

" CABLE AND ROPE TRACTION "

(Bucknall Smith)

ENGINEERING 1887

During the construction of the Highgate Hill cable tramway, London, a similar project was promoted in the City of Melbourne, Australia, and the requisite colonial Parliamentary powers for same were obtained in November 1885.

Before such powers were actually granted, it was arranged that Mr. F. B. Clapp and Mr. G. Duncan, the future managing director and engineer respectively to the enterprise should visit America and Europe respectively, in order to collect all useful information pertaining to modern systems of tramway traction, so that the best or most appropriate construction and methods of locomotion might be adopted. The Australian authorities wisely laid stress upon their desire that an engineer of some special technical experience should be retained as they considered it would probably prove an expensive and unsatisfactory matter to have to "educate and engineer to the cable business". It was appreciated that such a system would have to be very carefully designed from practical experience, otherwise breakdowns or vexatious delays and losses would probably arise. Ultimately it was decided that the various local authorities should build the tramways themselves, and lease them for working to a company for 30 years. This decision rendered necessary the formation of some "legal" Trust. The requisite election of trustees was accordingly arranged, comprising members of the city and municipalities, Alderman O'Grady acting as chairman.

The engineer, etc, having settled the requisite plans and specifications for the works, estimated to cost about £800,000, (independently of rolling stock which the working company has to provide), the next then and most important matter was to raise money for such operations.

At the close of October 1884, the Commercial Bank of Australia, and the Royal Bank of Scotland (representing the City of Melbourne Bank Ltd.) were instructed to negotiate a loan in London of 500,000 for this business enterprise, under the following terms:- "Colony of Victoria, The Melbourne Tramways Trust Loan, for £500,000, in 4 1/2% debentures, guaranteed by the City of Melbourne and the suburban municipalities jointly, and served under Acts of the Victorian Legislature!"

This loan was well received in London, so that little delay was occasioned in raising sufficient capital to commence this important tramway undertaking.

One page two is a plan of the City of Melbourne with its surrounding localities and in it are marked the various routes of authorised "cable tramways" which amounted to about thirty-four miles in length. Further there was to be sixteen miles of horse lines, this giving an aggregate of fifty miles of tramways to be constructed.

The total cost of construction is about £950,000 exclusive of rolling stock requirements.

In the scheme, as at first projected, the approximate value of materials plant and machinery, etc to be imported into the colony was about as follows:-

Rails and appendages.	£88,000
Slot Beams.	44,000
Tube Frames.	36,000
Wire ropes.	13,000
Tie-rods, Bolts etc.	12,000
Engines and Machinery	22,000
Portland Cement.	91,000
TOTAL VALUE	£306,000

According to clause 14 of the 4th schedule of the principal Act of Parliament the whole of the lines above must be constructed by October 1889. This required vigorous action to comply with the above schedule.

The Richmond and Brunswick sections have been already satisfactorily constructed and were opened for public traffic. The system will cost an average of £22,000 per mile, the heavier horse line costing about £14,000 per mile exclusive of equipments, land and buildings.

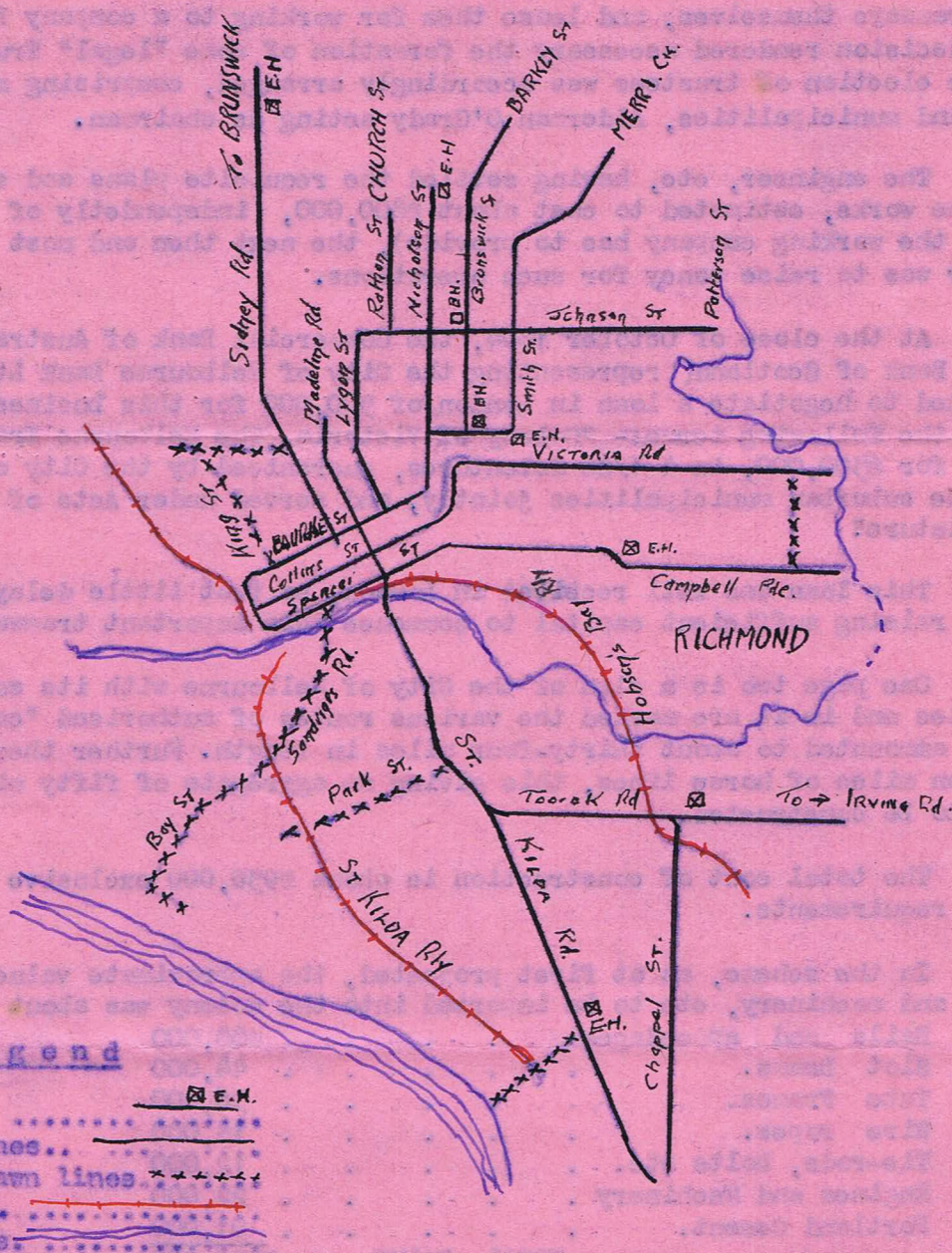
Steel rails varying from 67lb to 87lb per yard were laid throughout the

These cable lines amounts to 2,000 indicated horse power, which will be distributed over the system from eight independent engine houses. The engines are to be of the high pressure horizontal type throughout, fitted with automatic expansion gear, the average size of cylinders being 24" x 48".

The boilers to be used are of the Babcox and Willcox type. The engines will be driven at about 45 revolutions a minute, imparting a velocity to the cables around 575 feet per minute through the intervention of the usual gearing.

The cables will be composed of steel wires measuring about 3 1/2 inch in circumference, and having a tensile strength of about 90 tons per square inch of sectional area. The longest cable to be used in one length, will be about four and a half miles, or through two and a half miles of double track. The cables were manufactured by Messrs Sullivan and Co., of Millwall England and Messrs Cradlock and Co., of Wakefield and sent out to Melbourne for these lines. These ropes contain about 24 tons of wire in one continuous length i.e. without "tucking or splicing" a strand and involve special machinery for their manufacture.

MAP in reference to the Cable tramways mentioned herein.



The maximum gradient on the system is about 1 in 14, but generally the grades are fairly easy considerable portion being almost level for long sections.

Dummy or "Grip cars" with one ordinary car "Trailer" attached will be used throughout the system. These cars will hold a seating accommodation for 22 passengers, but no outside accommodation was supposed to be permitted.

The working company was required to pay the interest on the borrowed capital and it further had to pay the tramway "Trust" 1 1/2% per annum during

the first ten years of the lease, 2% during the second ten years, and 3% during the third period of ten years lease. The last amounts being set aside to form a sinking fund for redeeming the debentures at maturity and would thus ultimately secure the entire system for the local authorities free of cost to them. The working company is allowed to charge 3d. fares during the first ten years of the lease, after which the result of working could be reviewed and terms then be revised.

On certain sections, a fixed number of workmens cars were run at half-fares, but the introduction of the general 3d. fare was considered to place the company in a strong position. This tramway undertaking should prove remunerative if the ultimate capital cost be not too heavy.

The operation of threading the cable from the engine house at Brunswick street to Spencer-street and back a distance of three and a half miles was watched with great interest by a large number of spectators. The rope weighed 28 tons, and was manufactured by Messrs. Cradock and Company. This was rolled on an immense drum, and had to be drawn from same through 1 1/4 miles of covered track and back again. The end of the cable was made fast to the gripper of one of the cable Dummies which was then drawn forward by a gang of men carrying the rope with it. In a short time, however, the resistances became too great to be overcome in this manner and horses were bought into use. Eight horses were harnessed, but proved too few, when four more were added. These carried the dummy along for some time until the gripper suddenly snapped, and operations had then to be suspended until it was welded. A fresh start was made two hours later, and the terminus was ultimately reached without any serious mishaps. The cable was then led around the end pulley by means of a short auxiliary piece which had been previously placed into position, and then the return journey was made this time with twenty-four horses.

Six wire ropes have been supplied to the tramway by Messrs. Cradock and Company, making an aggregate length over 45,400 yards and weighing 134 tons. The longest rope was 8,500 yards, and all were made of patent crucible steel wires, to 3 5/8 inch in circumference.

It is now proposed that some of the horse tramways already planned and authorised shall be modified to permit cable traction being used. These lines were to be in Hotham, City of Melbourne (West Melbourne), South Melbourne, and Port Melbourne.

The modification necessitated the alteration of routes and largely increased the expenditure.

The South Melbourne line of 1 mile 75 cost £58,750. The Port Melbourne line of 2 miles 30 chains amounting to £74,625, buildings £9,000, engines and gearing £15,000, ~~GAS & WATER PIPES £3,000, DRAINAGE £19,000,~~ totalling in all 145,375 or £99,000 more than the projected horse tram lines. The Hotham and West Melbourne lines which covered 3 miles 55 chains of lines cost for construction £68,750, land £6,000, buildings £19,000, engines and gearing £12,000, pipes and drainage £9,000, totalling £104,750, or £80,750 more than the horse line. The cost of completing these authorised schemes for the northern lines as cable line amounted to £769,000 and as horse lines £19,500. For the southern lines, cable lines amounted to £275,000, and horse lines would be £82,000. The total cost of authorised tramways at this outset amounting to £1,146,400 all told.

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