

REPORT

ON

PROPOSED ELECTRIC TRAMWAY

BETWEEN

ESSENDON and WILLIAMSTOWN.

*H. G. Dix, Esq.
Comptroller of
C. & G. Party*

AUGUST, 1914

McCARTY, UNDERWOOD & CO.,
CONSULTING ENGINEERS,
31 QUEEN STREET,
MELBOURNE.

REPORT

ON

PROPOSED ELECTRIC TRAMWAY

BETWEEN

ESSENDON and WILLIAMSTOWN.

McCARTY, UNDERWOOD & CO.,
CONSULTING ENGINEERS,
31 QUEEN STREET,
MELBOURNE.

AUGUST, 1914

31 Queen Street,

Melbourne,

August 5th, 1914.

Gentlemen,—

We have the honor to acknowledge receipt of your letter dated March 16th, 1914, in which you ask us to prepare and place before you a report on the Proposed Tram or Motor-bus Service between Essendon and Williamstown; and also to advise as to the best route to be followed by such a service.

We have given careful consideration to the relative merits of electric tramways and motor buses, when applied to such a service, as would meet the traffic demands in the municipalities concerned, and, after studying the condition of the roads and local conditions generally, we are of the opinion that an electric tramway would prove the most satisfactory system to adopt.

We propose to divide the report into sections, and will deal with the various sections in the following order:—

- (a) Route.
- (b) Estimate of Cost of Construction.
- (c) Estimate of Revenue.
- (d) Estimate of Expenditure.
- (e) Engineering Difficulties.

(a) ROUTE.

We have carefully considered the route set out on the plans submitted to us by the various Councils, and have gone over the ground in order to check the information supplied, and also to make ourselves familiar with existing conditions, and, as a result of our investigations, we have come to the conclusion that the route indicated by the plan attached to the report is the best possible line of intercommunication between the municipalities concerned, and that it will also be suitable to deal with local traffic.

There are only two roads between Essendon and Williamstown which lend themselves to the system of intercommunication, and it appears to us that the Williamstown Road is the shortest and best direct route, and offers the greatest possible opportunity for development.

In selecting the route we have avoided, as far as possible, level crossings over railway lines, as they interfere with the running of the cars, and, consequently, reduce the schedule speed.

The proposed loop line through Footscray will, we believe, meet all local traffic requirements, and will operate as a feeder to the main through line.

Starting from Maribyrnong Bridge, and taking the line as shown on the plan, it will be noted that the district traversed offers splendid building sites that are not now available for settlement on account of the lack of travelling facilities, but, with the establishment of a good tramway service, this area will quickly develop into a good residential district that will materially add to the revenue of the line in the near future, and thus be a source of revenue that is not now apparent.

At the present time the greater part of the population of Footscray is located between the river and the Williamstown Road; therefore, as the city grows, the necessary extension will naturally travel westward, and in the future the Williamstown Road will be the centre of a thickly populated area.

In Williamstown the tramway is taken down Melbourne Road, along Ferguson Street, Nelson Place, and Cole Street to the beach. The line will enable residents in Newport and Spotswood to easily and quickly visit the business portion of the town.

We must also consider the large population in the northern suburbs which will travel on the proposed line, both from a business and pleasure point of view. The direct route to the Williamstown Beach will enable the citizens of Essendon and other northern suburbs to visit the seaside during the summer months, and the revenue to be derived by the tramway from this source should be very considerable.

To stimulate and give due effect to this traffic, it would appear that a line should be constructed in Essendon to connect up the present branch line of the North Melbourne tramways in the city of Essendon, in order to tap the population so as to give greater facilities for direct travelling to the seaside as mentioned above.

From past experience, we should judge that the increase of population within the area served by the tramway will be very great, and that the traffic returns will probably exceed those anticipated at the present time.

We will suggest, in the later part of the report, that a system of penny sections be introduced. These penny sections will be such that they will stimulate local traffic and will act as feeders to the railway.

(b) ESTIMATED COST OF CONSTRUCTION.

We assume that you desire to know the actual cost of a complete modern electric tramway covering the route given above; double and single track as specified, with special work, complete overhead construction cars, car depot, necessary offices and converter stations; the whole to be complete in every detail ready to commence operations.

Permanent Way Construction.

We have estimated that single track will be laid throughout the whole length of the through line from Williamstown to Essendon, with passing stations located in positions that will enable an efficient service to be maintained between Essendon and Williamstown. The single track would be laid on one side of the road, so that, when the system develops and traffic grows to such an extent that it becomes necessary to duplicate the line, the work may be done without interfering in any way with the existing track.

The Footscray loop line would be double track with 10ft. centres. A turnout with a single Y junction would be provided at the intersection of Charles Street and Williamstown Road to enable cars travelling in either direction to run on the main line.

The gauge taken is the recognised standard, i.e., 4ft. 8½in., and the distance from centre to centre of the double track 10ft., with side-pole construction. The permanent way construction we recommend has been adopted by all the principal tramway authorities in Australia, and is now practically a recognised standard. It consists of 90lb. girder type tram rails on the straight, and 96lb. rails for all curves. All joints to be Thermit welded, with the exception of expansion joints, and these to be as few as possible. We have estimated on using rails 60ft. in length.

Sleepers to be 7ft. 6in. long, 9in. wide, and 4½in. thick. For the purposes of this estimate, we have obtained prices for Ironbark sleepers of the above-mentioned dimensions, price for same being 6/9. In our opinion, ironbark is the most suitable timber for this class of work, but it is, of course, more costly than Tasmanian blue gum, etc., the difference in price being about £280 per mile of single track.

The excavations to be taken out to a depth of 17in. This allows 6in. of ballast under the sleepers, which is ample where good foundations are obtainable.

Ballast to be of the best 2½in. metal. We have estimated the cost of the metal at the ruling price now being paid for it in the districts to be traversed by the trams. We have also taken into consideration the necessary consolidation that would be obtained when rolling in the ballast with a 12½-ton steam roller. Surface finish for the tracks to be of the best tar macadam. The estimate covers this finish from 18in. outside each outer rail, and, in the case of double track, the roadway between tracks; all necessary bonds and expansion joints, rail to rail bonds, track to track bonds. Special work to be supplied as follows:— (This work is given separately in the schedule of prices.)

One Passing Loop about intersection of Melbourne Road and Stevedore Street.

One Passing Loop about intersection of Melbourne Road and Hudson Street.

One Passing Loop about intersection of Geelong Road and Gordon Street.

One Passing Loop about 2400 yards along Rosamond Road from Terminus.

One Intersection with Railway Line at West Footscray.

One Intersection with Braybrook Loop Railway Line in Melbourne Road.

One Intersection with Railway Line at Newport.

One Crossover at Footscray Railway Station.

One Single Track 3 part Y curve at intersection of Gordon Street and Ballarat Road.

One Single Track 3 part Y curve at intersection of Charles Street and Williamstown Road.

One Turnout from Double to Single Track at intersection of Charles Street and Williamstown Road.

Car Depot special work, including a turnout and all track work.

For your information we set out separately below the cost of the permanent way and overhead construction for the direct line from Essendon to Williamstown, and also for the Footscray loop line.

We are of the opinion that a standing loop may be required at the Footscray cricket ground entrance, in order to store cars to deal with a rush traffic without interfering with the main line traffic. This standing loop is not included in the estimate.

In order to carry out the permanent way work, it will be necessary to have certain alterations made to sewers, man-holes, and bench marks, and to alter some of the water and gas mains. We have allowed in the schedule of prices an amount that should be ample to cover these alterations. In the event of the scheme being proceeded with, it would be essential for the engineer constructing the works to confer with the engineers of the Metropolitan Board of Works and the Metropolitan Gas Co., and have them make the necessary alterations.

Overhead Construction.

The overhead construction would consist of steel side poles with overhead trolley wire, the whole to be installed in conformity with the best modern practice. We would here suggest that it would be advisable for the authorities constructing this line to see if they could not come to an arrangement with the Postmaster-General and the Footscray City Council to carry their wires on the side poles, charging them an annual rental for such service. The poles would need to be obtained a little longer to carry such wires, but the annual rental should show a good return on the extra capital involved. This would do away with all the unsightly wooden poles now used to carry telephone and electric light wires along the route. The Adelaide Tramways Trust and the Prahran and Malvern Tramways Trust have adopted this practice, and the improvement in the appearance of the streets is very marked.

The trolley wire to be of the best hard drawn copper of equivalent section to No. 3/0 B. and S. gauge, section to be of the non-fouling or channel type. All span wires to be 7/14 best galvanised steel wire. Trolley ears of approved mechanical type; hangers, ball strain insulators and section insulators to be of the very best quality and construction. All necessary frogs, pull-offs, etc., for crossovers, turnouts

and curves; special overhead construction for all turnouts and crossovers, and all special overhead work at car depot. Trolley feeders required are included, and would be carried overhead and equipped with isolating switches where necessary.

A telephone exchange will be installed in the car depot, and telephones will be located as follows:—

- Terminus at Maribyrnong Bridge.
- Passing Station in Rosamond Road.
- Passing Station near intersection of Gordon Street and Geelong Road.
- Passing Station near intersection of Melbourne Road and Hudson Road.
- Passing Station near intersection of Melbourne Road and Stevedore Street.
- Terminus at Williamstown Beach.
- Terminus of Loop Line at Ballarat Road.
- Terminus of Loop Line at Charles Street.

The number of cars we would recommend for the beginning would be 15, consisting of 10 small single truck cars, seating about 36 passengers, and 5 bogie cars, seating about 56 passengers.

The small cars would be similar to those used by the Prahran and Malvern Tramways Trust, and the bogie cars would be similar to the latest design adopted by the above Trust. The bogie car is very suitable for a crush traffic, and would be extremely valuable for such a loading as would develop on the Footscray loop line at certain times during the day, and also for traffic to and from the cricket ground and places of amusement. The centre portion of the bogie car being dropped allows easy entrance to the car. The smoking portion of the car is in the centre, while on the single truck cars both ends are used for smoking.

The car depot, offices, and substation would be located about the intersection of Somerville Road and Williamstown Road. This is a good position for the substation, and would be a very convenient place indeed for the car depot. Of course, we are unable to say whether land could be obtained at this point, but we have assumed such is the case in making our report. If, however, it were necessary to obtain another site for the substation and car depot, it would not alter our estimate of cost of construction, unless it is a considerable distance from the electrical centre of gravity.

For estimating purposes, we have laid down a rough design of the proposed depot, equipped with four tracks. The car depot would be capable of housing 20 cars, and would be so arranged that an increase in depth could be made to meet any future requirements.

The depot would have the following accommodation:—

- General Office.
- Receiving Office.
- Manager's Office.
- Board Room.
- Conductors' and Motormen's Rooms.
- Rooms for Battery and Converting Apparatus, and Workshop.

Naturally the length and width of the building will depend upon the ground available, but, if the building is made wider and shorter, it would make very little difference in the total cost of the building, and would only add a little more to the cost of special work in the tram tracks at the depot entrance, but this would not materially affect the price. We have estimated the cost of a car depot and substation of the size indicated, built in brick, with steel girders supporting the roof, the whole to be of the very latest design. The price for such a building is given in the schedule

below. However, if you decide to have the building constructed in wood and iron, it would cost about £2500 less than the price that is given for the brick building described above, but we do not think that it would be wise to build it in wood and iron, for the reason that insurances on the cars would be much greater, and a building of this type should be constructed in a substantial manner in the first place.

The battery we have estimated on is just large enough to act as a floating battery on the line in conjunction with an automatic reversible booster, which will keep the load on the supply feeder at the substation steady. The corporation supplying the power will require these measures to be taken to regulate the load.

COST OF CONSTRUCTION.

Permanent Way Construction.

8 miles, 79 chains, 33 feet S. T. Standard construction, at £5150 per mile	£46,317	0	0
2 miles, 56 chains, 9 feet D.T. Standard construction, at £10,300 per mile	27,828	0	0
Altering Sewers, Man-holes, etc.; removing Bench-marks and Boxes; altering Water and Gas Mains. Estimated from previous work	4,000	0	0
			£78,145 0 0

Special Work.

One Passing Station about intersection of Melbourne Road and Stevedore Street			
One Passing Station about intersection of Melbourne Road and Hudson Street			
One Passing Station about intersection of Geelong Rd. and Gordon St.			
One Passing Station about 2400 yards along Rosamond Road from Terminus			
One Intersection with Railway Line at West Footscray			
One Intersection with Braybrook Loop Railway Line in Melbourne Road			
One Intersection with Railway Line at Newport			
One Crossover at Footscray Railway Station			
One Single Track 3 part Y. curve at intersection of Gordon Street and Ballarat Road			
One Single Track 3 part Y curve at intersection of Charles Street and Williamstown Road			
One Turnout from Double to Single track at intersection of Charles Street and Williamstown Road			
Car Depot Special Work, including a turnout and all track work			£4,391 0 0

Overhead Construction.

8 miles, 79 chains, 33 feet Overhead Construction complete for single track, including special overhead construction	£10,800	0	0
2 miles, 56 chains, 9 feet Overhead construction for double track	3,440	0	0
Estimated cost of alterations to P.M.G.'s Department's wires and F.C.C.'s electric light wires, etc.	950	0	0
			£15,190 0 0

Cars, Car Depot, Equipment, Etc.

5 Bogie Cars, at £1,650 each	8,250	0	0
10 Single Truck Cars, at £1,150 each	11,500	0	0
Car Depot and Offices	8,500	0	0
Battery, Booster, Station Wiring and Lighting	3,151	0	0
Interest during construction	2,057	0	0
Engineering Fees and Contingencies	8,000	0	0
			£139,184 0 0
Total			

The above estimated cost of construction, i.e., £139,184, includes the cost of both the direct routes from Williamstown to Essendon and the Footscray loop line.

For your information we set out below the cost of permanent way and overhead construction for the Footscray loop line only:—

COST OF CONSTRUCTION.

2 miles, 56 chains, 9 feet D.T. Standard Construction	£27,828	0	0
2 miles, 56 chains, 9 feet Overhead Construction for D.T.	3,440	0	0
Estimated cost of alterations to P.M.G.'s Department's Wires and F.C.C.'s Electric Light Wires	400	0	0
Altering Sewers, Man-holes, etc.	1,500	0	0
Total	<u>£33,168</u>	<u>0</u>	<u>0</u>

(a) ESTIMATED REVENUE.

The most difficult portion of a report on a proposed tramway scheme is the estimating of revenue. The cost of construction can be given with accuracy, and the actual expenditure can be calculated on the car mileage basis, but in arriving at the probable income the conditions that prevail in the locality under review have to be considered. There is no general rule for arriving at the probable returns on any proposed tramway, but we are of opinion that the proper way to arrive at a fair figure is to base the estimate on the actual return per head of population that may reasonably be expected, taking into consideration local conditions. We have obtained official information from the various municipalities in connection with the population along the route, within a radius of $\frac{1}{4}$ mile of the line. We estimated from figures submitted to us that the population along the proposed line within a radius of $\frac{1}{4}$ mile at the present time is 35,000.

These figures provide a basis by means of which we are able to estimate the probable revenue to be derived from the line as far as local traffic in Footscray and the traffic between Williamstown and Footscray are concerned; but we must also take into consideration the fact that people living in Essendon and the other northern suburbs will have open to them a means of easy and direct communication with Footscray and Williamstown.

During the summer months the beach at Williamstown is very popular, not only with local residents, but also with the people residing in Yarraville and Footscray, and it is only reasonable to suppose that the people in the northern suburbs will avail themselves of the opportunity to so easily visit the seaside during the summer months.

It appears to us that if the Maribyrnong Road tramways in Essendon were connected right through to Mt. Alexander Road, thereby tapping the heart of Essendon, the traffic between the various centres would be much greater, and be to the advantage of all the people located in the various municipalities concerned.

We suggest that penny fares be charged on the proposed line as given below. Certain sections taken together, as indicated, will give the through fare, while other sections overlap the ordinary penny sections, and are calculated to catch local traffic.

It is essential to assume such scale of fares in order to arrive at the proper revenue of the proposed line.

SUGGESTED PENNY SECTIONS.

First Ordinary Penny Section—

From Maribyrnong Bridge to a point midway between Maribyrnong Road and Mitchell Street.
From Maribyrnong Road to Ballarat Road.

Second Ordinary Penny Section—

From midway between Maribyrnong Road and Mitchell Street to the intersection of Gordon Street and Ballarat Road.
From intersection of Ballarat and Rosamond Roads to West Footscray.

Third Ordinary Penny Section—

From intersection of Gordon Street with Ballarat Road to corner of Charles Street and Williamstown Road.
From Barney Street to Anderson Street.

Fourth Ordinary Penny Section—

From Charles Street to Hudson's Road.
From Anderson Street to Blackshaw's Road.

Fifth Ordinary Penny Section—

From Hudson's Road to North Road.
From Blackshaw's Road to Yarra Street.

Sixth Ordinary Penny Section—

From North Road to Electra Street.
From Yarra Street to Post Office.

Seventh Ordinary Penny Section—

From Electra Street to Terminus.
Through Fare from Terminus to Terminus—Sixpence.

PENNY SECTIONS ON FOOTSCRAY LOOP LINE.

From Gordon Street to Footscray Station.
From Williamstown Road to Footscray Station.
From cr. Rosamond Road and Ballarat Road to Nicholson Street.
From cr. Gamon Street and Charles Street to cr. Nicholson and Hopkins Streets.
Maximum Fare on Loop Line—Twopence.

The above penny sections will catch a considerable amount of local traffic, and, although the sections in a few instances are rather long, it is due, in most instances, to the proposed tramline traversing undeveloped territory.

The Adelaide tramways in 1912 showed a return of £2/1/5 as the average traffic revenue per head of population served. This return is very high, but no competition exists with other tramways, and there is practically no railway competition.

The return per head of population served by the Prahran and Malvern Tramways Trust in 1912 works out at 15/11, and the 1913 report of the same Trust shows that the return was about 17/10 2-5.

The first year's operation of the Fremantle tramways showed about 16/6 as the average total revenue per head of population per annum.

We have taken the population of the area to be served at 35,000, being those who reside on the route within the $\frac{1}{4}$ mile radius given previously. After careful consideration, and taking into account those who are not in the tramway area, and yet will use the line for reasons given above, we believe that a reasonable deduction can be made that the return per head of population in the area under review should be put down at 12/6. This gives us the following return:—35,000 at 12/6, making a gross annual return of £21,875.

(d) EXPENDITURE.

We would recommend that a supply of electric energy be obtained from either the Melbourne City Council or the Footscray City Council. It is a matter which affects the cost of operation, and we have assumed for the purposes of this estimate that the supply of power will be obtained from either of the above-named authorities. They will require the authorities controlling the Proposed Tramway to instal a Battery, Booster and Switchboard, and the cost of this apparatus has been placed in the estimate of Cost of Construction.

We have taken an assumed figure for the cost per unit supplied at the Direct Current Switchboard, but will not publish this figure in the report. It is reasonable to suppose that the consumption of energy within the Metropolitan area will

increase rapidly during the next few years, and such a development will necessitate the installation of a large central power authority, from which energy could be purchased at a much cheaper rate than that existing at present.

The country traversed by the Tramway is of a very level character, and we believe that the current consumption per car mile will be low when compared with that obtaining on many of the Metropolitan Electric Lines.

From the terminus at Maribyrnong Bridge to Ballarat Road there is an almost level track without stops, except on special occasions, and in consequence a high average speed per car mile will be obtained on a low power consumption. Another clear run with only one important stop exists between Blackshaw's Road and Somerville Road, which will mean a reduction in current consumption per car mile.

Assuming that large bogie cars will only be used during busy periods, and taking the above conditions into consideration, we do not think the current consumption should exceed 1.7 units per car mile.

When working out the total car mileage per annum, we came to the conclusion that an efficient service of early morning cars must be provided to meet the requirements of workmen engaged in the various factories throughout the area served. A frequent service on the loop line would be maintained to deal with the traffic to and from the Footscray Railway Station until about nine o'clock in the morning, then the service would be reduced until about 11.30, when it would again be increased during the busy 2½ hours at midday; the service would again be reduced during the afternoon, but would be increased to deal with the rush traffic between 5 and 8 o'clock.

By running out a graphic time-table on these lines we have arrived at a figure of 400,000 car miles per annum.

With the gross annual income of £21,875, and taking the car mileage as 400,000, we obtain a return per car mile of 13.125d. as against the Prahran and Malvern return in 1913 of 14.422d. per car mile. The Adelaide Tramways Trust's return in 1912 was 14.275d. per car mile.

We estimate that the working expenses of the system will be 9.75d. per car mile; therefore the annual working cost on 400,000 car miles will be £16,250. This working cost of £16,250 is equivalent to 74.28 per cent. of the gross estimated receipts, i.e., £21,875. The working expenses of the Prahran and Malvern Tramways Trust for the year 1912 worked out at 63.584 per cent. of the total revenue; the working expenses for 1913 were 66.309 per cent. of the total revenue.

We wish to point out that the high working cost as against the total revenue for the line is due to the fact that the population per mile of the proposed line is now low, but with travelling facilities settlement will be stimulated in the sparsely populated districts along the track, and as a consequence of this development the population per track mile will increase and bring the proportion between the total revenue and working expenses on the line down. Another cause for the high proportion given above is the fact that the figure we have estimated on for the supply of electric energy is conservative.

The annual interest on the total capital expenditure of £139,184 at 4½ per cent. would be £6263.

We are of the opinion that a Renewals Reserve Fund on the following expenditure should be provided:—

Permanent Way	£74,145	0	0
Overhead Construction	14,240	0	0
Cars	19,750	0	0
Car Depot and Offices	8,500	0	0
Special Work	4,391	0	0
Battery, Booster and Switchgear	3,151	0	0
	<u>£124,177</u>	<u>0</u>	<u>0</u>

If two per cent. per annum is charged on this amount of £124,177 for the Renewals Reserve Fund, it would amount to £2484. The financial aspect of the undertaking would then be as follows:—

Revenue per annum	£21,875	0	0
Working expenses per annum, including Maintenance, Power, Cost, and Management, 400,000 car miles at 9.75d.	£16,250	0	0
Interest on £139,184 at 4½ per cent.	6,263	0	0
Renewals, Reserve Fund, 2 per cent. on £124,177	2,484	0	0
	<u>£24,997</u>	<u>0</u>	<u>0</u>
Approximate Loss		<u>£3,122</u>	<u>0</u>

The above statement shows a deficiency of £3122, but such a financial condition is to be expected on a Tramway Installation under the peculiar conditions that exist. The true value of the Tramway is not fairly represented by its financial aspect, but by its undoubted power to stimulate the development of the districts served, and as a consequence the increase in population will add very considerably to the Tramway Traffic returns.

The length of time that would be taken to build the Proposed Tramway has not been given previously in the report, but we would judge that the total time required for designing, letting Contracts and completing the Construction would be about eighteen months.

(e) ENGINEERING DIFFICULTIES.

We have examined the route of the proposed Tramway very carefully from end to end, and have included a price in our estimate to cover the cost of any work that may be necessary in order to overcome any obstacles in the way of construction.

The Engineering difficulties of the line are only those that are met with in any ordinary Tramway work, and can be easily overcome. In many cases local drains will have to be crossed, and these will be dealt with in the usual manner; also some of the small bridges along the route will have to be strengthened, but these are every day occurrences in building any Tram line through new territory.

Where the Tramway crosses the Railway on the level, your Engineers would have to make arrangements with the Railway Department to carry out this work, but we have allowed a sum under the heading of "Special Work," which we believe will be ample for the work required at each crossing. Where the line crosses the Railway over bridges, these may, in some cases, have to be strengthened, but the sum required, which is rather hard to estimate at the present time, should be covered by the Contingency Fund that is shown in the Report.

The alterations to Sewers, Man-holes, etc., and removing of Bench marks and Boxes, as well as the alterations to water mains along the route, will have to be entrusted to the Metropolitan Board of Works. We would recommend that this work be one of the first authorised by the Trust so that it will occasion no delay in the construction of the track.

It may be necessary to obtain portions of certain corners in order to get in the proper curves for the Tramway, as the streets in some cases are rather narrow, and we believe that you will have to resume small pieces of land in order to meet the above requirements for curves. In this connection we have not allowed anything in our estimate.

In conclusion, we desire to express the opinion that if the Proposed Tramway is installed the population along the route will increase, and the deficiency shown in our Report would be more than met by the increased revenue. We have estimated on the most approved construction and equipment, and the cost of the completed line is based on the cost of similar Tramways that have been recently

constructed, therefore our estimate should be absolutely correct for the work specified. The maintenance of the entire roadway from 18 inches outside each outer rail, including the centre portion between tracks, will be a charge on the Tramway. This will mean a large reduction on the road maintenance in the streets the Tramway traverses. We would advocate a system of lighting the tram tracks similar to that adopted on some of the lines that have just been completed. This system does not entail extra capital expenditure to the Trust, but would make a decided saving on the street lighting accounts of the Cities and Municipalities traversed.

The estimate of Revenue and Expenditure is conservative, and shows that during the first year's operation a loss of £3122 will be incurred, providing the Tramway is charged up with the Renewals Reserve Fund of £2484. We are, however, of the opinion that, even although the estimated loss is rather high, the indirect gain due to increased settlement and valuation would almost meet the direct loss on the Tramway, and in the future naturally the direct loss will disappear, and the Municipalities will then have a splendid asset in the Proposed Line.

In conclusion, we desire to thank the Chairman of the Conference and also the Officers of the Councils interested for the valuable information placed before us.

We have the honor to be,

Gentlemen,

Your obedient Servants,

McCARTY, UNDERWOOD & CO.,

To the Chairman and Members of the Conference for the Proposed Tramway
between Essendon and Williamstown.

APPENDIX A.

31 Queen Street,
Melbourne,

August 27th, 1914.

Gentlemen,—

MOTOR BUSES.

We did not mention in the main portion of our Report our opinion of Motor Buses, as applied to traffic over the proposed route of your suggested Electric Tramway.

We understand that the principal argument for the selection of Motor Buses for any route is their low initial cost as compared with a modern Electric Tramway, and also the adaptability of the Motor Bus in reference to selection of routes.

The arguments put forward by the exponents of the Motor Bus in regard to the selection of routes we do not think sound in every respect. They say that if you try a route with Motor Buses and find that such a route will not pay, then you can transfer the Motor Buses to some other route that may pay. We feel that before any route is selected duly qualified traction Engineers should be consulted in reference to the proposed route, and if their reports are favorable to the route this selected route should be retained, even if a loss was made for the first few years. The reason for this is that no one would like to build along a route with traffic facilities when such facilities may be removed at any time.

It is essential for a satisfactory Motor Bus service to have a well constructed roadway. We are convinced from experience now gained that there are only two types of roadway that are reasonably suitable for Motor Bus traffic, i.e., 6in. to 7in. concrete foundations with 6in. wood blocks properly tar dressed, or 6in. to 7in. concrete foundations with a topping of 1½in. asphalt. Such a road 20ft. wide would cost about £11,733 per mile.

A roadway of such durability is required for the reason that the solid rubber tyres of the Motor Buses, in conjunction with the heavy loads on the wheels, cause the ordinary roads to deteriorate very rapidly, necessitating excessive road maintenance.

We find it difficult to obtain reliable figures on the operating cost per mile for buses, but we feel that, if the Motor Buses were charged their proper share of road maintenance, and the extra amount of wages due to Australian conditions were added to the figures placed before us, the cost of operating Motor Buses per mile would be found to be greater than the cost per car mile on a modern tramway. The crush traffic on an electric system can be handled much more easily than by Motor Buses.

We beg to quote the following sentence, which meets with our approval:—
“The conditions under which Motor Omnibuses operate in London are unique, and the returns cannot properly be used as a basis on which to estimate results in less favourable circumstances.”

The Motor Omnibus undoubtedly has many advantages for certain services, but, taking local conditions into account, the advantages of an up-to-date electric Tramway, which in time will be a part of the Greater Melbourne system, we feel that we could not recommend you to adopt Motor Omnibuses.

We have the honor to be,

Gentlemen,

Your obedient Servants,

McCARTY, UNDERWOOD & CO.

The Chairman and Members, Conference for the Proposed Electric Tramway from
Essendon to Williamstown.

APPENDIX B.

31 Queen Street,
Melbourne,
27th August, 1914.

Gentlemen,—

RAILLESS ELECTRIC TRACTION.

The Railless Electric Traction is not used for through main line work, but is more used as an auxiliary to an established system of tramways. In this connection the Railless Electric system is utilised in the opening up of new routes through sparsely settled districts.

Some of the objections to Motor Omnibuses given in Appendix A apply to the Railless Electric system, that is in reference to roadways, etc.

The electrical equipment of the Railless Traction system is much superior to the equipment of the Motor Buses in regard to smooth acceleration, economy of operation and maintenance.

The only feature of the railless system to appeal to Tramway authorities is that by this system permanent way is not required, and a saving is made in capital expenditure and also in fixed charges and road maintenance.

We are of the opinion that the Railless Electric System has advantages as an adjunct to an existing Tramway when it is required to extend the system into sparsely settled areas; but in the case of your suggested line we would not recommend this system.

We have the honor to be,

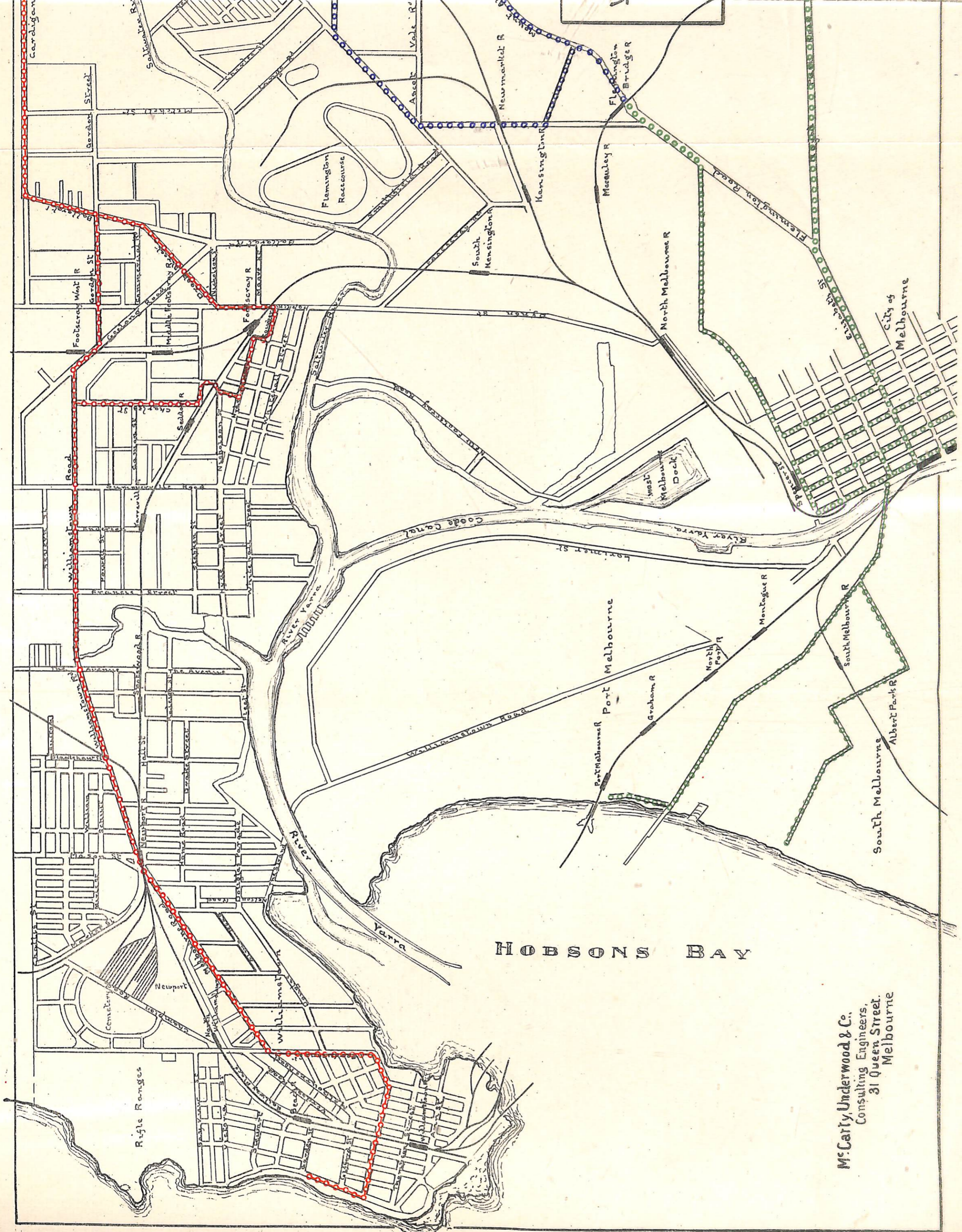
Gentlemen,

Your obedient Servants,

McCARTY, UNDERWOOD & CO.

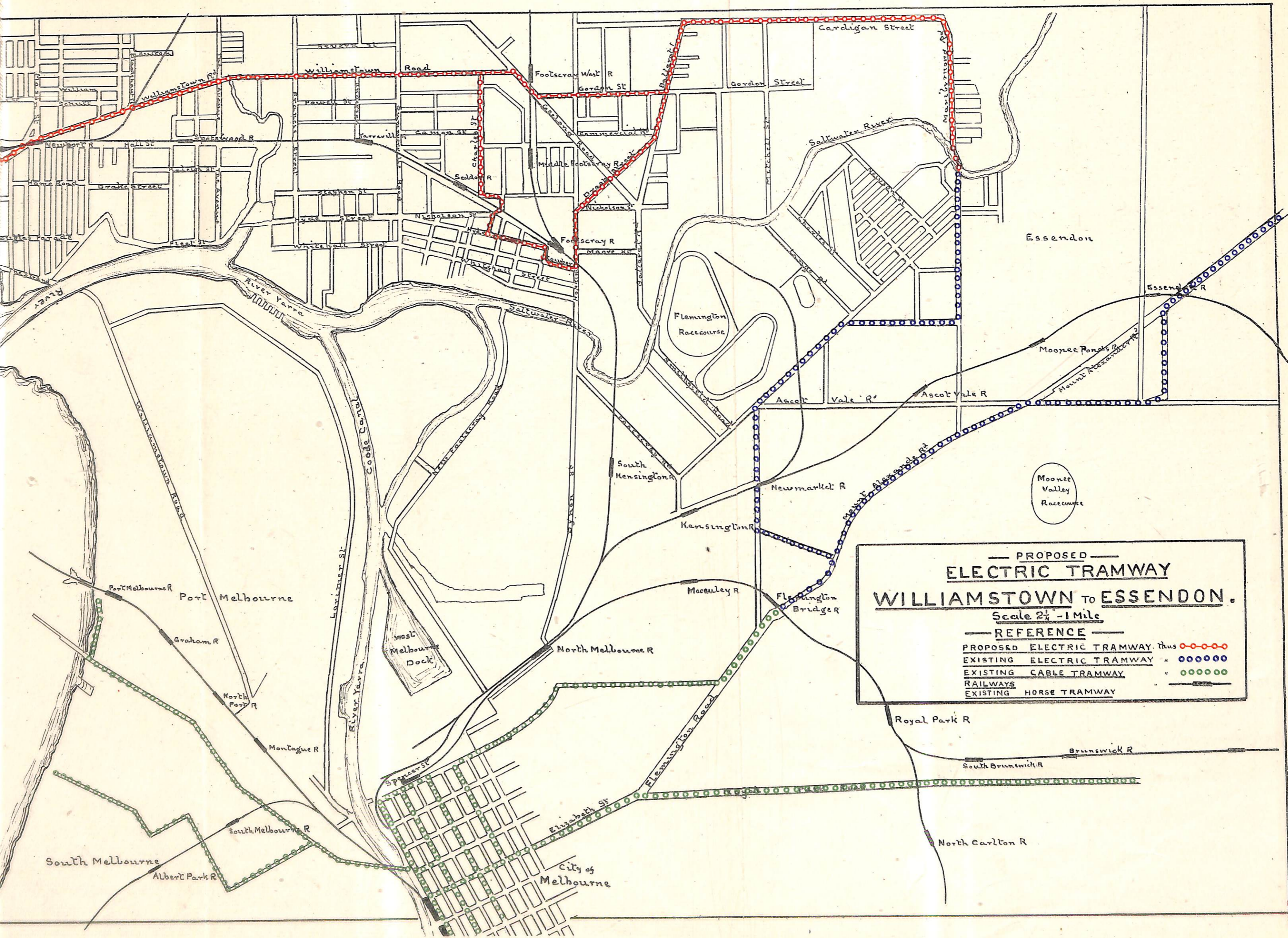
The Chairman and Members, Conference for the Proposed Electric Tramway from Essendon to Williamstown.





HOBSONS BAY

McCarthy, Underwood & Co.,
 Consulting Engineers,
 31 Queen Street,
 Melbourne



— PROPOSED —
ELECTRIC TRAMWAY
WILLIAMSTOWN TO ESSENDON.
 Scale $2\frac{1}{4}$ - 1 Mile

— REFERENCE —

PROPOSED ELECTRIC TRAMWAY	thus	
EXISTING ELECTRIC TRAMWAY	"	
EXISTING CABLE TRAMWAY	"	
RAILWAYS	"	
EXISTING HORSE TRAMWAY	"	

