ON APPROXIMATE LOCATION.

Deflection.	Radii.	Degrees of curvature.	Degrees per mile.	LENGTH.		Percentage of whole.
				Chains.	Miles.	
1°	57·30	116	.....	115·60		
1½°	38·20	200	.....	132·80		
2°	28·65	593	.....	296·50		
2½°	22·92	139	.....	55·80	27·69	41·22
3°	19·10	1615	.....	531·30		
3½°	16·37	200	.....	57·00		
4°	14·33	814	.....	203·50		
5°	11·46	350	.....	70·00		
	Tangent.....			2094·50	39·66	58·88
		4027	70¼	3557·00	67·35	100·
Length of first traverse.....				3544·50	67·11	
Length of second traverse.....				3585·00	67·89	
Length of air line.....				3129·00	59·26	
Increase of location over air line...				428·00	8·10	13·64

NEWFOUNDLAND RAILWAY.

ST. GEGERGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF GRADES ON APPROXIMATE LOCATION.

Station 0 to Station 3557. St. George's Harbor to Red Indian Lake.	DISTANCE.		Percentage of Whole.
	Chains.	Miles.	
Level.....	357·50	6·77	10·05
0·50 per 100 and under.....	1835·50	34·76	51·60
1·0 per 100 and under to 0·50 per 100	1314·00	24·88	36·94
1·20 per 100.....	50·00	·95	1·41
Totals	3557·00	67·36	100
Distance rising eastward	1940·50	36·74	
Distance falling eastward	1259·00	23·84	
Level	357·50	6·77	
	3557·00	67·35	
Total rise eastward.....	1342 feet		
Total fall eastward	834		
Difference	508		

ATION.

Percentage of whole.

41·22

58·88

100·

13·64

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF EARTH AND ROCK EXCAVATION.

From St. George's Harbor to Red Indian Lake. Road bed
17 feet—cuts 22 feet.

67.35 miles.	Miles.	Cubic yards per mile.	Total Earth.	Total Rock.
Light work	20	15,000	300,000	
Heavy work	35	38,500	1,347,500	
This portion taken by average of other two..	12	31,000	37,200	
General average of rock..	67	5,000	.....	335,000
Total .....	.....	.....	2,019,500	335,000
Mean.....	1	30,000	.....	5,000

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF MASONRY STRUCTURES.

St. George's Harbor to Red Indian Lake—67.3 miles.

Structures.	No.	Size.	1st Class.	2nd Class.	Paving.
			C. yards.	C. yards.	C. yds.
Box culverts.....	60	3x4			
Box culverts.....	25	4x4			
Box culverts.....	16	4x5			
Open culverts	6	.....		
Beam culverts	6	.....	8,100	18,900	1350
Bridges	4	30			
Bridges	2	50			
Bridges	4	60			
Bridge	1	160			
Bridges	2	180			
Totals.....			8,100	18,900	1350

6.

ad bed

al Rock.

35,000

35,000

5,000

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF TIMBER STRUCTURES.

	FIL.	No. of Structures.	No. of Bents.	Timber. C. Ft.	Wrought iron	Cast iron.	Soft wood plank.	Hard wood plank.	Cribwork.
Trestle Culverts	2	} 13	26	5,200	650	140			
Trestle Culverts	4								
Trestle Culverts	6	20	80	19,600	4,000	600			
Trestle Culverts	8	22	88	23,320	4,400	680			
Trestle Culverts	10	10	40	10,920	2,000	300			
Trestle Culverts	12	22	88	24,000	4,400	660			
Trestle Culverts	15	10	60	17,800	2,000	300			
Trestle Culverts	20	12	96	32,600	2,400	380	50,000	8,000	5,000
Trestle Culverts	25	1	8	3,400	200	40			
Bridges.....	12	2							
Bridges.....	15	2							
Bridges.....	20	2							
Bridges.....	25	2							
Bridges.....	30	1							
Bridges.....	40	1							
Bridges.....	41	1							
Totals.....		121	486	136,840	30,050	3100	50,000	8,000	5,000

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

APPROXIMATE QUANTITIES. MASONRY STRUCTURES.

Sea! Rocks to Red Indian River. 67.35 miles.	Quantities.	
Clearing, acres.....	942	
Close cutting, acres.....	67	
Grubbing, acres.....	168	
Fencing, lin. feet.....	113,000	
Embankment, c. yards.....	2,019,000	
Rock excavation, c. yards...	336,500	
Under drains, lin. feet	101,000	
1st class masonry, c. yards..	8,100	
2nd class masonry, c. yards..	18,850	
Paving, c. yards.....	1,350	
Riprap, c. yards.....	2,350	
	Span.	
Bridge superstructure, 2 of	180 ft.	
Bridge superstructure, 1 of	160 ft.	
Bridge superstructure, 4 of	60 ft.	
Bridge superstructure, 2 of	50 ft.	
Bridge superstructure, 4 of	30 ft.	

000	5,000
3,000	5,000

6.

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

APPROXIMATE QUANTITIES. TIMBER STRUCTURES.

Seal Rocks to Red Indian Lake, 67.35 miles.	Quantities.	
Clearing, acres.....	942	
Close cutting, acres.....	67	
Grubbing, acres.....	168	
Fencing, lin. feet.....	113,000	
Embankment, c. yards.....	2,019,000	
Rock excavation, c. yards..	336,500	
Under drains, lin. feet.....	100,950	
1st class masonry, c. yards..	3,400	
2nd class masonry, c. yards	5,000	
Timber for culverts, l. feet	136,840	
Wrought iron, lbs.....	20,050	
Cast iron, lbs.	3,100	
Softwood plank, feet, b. m..	50,000	Board measure.
Hardwood plank, feet, b. m.	8,000	
Cribwork, c. yards.....	5,000	
Bridge superstructure, l. ft.		
<i>vide</i> last table	980	

NEWFOUNDLAND RAILWAY.

ST. GEORGE'S BAY, DIVISION A.—PLAN AND SECTION No. 6.

STATEMENT OF BRIDGES

Between St. George's Harbour and Red Indian Lake.

	Miles from Seal Rocks.	Span.	Height.
		Feet.	Feet.
Barachois River.....	2	160	30
Bog Brook.....	8	30	15
Deer Brook.....	17	30	15
South Branch St. George....	23	60	20
St. George River.....	29	180	50
Eagle Brook.....	31	40	25
Carter Brook.....	34	30	20
Cache Brook.....	47	60	40
Paddle Lake Narrows.....	49	60	12
Bottle Brook.....	51	60	12
Gooseberry Brook.....	54	30	25
Otter Brook.....	59	50	45
Red Indian River.....	66	180	50

