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REPORT

ON THE

TRAMWAYS OF NEW SOUTH WALES.



TRAMWAYS OF NEW SOUTH WALES.

Department of Public Works, Railway Branch,
Sydney, 1st Sept., 1880.

Sir,

I have the honor to supplement my report, for 1879, upon the Railways of the Colony, with a report upon the introduction and working of Tramways in the City and Suburbs of Sydney.

Mr. D. K. Clark, C.E. (whose exhaustive treatise upon the construction and working of Tramways is a recognised book of reference) says, very truly, that Tramways have been developed by dint of sheer hard work and persistency; and that they are now an accepted means of transport, urban and suburban, sanctioned by experience, approved and adopted by the public.

The first public Tramway established in this country was constructed and opened for traffic as far back as December, 1861. A Select Committee of the Legislative Assembly, for whose consideration and report "the Pitt-street Tramway Bill" was referred, gave it as their opinion that the construction of a Tramway to the semi-Circular Quay would lessen the cost of conveying railway stock and goods to and from the Railway terminus, and also facilitate the passenger traffic. They did not coincide with the objections which certain witnesses, whose evidence was taken by them, urged in opposition to the proposal, but considered that there were no difficulties which could not be overcome by proper arrangements, and, recognising the importance of affording within the City additional facilities for railway traffic, they recommended that the experiment of constructing a Tramway from the Redfern Station along Pitt-street to the Circular Quay should be fairly and fully tried.

One of the conditions of this experiment was that, in working the line, recourse should be had to horse traction only.

It was at first proposed to use the discarded "Barlow railway rails" for this Tramway; but, ultimately, Captain Martindale, who was then Commissioner for Railways, requested the Inspecting Engineer in England, Captain Galton, R.E., to select such rails as his experience and the opportunities which his position naturally afforded him of judging, would point out as the best, and also to select and forward two carriages for passenger traffic. This order was fulfilled in a far from satisfactory manner. The two tramcars sent out were so much injured in consequence of bad packing, that they had to be repaired and strengthened before they could be used, and the rails selected and forwarded ("Train's patent tram rails," the step-rail used to this day in America), were found to be unsuitable; the step of the rail from its flange was only $\frac{5}{8}$ of an inch, whereas the flange of the wheels intended to run between the step and the flange of the rail was 1 inch. To remedy this defect, the remarkable expedient was resorted to of reversing the rails, with, as might have been expected, very unsatisfactory results to the ordinary vehicular traffic. The line moreover was opened before it was consolidated; at least this

was

was the reason afforded for the large expenditure that had to be incurred to keep it in repair; and subsequent inquiry showed that the working expenses, in the first eight months of its operation, exceeded the earnings by over 38 per cent.

Very soon after its completion, the public, and more earnestly, the shop proprietors of Pitt-street, began to complain of the inconvenience it occasioned, and on the 25th July, 1862, a Select Committee of the Legislative Assembly was appointed, with power to send for persons and papers, to inquire into and report as to the desirability of its removal. The Committee submitted a progress report in December, 1862, but contented themselves with recommending the resumption of the inquiry at some future time.

It was not till November, 1865, that the inquiry was resumed; public dissatisfaction with the Tramway had, in the meantime, greatly increased more especially as regarded the manner in which the rails had been laid down, and when, on the 7th November, 1866, the report of the Select Committee, which recommended that the rails be taken up and finally removed, was adopted by the Legislative Assembly, the decision was hailed with general satisfaction.

In the meantime, street Tramway construction in other parts of the world had been undertaken with varying success. In America, and in some of the Continental Cities of Europe, they were pronounced to be completely successful.

Mr. Train constructed the first street Tramway in England, at Birkenhead, using the step rails. In 1860 and 1861, he laid down similar short lines in London—Bayswater Road and Kennington Road having been selected for the experiment.

After a brief experience of the inconvenience of the step-rails (an inconvenience which was aggravated in the case of the Sydney Tramway by their having been laid inside out) the lines laid in London were removed, whilst the Birkenhead Tramway and one or two others were only rescued from a similar fate by the timely substitution of flat-grooved for step rails. The grooves in the new rails were sufficiently roomy to afford free play for the flanges of the wheels, at the same time being sufficiently narrow to prevent the wheels of common road vehicles from entering them.

The construction of Tramways in England, and even in London, was not, however, discouraged for any lengthened time. In 1865, they were constructed in Liverpool, by consent of the Corporation; and in 1868, Parliament passed an Act giving encouragement to the construction of Tramways, thus affording the highest testimony in favour of these systems of conveyance. Before the close of 1870, there were 55 miles of street Tramway opened for traffic in London and its immediate neighbourhood, the North Metropolitan; while in the United Kingdom the length of these lines, at the close of 1873, exceeded 200 miles, and double that extent had been authorized.

I particularly take 1873, as a period for marking the progress made in the extension of Tramways, a second attempt having been made in that year to introduce them into Sydney. Mr. J. D. Larsen, C.E., who was the engineer and promoter, had been largely engaged in England and on the Continent in constructing Tramways with flat-grooved rails, which offered no obstruction

obstruction whatever to the ordinary street traffic. To carry the project into effect, a Bill was introduced into Parliament, in November, 1873, for the incorporation of the "Sydney and Suburban Street Tramway Company," with a capital of £95,000. The proposal embraced the laying down of Tramways (for horse traction only) on seven routes, some identical with and the others somewhat similar to, the lines, which, after an interval of seven years, the Government has now been authorised by Parliament to carry out. The Bill, after being read a first time, was referred to a Select Committee of the Legislative Assembly for consideration and report. Their report, with the evidence given, was laid before the House on 19th December, 1873, but no subsequent action was taken to promote the measure further, and the project was abandoned.

Four years afterwards, viz., in December, 1877, another attempt was made to establish Street Tramways in Sydney; the project was promoted by the Omnibus Company—the usual formula was gone through of introducing a Bill into Parliament, which was read a first time, and referred to a Select Committee of the Legislative Assembly for enquiry and report. The report was made on the 20th March, 1878, but it was not till February, 1879, that further action was taken; the second reading of the Bill was then moved, but the House was counted out.

The evidence, however, in favour of Tramways, which had been given at these inquiries and the discussions which followed, served to reconcile the public to the re-establishment in Sydney of this mode of transport. The proposal to construct a Railway, from the Redfern Station to the Circular Quay, by a route which must necessarily have cost, at the lowest computation, one million and a half of public money, had not met with popular favour, notwithstanding that the want of adequate means of conveyance, between the Railway Station and the business portions of the City, was felt to be, by the large and increasing population of the suburbs, a great and growing inconvenience. The additions to the traffic, moreover, which reasonably was expected to take place upon the opening of the International Exhibition and during its continuance, would, it was considered, greatly enhance the difficulty experienced in providing the means of transport. At this juncture, the Government, upon your recommendation, determined upon submitting a Bill to Parliament for the construction of a line of Tramway, from the Redfern Station to Hunter-street, via Pitt-street, Belmore Park, and Elizabeth-street—a length of 1 mile and 45 chains.

The prejudice, however, entertained by the public against Tramways, engendered by their experience of the line in Pitt-street, was still so great that it was thought expedient, in order to secure the passing of the measure, to accompany the proposal with an assurance that, as the Tramway was required to meet only a special emergency, it should be taken up, as soon as the Exhibition was over and provision had been made for the construction of a Railway Line to the central portion of the City.

Upon these terms the first reading of the Bill was carried by a large majority, the ayes being 31 and the noes 10. As the limited time at disposal for the construction of the line did not admit of a day's delay, this division which took place on the 13th March, 1879, was accepted as an indication that the Bill would be passed. Orders were at once given by cablegram for the importation
from

from America of the rolling stock, estimated as requisite for the conduct of the traffic, viz., four steam motors and six tramway-cars. The source from which the rails should be obtained was a question of great difficulty. Time did not admit of steel rails being imported from England, because—although for the rolling stock required we could wait until September in which month the Exhibition was to be opened—it would be necessary to have the rails and fastenings supplied as the work of construction proceeded, and it was indispensable that they should be on the ground not later than June. In this difficulty, Mr. D. Williams offered to roll the rails in the Colony (at the Esk Bank Iron Works) if supplied with old iron rails for the purpose. The offer was accepted, and the rails, which were designed to the “Larsen” pattern—62 lbs. to the yard, were successfully rolled. They have, however, proved to be far from durable, but this must be attributed to the bad English iron of which they were made, rather than to any defect in their manufacture. The “Larsen” rail, moreover, was originally designed for a horse Tramway. The rolling load over the rails, if horse-power instead of steam-power had been adopted, would have been considerably less, and the life of the rails would have been proportionately greater.

The estimated cost of the line (without the pavement, which was proposed at first to be dispensed with, or shed and workshop accommodation, but inclusive of rolling stock) was £14,000. The actual cost was £22,269, the increase being caused by the paving of the road subsequently found to be necessary, and the expense of providing shed and workshop accommodation which was also indispensable.

As the line was to be an experimental one, the success or failure of which would, in a large measure, determine the question of the adoption of street Tramways for the City of Sydney, it was considered desirable that it should be constructed in the most perfect manner, and equipped with the best known appliances for working the traffic. It was decided that steam would furnish the best motive power, and although the superiority of steam power over horse traction for Tramways was not by any means universally admitted—in fact, not only its superiority but its adaptability was denied by many—the result has shewn that the decision was wise and judicious.

The Railway Engineers of the department, although they suggested and surveyed the route to be followed, expressed a disinclination to be connected with the carrying out of the work, and the Government appointed Mr. Gjedsted to superintend the construction of the line. Mr. Gjedsted, who was at the time employed as a draftsman in the office of the Engineer-in-Chief, had been engaged in Tramway construction in England, Ireland, and Denmark, and had come to the Colony in 1873 with Mr. Larsen to assist him in the project of establishing Tramways in Sydney.

In his book on Tramways, Mr. Clarke says, “there exists a sentiment, which is somewhat prevalent, that Tramway engineering is but a humble branch of the profession. The sentiment, born of self-complacency, is delusive; Tramways cost half as much as Railways, and they earn more money by the mile; they have involved as much blundering as Railways; like Railways they have exhausted reputations, and, unassuming and unobtrusive as they are, Tramways have been the subject of a wide range of experience.”

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The line from Redfern to Hunter-street, which was successfully carried out, by day labour, under Mr. Gjedsted's superintendence, was opened for traffic on 16th September, 1879, the day prior to the opening of the International Exhibition, and at once became popular. In the 106 days which followed between the date mentioned and the close of the year, 443,341 passengers were conveyed upon it, equal to a daily average of 4,182. Its success, financially, was found to be correspondingly great, and although the cost of renewals and the decrease of traffic following upon the close of the Exhibition will, no doubt, abate the large return which the net results, at the close of 1879, showed the line to be paying upon the capital invested, the transactions to this date disclose a sufficient margin of profit to prove conclusively that Tramways in Sydney, under efficient and economical management, can be made very profitable undertakings. In the Appendix will be found a statement, giving in detail the capital cost of the line and particulars of its revenue and expenditure to 31st December, 1879. Appendix A,
p. 43.

The success of this experimental line revived the project of the Sydney Omnibus Company to establish Tramways in the principal streets and suburbs of Sydney; but popular opinion was in favour of Tramways being constructed and worked by the Government rather than by private enterprise. The reasons which were given in favour of this course may be briefly summarised as follows:—

1. The Tramways, if constructed by the Government, would be of a more durable nature, and more complete in their arrangement and equipment.
2. The rates of conveyance would be more permanent, local causes not being allowed to affect them to the same degree, and the fluctuations so often prevailing with undertakings in the hands of private Companies would be avoided.
3. Greater civility and attention would be assured from the employees, as they would be more directly the servants of the public.
4. The Government, looking only for a fair return on the capital invested, would make more moderate charges than a Company whose aim would be to obtain as large dividends as possible for its shareholders.
5. A Company would not construct a line unless assured that it would yield an *immediate* return upon its outlay, and thus Tramway accommodation would be denied to many places, the future prosperity of which would be dependent upon increased means of communication.

You will doubtless, Sir, remember the number of deputations which waited upon you on this subject, especially a large and influential one, including in its numbers the representatives of no less than twenty-two suburban Municipalities, all of them desirous that the new system of steam Tramways established by the Government should be continued under its control, and extended to their respective districts.

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The natural arbiter for deciding the question was, of course, the Parliament of the Country. On the 25th November, 1879, the "Sydney City and Suburban Tramway and Omnibus Company's Bill" was brought in, and two days afterwards, you, Sir, formally moved—"that the House should resolve itself into a Committee of the whole, to consider the expediency of bringing in a Bill to empower the Government to construct Tramways." This was assented to on the 19th February, 1880, and the Bill was read a first time on the 24th of that month.

In the meantime the Bill of the Company had been referred to a Select Committee for consideration and report. On the 26th February, 1880, the Committee reported and laid the evidence they had taken on the table of the House; the Bill, however, was finally withdrawn on the 30th April following, on which date the order for its second reading was, by resolution of the Assembly, discharged from the business paper.

The measure of the Government, which was entitled "A Bill to authorise the construction and maintenance of Tramways along certain streets and highways in the city and suburbs of Sydney and elsewhere," after passing through the usual intermediate stages, was finally assented to on the 28th April, 1880.

The following is a list of Tramway routes which that Act (43 Victoria No. 25) authorises to be carried out:—

- No. 1. A line to commence in Elizabeth-street at Hunter-street, then passing along Elizabeth-street, Liverpool-street, Oxford-street, and Old South Head Road, and terminating in this road at or about Moncur-street.
- No. 2. A line to branch off the line in Oxford-street, thence passing along Crown-street and Cleveland-street, and terminating at Randwick Road.
- No. 3. A line branching off the line at Darlinghurst, then passing along Botany-street, Randwick Road, and Avoca-street, and terminating in this street in Randwick.
- No. 4. A line to branch off the line at Darlinghurst, then passing along Darlinghurst Road, and terminating opposite William-street.
- No. 5. A line to branch off the line at Paddington, thence passing along Piper-street and Upper Ocean-street, and terminating at Woollahra.
- No. 6. A line to be a continuation of line No. 1, to commence at Paddington, then passing along Old South Head Road, Brisbane-street, and Cowper-street, and terminating at Charing Cross, Waverley.
- No. 7. A line to commence in York-street, at Charlotte-place, then passing along York-street, through Druitt-street, along George-street, across the Railway Bridge, and along Parramatta-street, and terminating at the Glebe.

No.

- No. 8. A line to branch off the line in Parramatta-street, then passing along Regent-street, Botany-street, and Botany Road, and terminating at the Toll-bar, Waterloo.
- No. 9. A line to commence at the Glebe, branching off the line No. 7, then passing along Newtown New Road, Newtown Road, across Railway Bridge, Newtown, along the Enmore Road towards Marrickville, and terminating in that Municipality.
- No. 10. A line to commence at the Glebe at the termination of line No. 7, then passing along the Glebe Point Road, and terminating in this road at the Glebe Point.
- No. 11. A line to branch off line No. 7, in Parramatta-street, then passing along Harris-street, and terminating at the intersection of this street with John-street at Pyrmont.
- No. 12. A line branching off line No. 9, at the Railway Bridge, Newtown, then passing along Cook's River Road, and terminating at Cook's River, parish of St. Peters.
- No. 13. A line to commence at the termination of line No. 8, in Waterloo, then passing along the Botany Road, and terminating at a place called Banks' Meadows, at Botany Bay.
- No. 14. A line to branch off the Glebe Point line, No. 10, and then passing through the suburb of Forest Lodge, and terminating at Camperdown.
- No. 15. A line to commence at the Railway Station, Campbelltown, passing along the Camden Road, through the township of Narellan, across the Camden Bridge, and terminating in the town of Camden.

By the 2nd section of the Act authority is given for the construction of Tramways along any other route or routes within the City of Sydney and Suburbs thereof which may be approved by the Governor with the advice of the Executive Council, and by the 4th section, authority is given, under like approval, for the construction of Tramways from points along the line of any Government railway to places distant not more than 50 miles therefrom, but it is provided, in regard to these latter lines, that before they shall be commenced, the plans and books of reference of the routes which they are to follow shall be laid before and be approved by Parliament.

In the Loan Act of 1880, assented to on the 12th July, the sum of £600,000 was provided for the construction of the Tramways authorized by the Tramway Act, and no time was lost in commencing some portion of the works and ordering the necessary rolling stock for carrying on the traffic as soon as the lines should be completed. Portions of lines Nos. 1 and 3, from Hunter-street along Elizabeth, Liverpool, and Oxford Streets, and thence by Botany-street, through Moore Park, to a point opposite the gates of the Randwick Racecourse, have been nearly completed and will be opened for traffic in a few days; and a tender has been accepted for the construction of the lines to Woollahra and Waverley, and also from Oxford-street along Crown-street to Cleveland-street.

In the Appendix will be found a statement of the contract price for these lines, and particulars of their respective forms of construction.

Notwithstanding

Appendix B.
p. 45.

Notwithstanding that tramways have been the subject of a wide range of experience, the best mode of constructing them is still a vexed and unsettled question. It is admitted by tramway engineers that, in consequence of the imperfect state of the permanent way, there is scarcely a town tramway in the United Kingdom on which locomotives could be economically employed; and Mr. Henry Vignoles, civil engineer, has stated that even for horse traction it is evident to all engineers who study the subject carefully, that there are many defects, extending to the latest improvements, in the permanent way of tramways.

Mr. R. Price Williams, who is an accepted authority on iron ways, stated, so lately as April last, at the spring meeting of the Institution of Mechanical Engineers, "that engineers were now feeling their way with regard to the permanent way of tramways just as they did in the case of railways. Many members could remember, as he did, the time when Mr. Bridges Adams gave an exhaustive paper on the permanent way of railways. A great variety of designs were then discussed, all of which (Mr. Adams's included) had since disappeared." Mr. J. D. Larsen, C.E., whose design of rail was adopted for the line between the Railway Station and Hunter-street has recently abandoned it for a rail better adapted for steam traction; and he points out that lines constructed with the lighter rail have been unfairly handicapped by being called upon to perform duties for which they were never designed or constructed; for, by the substitution of steam traction for horse power, in addition to the rails having to carry three times the load, all the tractive force is transferred from the roadway to the rails.

The question of the proper weight of rail which should be used for tramways worked by steam traction was also discussed recently before the Institution referred to. Mr. B. C. Brown, C.E., gave expression to his belief that "very few, even of those tramways which had never had an engine on them, were fit for anything. He had to look at this tramway question, not only as an engineer, but also as a Town Councillor, and it appeared to him that whatever system had been adopted, almost all roads were made far too light, not so much for the tramway work, as for the other work that came upon them * * * * heavily loaded vehicles, once crossing over a tramway, might so injure it as to make it very awkward for either cars or engines passing over it afterwards." While these views found support at the hands of Mr. T. R. Crampton, C.E., who gave it as his opinion that a tramway road should be much stronger, not lighter than the ordinary railroad, Mr. Henry Vignoles, C.E. (whose design of railroad rail has been so extensively adopted) says, with regard to economy in the cost of construction, that "No system, however perfect, can be favourably entertained by shareholders unless the first cost can be shown to be moderate. It is well known that some of the tramways in the metropolis are now being renewed, almost regardless of cost, with rails weighing 90 lbs. per yard," and he adds "I should feel ashamed to tell any Board of Directors that rails weighing 90 lbs. per yard were necessary for a tramway."

I have thought it advisable to quote some of the varying authoritative opinions upon which the whole body of engineers seems to be divided, in order to show that nothing very definite or final, in regard to either the form and weight of rail or the best mode of constructing tramways, has yet been arrived at. With this information before me I was not unprepared to learn from our tramway

tramway engineer (Mr. Gjedsted) that he proposed to abandon the form of rail used in the Elizabeth-street line (the “Larsen” rail,—abandoned also by its original designer as being too light for steam traction), and to substitute a heavier rail, designed, in some respects to “Barker’s form of rail,” but differing from it in many important points.

With your concurrence, tenders were invited for a small quantity of these rails, to be made from colonial mine iron, sufficient to test, in a practical way, their adaptability to our requirements, as to which I was in some doubt. Though urged to do so, I have refrained from recommending that *steel* rails, as designed by Mr. Gjedsted, be ordered from England, considering it essential, on the grounds of economy and prudence, that we should first be satisfied that the design of rail is a suitable one, before any large expenditure for the requisite supply is incurred. About 5,000 tons will be required for the tramways authorized, and their cost, delivered in the Colony, will not be less than £55,000.

Only one tender was received for the rails to be made from colonial mine iron, viz., that of Mr. Enoch Hughes, of the Eskbank Iron Works; his price is £11 5s. per ton for 420 tons delivered at the Redfern Railway Station. These rails are being used for the line in Oxford and Botany Streets, and also for the double line in Elizabeth-street.

MOTIVE POWER FOR WORKING TRAMWAYS.

The uncertainty which exists as regards the proper form and weight of rail, and the best mode of constructing tramways, extends also to the motive power to be used in working them. It seems to be generally agreed that mechanical power will, to a greater extent than has heretofore been the case, supersede horse traction; and with this object in view, several mechanical appliances have been and still are on their trial, while some have already been abandoned as not fulfilling the recognized requirements.

The conditions imposed by the English Board of Trade to admit of locomotives being used in the streets of London are—that there must be no visible smoke or steam, no visible fire, no noise of either blast or machinery, and no visible working parts. The object of all these restrictions is to avoid frightening horses or annoying the public.

The speed is limited to 8 miles an hour, and the Board of Trade requires that a speed indicator always visible to the driver, a governor, brake-power sufficient to stop the engine in its own length, and a bell or whistle for signalling be in use on all tramways worked by steam.

The types of tramway engines already established are (1) the independent locomotive class, (2) the combined engine and car, (3) the fireless locomotive, using steam, and (4) the compressed air engine. There are also gas engines, and engines worked by electricity, but these have not yet been brought into practical use.

Mechanical power, as applied by the fireless locomotive and the compressed air engine, requires the employment at the terminus of the tramway of a fixed engine for supplying steam or for compressing air. Where compressed air is used as a motive power, it has been found by experiment "that the resultant efficiency of the running engine, as compared with the stationary air-compressing engine, rarely exceeds 30 per cent; consequently the difference in cost, under the most favourable conditions, will be as 3 to 1 against compressed air. This difference is sufficient to justify us for the present in discarding the idea of compressed air as a motor for tramway purposes. The same objection applies, though not perhaps to the same extent, to the hot water or fireless engine, invented by Dr. Lamm, of America. Several modifications of this type have been tried with varying success. The chief reason that its use has not been extended is doubtless the financial difficulty, that is, the cost of working."

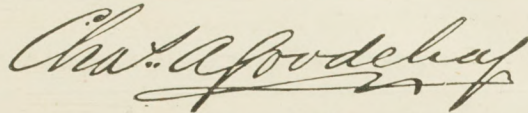
It is clear that recourse must be had to the ordinary steam motor until further experience shall have demonstrated the superiority of engines worked by compressed air, gas, or electric power, or of the fireless locomotive. The question as to whether it is more advantageous to have engine and car combined, or a separate motor, depends much upon the character of the work to be performed. In cases where the number of passengers to be carried exceeds the number that can be accommodated in one car, then an independent engine, of sufficient power to haul two or three cars, would seem to be not only preferable but necessary; where, however, the traffic is light and constant, nor liable to be occasionally increased beyond the carrying capacity of one car, the "combined engine and car" has advantages which should not be overlooked. The most important of these advantages is that, as the necessity for increased adhesion arises, this essential is supplied by the cause which renders it necessary, viz., the increased weight of additional passengers, the wheels of the motor acquiring, through this additional weight, the necessary adhesive power to overcome the resistance.

The number of passengers, travelling between the suburbs of Sydney and the city, was known to vary considerably at different hours of the day, and it was therefore thought desirable to import the independent motor for our tramways, as being more efficient for all purposes than the combined engine and car. Four of them, as previously stated, were ordered from the Baldwin Company at Philadelphia, for the line from the Redfern Station to Hunter-street, and six additional motors, with improved gearing and fittings, were subsequently ordered from the same firm when the extension of the tramway system was decided upon. It is estimated that sixty motors will be required to work the traffic on the tramway lines which have been authorized. A photographic view of one of the motors, with cars attached, forming an ordinary tramway train running in Elizabeth-street, will be found in the appendix.

In submitting this resumé of the history of the introduction of Tramways in New South Wales, and the present aspect of the system as established in the United Kingdom, I feel I am entitled to congratulate
you

you upon the success which has so far attended the scheme of Steam Tramways for the City and Suburbs of Sydney, and to express my belief that when the initiatory difficulties (inseparable from the introduction of all new undertakings) shall have been overcome, Steam Tramways in New South Wales will confer upon the Colony all the numerous advantages which have followed their introduction in other parts of the world.

I have the honor to be,
Sir,
Your obedient Servant,

A handwritten signature in cursive script, reading "Chas. A. Fox". The signature is written in dark ink and is positioned above the printed name of the Commissioner for Railways.

The Honorable John Lackey,
Secretary for Public Works, &c., &c.

Commissioner for Railways.

APPENDIX A.

TRAMWAY—REDFERN TO HUNTER-STREET.

CAPITAL EXPENDITURE.

	£	s.	d.
Construction	15,227	0	0
Rolling Stock... ..	6,547	0	0
Machinery	287	0	0
Furniture	208	0	0
Total	£22,269	0	0

STATEMENT OF TRAFFIC—16 September to 31 December, 1879.

Months.	Number of Passengers.					Gross Revenue.			Discount allowed.	Total net Revenue.
	By Tickets.	Cash fares.	School Children.	Free.	Total number of Passengers	Tickets sold.	Cash Fares.	Total.		
September.....	15,326	12,798	...	...	28,124	£ s. d. 206 12 0	£ s. d. 161 3 9	£ s. d. 367 15 9	£ s. d. 6 0 0	£ s. d. 361 15 9
October.....	82,778	43,322	764	...	126,864	780 9 11	546 4 9	1,326 14 8	23 2 0	1,303 12 8
November.....	107,940	34,431	484	...	142,855	1,045 6 7	433 7 1	1,478 13 8	36 17 6	1,441 16 2
December.....	109,659	35,279	40	520	145,498	906 14 0	441 5 3	1,347 19 3	38 15 6	1,309 3 9
Totals.....	315,703	125,830	1,288	520	443,341	2,939 2 6	1,582 0 10	4,521 3 4	104 15 0	4,416 8 4

RETURN OF EARNINGS AND EXPENDITURE.

	£	s.	d.	£	s.	d.
Superintendence and Office Expenses	410	1	4			
Running Expenses—Motors	1,010	6	11			
" Cars	370	3	11			
				1,380	10	10
Repairing Expenses—Motors	87	10	9			
" Cars	33	6	6			
				120	17	3
Maintenance and Renewal of Way	222	10	6			
General Expenses	143	16	11			
Total Working Expenses	£ 2,277	16	10			
" Earnings	4,416	8	4			
Net Earnings... ..	£ 2,138	11	6			
Proportion of Expenditure to Earnings	51	59				
Number of Miles run	13,270					
Total Earnings per Train Mile	79	87	d.			
" Expenditure do.	41	19	d.			
Net Earnings per Train Mile	38	68	d.			
Interest on Capital	33	%				
Rolling Stock—Number of Motors... ..	4					
" " Cars... ..	6					

APPENDIX B.

RETURN showing the prices paid for materials and work for the Tramway Lines.

Crown-street Line and Extension to Woollahra and Waverley. Contract No. 2E.	Materials and Work.	Doubling Line, Redfern to Hunter-street, and Single Line from Liverpool-street to Moore Park, via Oxford and Botany-streets. Contract No. 1E.	Line through Moore Park. Contract No. 1E.
£ s. d. 11 5 0	Rails, per ton	£ s. d. 11 5 0	£ s. d. 11 0 0
7 11 6	Chairs, per ton	7 17 6	.....
32 0 0	Fastenings, per ton	20 5 0	£12 10s., £20 10s., £42
1 12 0	Cube sets, „	£1 9s., £1 12s.	.....
4s. and 4s. 6d.	Sleepers, each	£3,600 per mile.	£1,700 per mile, single line.
2s.	Ballast, per lineal yard		
12s.	Concrete „		
4s. 3d.	Excavation, per cubic yard		
3s.	Laying Permanent Way, per lineal yard ... ..	.....	.....
1s. 9d.	„ Paving, per sup. yard		
.....	Cost of Platform, approaches, gates, &c. ... ..	.....	£550

Description of construction, &c., of Tramway Contracts.

CONTRACT No. 2E.

This contract, undertaken by Messrs. Topham, Angus, & Co., is for the construction of three lines of tramway—

- 1st. From 1 mile 19 chains Oxford-street, along South Head Road, and terminating at 4 miles at Charing Cross, Waverley, a distance of 2 miles 61 chains.
- 2nd. Commencing at 2 miles 28 chains South Head Road, along Piper, and Ocean streets, and terminating at 3 miles 14 chains Ocean-street, Woollahra, being a length of 66 chains.
- 3rd. Commencing at 1 mile 7 chains Oxford-street, along Crown-street, and terminating at 1 mile 76 chains Cleveland-street, being a length of 69 chains.

The contractor has to supply all materials required under this contract (with the exception of rails chairs, fastenings, and cube sets, which are supplied by the department), and all labour necessary for the full and proper completion of the contract.

The lines are to be constructed in the following manner:—A trench 8 feet 3 inches wide, and 1 foot 2 inches deep for the straight portions, and 1 foot 4¼ inches for curves, is to be made in the streets, the bottom to be perfectly level, and beaten to secure a uniform bearing. The trench is then to be ballasted with good bottom block sandstone, broken to a gauge of 3 inches, and laid to a thickness of 4 inches on the straight portion of the line, and on curves sufficient to give the proper super elevation to the outer rail. The sleepers are then to be laid on the ballast, and after the rails have been securely fixed to them and raised to the proper level, the ballast is carefully packed and beaten underneath the sleepers. The space between the sleepers, and to a height of within ½-inch from the paving sets, is then to be laid with concrete composed of—

Blue metal, broken to a gauge of 2 inches	... ..	6 parts.
Cement	... ..	1 part.
Sand...	... ..	1 „
Total	... ..	8 parts.

Sleepers to be of approved hardwood, sawn to size, and cut when the sap is down. The intermediate sleepers are to be 8 inches × 4 inches × 8 feet long, the joint sleepers to be 12 inches × 4 inches × 8 feet long, the distance from centre to centre throughout to be 2 feet 11½ inches.

The cube or paving sets are placed on a layer of coarse sand or gravel, ½-inch thick, and grouted with a mixture of coarse sand, and lime, in the proportion of four parts of sand, to one part of lime, and properly rammed to the required levels of the streets.

Contract to be paid for at Schedule rates. See above Schedule.

CONTRACT

CONTRACT NO. 1E.

This contract, undertaken by Messrs. Topham, Angus, & Co., is for the construction of the following lines:—

- 1st. For single line from Hunter-street to Redfern Railway Station, alongside the present line, a distance of about 1 mile 23 chains.
- 2nd. A single line, commencing at the intersection of Elizabeth and Liverpool streets, and passing along Liverpool, Oxford, and Botany streets to the Randwick Road, being a distance of about 1 mile 10 chains.
- 3rd. A double line, commencing at the termination of the second line, and passing along the side of Randwick Road, terminating at Randwick Racecourse, being a distance of about 1 mile 63 chains.

The first and second lines are to be constructed in the same manner as Contract No. 2E; No. 3 line is to be laid as a double line of tramway, with single-headed rails weighing 42 lbs. to the yard.

The ballast for No. 3 line is to be of sand-stone, broken to a gauge of 3 inches, 11 inches above the level in the centre and $13\frac{3}{4}$ inches at the ends of the sleepers. The width of ballast at bottom is 21 feet $9\frac{1}{2}$ inches for the double line, and the width at the top is 18 feet $7\frac{1}{2}$ inches.

The sleepers for No. 3 line to be of approved hardwood, sawn to size, and adzed to form the bed for the rail. To be throughout 8 inches $\times$ 4 inches $\times$ 8 feet long; the distance from centre to centre of intermediate sleepers to be 2 feet $7\frac{1}{2}$ inches and 2 feet $8\frac{1}{2}$ inches; where joints occur the sleepers are to be placed 2 feet 3 inches from centre to centre.

The contract to be paid for at per mile of line; extras to be paid for at the following Schedule rates:—

	Nos. 1 and 2 Lines.		No. 3 Line.	
	s.	d.	£	s. d.
Excavation, per cubic yard	4	3	0	4 3
Ballasting, per lineal yard	2	3	0	7 6
Concreting, „	17	6		.....
Laying permanent way, per lineal yard	4	0	0	2 9
„ paving, per superficial yard	2	6		.....
Sleepers, each	{ 4 9		}	0 4 9
	{ 5 9			
Extra ballasting, per cubic yard	7	6	0	7 6
Brickwork in cement, for culverts and drains, per cubic yard			4	0 0
Drain pipes, 12 in., per lineal foot			0	2 6
„ 18 in., „			0	8 0
„ 24 in., „			0	16 6
Timberwork in bridges and retaining walls, every description, per cubic foot			0	5 0
Ironwork in bridges, &c., per lb.			0	0 7
Kerosene tarring, two coats, per superficial yard			0	0 8

Sept. 1, 1880.



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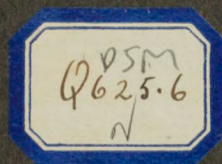
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