

# REPORT

UPON THE

## Proposed Electric Tramway

FOR THE

CITY OF SOUTH MELBOURNE

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MCCARTY, UNDERWOOD & Co.,  
Consulting Electrical Engineers,  
31 QUEEN STREET,  
MELBOURNE.

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31 Queen Street,  
Melbourne,

Aug. 13th, 1913.

GENTLEMEN,—

We have the honour to acknowledge receipt of your letters of 3rd and 10th July, 1913, in which you ask us to prepare and place before you a report on the Electric Tramway for South Melbourne and in the following order :—

- (a) Estimate of cost of construction of Double Track.
- (b) Estimated Revenue and Expenditure.
- (c) Engineering Difficulties (if any).
- (d) Advisability of extension southward through St. Kilda to junction with Balclava Road Tramway.

We beg to inform you that as soon as we received the instructions, we commenced the gathering of the necessary information for the Report.

The Town Clerk and City Surveyor furnished us with the following reports and plans :—

Memorandum, dated 10th June, 1912, from Cr. W. O. Strangward to the South Melbourne Council, on the Proposed Electric Tramway in South Melbourne; also Suggested Penny Sections.

Report, dated 1st August, 1912, by Mr. A. E. Aughtie, City Surveyor, on Proposed Electric Tramway.

Minutes of Evidence taken before The Railways Standing Committee.

Third Progress Report from the Parliamentary Standing Committee on Railways on the Proposed Suburban Electric Tramways (South Melbourne), together with Minutes of Evidence.

Plan of South Melbourne, showing in colored lines Cable Tramway, Railways and Proposed Electric Tramways; Detailed Tracings showing all main Water and Gas pipes, Sewers, principal drains, gratings, crossings, Telegraph and Electric wires, conduits, cables, etc.

At the end of the Report you will find our Plan of South Melbourne and portion of St. Kilda, which will give you the disposition of the Railways, Cable Tramways, Existing Electric Tramways and the Proposed Electric Tramway.

We may mention here, that we have not been requested to report on the route selected, namely—from Princes Bridge along Sturt Street, Eastern Road, Park Street, Clarendon Street, Albert Road, Kerferd Road, Danks Street and Patterson Street to Fraser Street; but we consider this route undoubtedly the best from a traffic point of view. We have taken this route as the proposed one and have allowed for an extension of three chains at Princes Bridge into the City of Melbourne, as recommended by the Parliamentary Standing Committee on Railways. The route mileage will thus be 3 miles, 17 chains in South Melbourne, plus 3 chains in Melbourne, making exactly 3 miles, 20 chains of Double Track. This does not include Special Work, which we will estimate on separately.

Dealing with the information required by you in the order mentioned, we beg to report as follows :—

## (a) ESTIMATE OF COST OF CONSTRUCTION OF DOUBLE TRACK.

We assume that you desire to know what the actual cost would be of a complete modern Electric Tramway, consisting of 3 miles, 20 chains, Double Track, Special Works, complete over-head construction, 10 cars, Car Depot, necessary Offices and Sub-station Equipment; the whole to be complete in every detail ready to commence operations.

### PERMANENT WAY CONSTRUCTION.

We have assumed that the turnout required at Princes Bridge will be placed close to the footpath on the Western side of St. Kilda Road, and started from a point so as to allow a car to stand close to the footpath well up toward Princes Bridge. This position would not interfere with the present St. Kilda Road traffic, and the cars could be seen from Flinders Street.

The gauge we have taken is the recognised standard, i.e., 4ft. 8½in., and the distance from centre to centre of the double track, 10ft., with side poles, with the exception of Albert Road, from the corner of Clarendon Street to Kerferd Road Subway, which should be say, 12ft. centres with centre poles, the tracks being taken through the centre of Albert Road between the plantations now being made. Before passing under the Kerferd Road Subway, the tracks to be again brought to 10ft. centres. After passing the Subway, both tracks to be carried up Kerferd Road on the Middle Park side. The up track to run close to the present plantations, and spring gates, with notices, to be placed at all footpath openings in the reserves as a warning to the public.

The track to be taken down the centre of Danks Street, with 12ft. centre and centre poles to the corner of Mills Street. At this point, Danks Street narrows down considerably, and from the above-mentioned corner to Fraser Street the track to have 10ft. centres with side pole construction.

This suggestion would mean the destruction of the present plantations, as far as they have gone, in Danks Street from Kerferd Road to Mills Street, but we consider this the only satisfactory method of dealing with this section of the track, as the roads on each side of the present plantations are too narrow to accommodate a single tram-line. It may be possible to arrange ornamental plantations on each side of the tramway in Danks Street from Kerferd Road to Mills Street, reserving the centre portion of the street for tramway purposes only, and the side roads for vehicular traffic.

The construction we would recommend for the Permanent Way would be what is practically called now in Australia, Standard Construction, and consists of 90lb. girder type tram rails on the straight, and 95lb. rails for all curves. We estimated on using rails of 60ft. in length. All joints to be Thermit Welded, with the exception of expansion joints, and these to be as few as possible.

Sleepers to be 7ft. 6in. long, 9in. wide and 4½in. thick, and to be Tasmanian Blue Gum or equivalent timber. We mention this timber as we have based our estimate on it.

Excavation 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, but, as your City Surveyor is under the impression that we may get some bad foundations in Sturt Street, we have allowed a lump sum in our estimate of £300 to cover any extra works in this connection.

Ballast to be of the best 2½in. metal. In estimating the cost of metal we have used the present rate quoted by the City Surveyor. We have also taken into consideration the necessary consolidation that would be obtained after rolling it in with a 12½ ton Steam Roller.

Surface finish over the tracks to be of the best tar macadam. The estimate covers this finish from 18in. outside each outer rail, and includes the roadway between tracks.

All necessary bonds at expansion joints, rail to rail bonds and track to track bonds.

Special work to be supplied as follows. (This work is given separately in the Schedule of prices) :—

Turnout at Princes Bridge.

Turnout at Fraser Street and Danks Street.

Cross over in Clarendon Street, near corner of Park Street.

Crossover in Albert Road, near entrance to S.M.C.G.

Special work at Car Depot, with crossover in main track at same point.

A standing loop may be required at the S.M.C.G. in order to store Cars to deal with rush traffic without interfering with the main line traffic. This is not included in the estimate.

The turnouts are essential, also the crossover and Special Work at the Car Depot. The crossover in Clarendon Street near Park Street, was put in to take care of rush traffic either to the beach or the places of amusement at Princes Bridge. The crossover at the entrance to the S.M.C.G., is included to deal with the rush traffic that may develop at this point.

### OVERHEAD CONSTRUCTION.

To be steel side pole construction, with the exception of the section in Albert Road from Clarendon Street to about the Kerferd Road Subway, and also the section in Danks Street, from the corner of Kerferd Road to Mills Street, where we think it would be advisable, on account of the width of road, to use centre poles.

We would here suggest that wherever side pole construction is used, it might be advisable for the Council to see if it could come to an agreement with the Postmaster-General and the Melbourne Electric Supply Company to carry their wires on the side poles, charging them an annual rental for such service. The poles would need to be ordered a little longer to carry such wires, but the annual rental should pay 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 Tramway Trust has 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. 000 B. & S. gauge, the section to be of the squeezed upper Fig. 8 type. Span wire to be 7/14 best Galvanized Steel wire. Trolley ears of approved mechanical type, hangers, ball strain insulators and section insulators to be of the very best construction; all suitable 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.

The Trolley Feeders required, are included, and will be carried overhead and equipped with isolating switches where necessary.

Telephones for Car Depot (including an exchange), Princes Bridge, corner of Clarendon and Park Streets, S.M.C.G., and corner of Fraser and Danks Streets.

The tram cars that we would recommend at the start, would be 10 cars similar to those first introduced into Melbourne by the Prahran and Malvern Tramway Trust. These cars are about 32 ft. over all, and capable of seating 36 passengers, and would allow a fairly good crush load. Later, when conditions warrant it, a larger car could be obtained, similar to some of the new types that are now being adopted by the existing tramways. The cars recommended have drop ends, which reduce the step at the entrance to the cars. Both ends are open for smokers, and can be enclosed with blinds in inclement weather. The centre of the cars are enclosed, but the windows drop down, so that in pleasant weather they are practically open cars.

The Car Depot, we consider, can be located on some of the vacant ground in Sturt Street near Hanna Street, which we understand is Crown Land, but which should be available at a fair rental. As the ground is suitable and adjacent to the line, it would make an excellent site for both the Car Depot and Sub-station.

For estimating purposes we have laid out a rough design of such a Depot equipped with three tracks, and capable of housing, say, fifteen small cars or twelve large cars. The Car Depot would be about 188ft. in length and 37ft. in width; while down one side would be the offices, motormen's and conductors' rooms, battery room, sub-station room, workshop and store room. This portion of the building would be 188ft. long by 20ft. wide, marking the total building 188ft. long by 57ft. wide. We think it is wise to make the storage in the Car Depot as large as we have estimated, as there is no doubt in our mind that this will be required at an early date.

We would recommend that no great expenditure should be undertaken on the Car Depot at the present time, and that the building should be built of galvanized iron, and where required, the offices can be lined with match board. We have estimated on this construction, but we draw your attention to the fact, that when you finally go into the actual merits of the case, it may pay you to adopt brick construction on account of the reduction in insurance on cars and equipment in the Car Depot. It is merely a matter of pounds, shillings and pence, to see which will pay, but, for the purpose of this estimate, we have taken the former construction.

The Battery we have decided 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 sub-station steady. The Corporation supplying the power will require these measures to be taken to regulate the load.

### COST OF CONSTRUCTION.

#### PERMANENT WAY CONSTRUCTION :—

|  |             |
|--|-------------|
| 3½ miles double track, at £9,974 .. .. .                     | £32,415 0 0 |
| Lump sum allowed for bad foundations in Sturt Street .. .. . | 300 0 0     |
| Allowance for sewer, gas and water pipes, etc. .. .. .       | 650 0 0     |
|  | £33,365 0 0 |

#### SPECIAL WORK :—

|  |           |
|--|-----------|
| Two turnouts .. .. .   |           |
| Two Crossovers .. .. .   |           |
| Car Depot special work, including a crossover and turnout, and all work in Car Depot .. .. . | 2,248 0 0 |

#### OVERHEAD CONSTRUCTION :—

|   |           |
|---|-----------|
| 3½ miles of overhead construction, side poles, with centre poles as specified, including crossovers, turnouts and Car Depot work; also including alterations to telephone, telegraph and electric light wires .. .. . | 5,352 0 0 |
|---|-----------|

#### CARS :—

|  |             |
|--|-------------|
| 10 cars of about 32ft. overall, and seating about 36 passengers, at £1,100 .. .. . | 11,000 0 0  |
| Car Depot and Offices .. .. .  | 2,500 0 0   |
| Battery, Automatic Booster and Switchboard .. .. .                                 | 2,000 0 0   |
| Kerferd Road Subway .. .. .  | 2,088 0 0   |
| Interest during construction .. .. .   | 820 0 0     |
| Engineering Fees and Unforeseen Contingencies .. .. .                              | 4,000 0 0   |
| Total .. .. .  | £63,373 0 0 |

### (b) ESTIMATED REVENUE AND EXPENDITURE.

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 annual 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 of 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 annual return per head of population that may reasonably be expected, taking into consideration local conditions.

In this particular case we are dealing with a City of great magnitude, situated between Melbourne and St. Kilda, which has a large population, foreign to its boundaries, desirous at times to travel to its foreshores, cricket grounds, factories, etc. This is a factor that needs careful consideration in arriving at the revenue.

The picture shows and other places of amusement at Princes Bridge will, no doubt, create a large traffic within your City boundaries, for if you give people the facilities of rapid transit, they will avail themselves of it.

The proposed Government Markets to be located in Sturt Street will, no doubt, bring increased traffic, and add to the receipts of your proposed line, the line being almost a required factor for the success of the proposed markets.

A large number of workshops are located in the vicinity of Sturt Street, and the tramway will no doubt be a great convenience to the employees of these factories. The traffic returns from this source should be no mean addition to your revenue.

We desire here, to quote the proposed penny sections, which, we believe were decided upon by you, and which, we understand, will satisfy your local requirements.

### SUGGESTED PENNY SECTIONS.

|  | DISTANCE.  |
|--|------------|
| 1.—(First Ordinary Penny Section)—Corner Fraser and Patterson Streets to corner Kerferd Road and Danks Street .. .. .  | 84 chains. |
| 2.—Corner Armstrong and Danks Streets to Kerferd Road Subway (to catch Beaconsfield Parade and Danks Street residents to Albert Park Station, also traffic to Middle Park Baths and beach) .. .. . | 90 chains. |
| 3.—Corner Wright and Danks Streets to S.M.C.G. (to catch Middle Park traffic to S.M.C.G.)  | 91 chains. |
| 4.—(Second Ordinary Penny Section)—Corner Kerferd Road and Danks Street to corner Park and Clarendon Streets (entry to Clarendon Street and nearest point to Kerferd Road pier .. .. .             | 89 chains. |
| 5.—Kerferd Road Subway to Hanna Street (allows Moray Street area to use penny section to S.M.C.G.) .. .. .   | 83 chains. |
| 6.—S.M.C.G. to corner Sturt and Grant Streets (cater for factory area population) .. .. .  | 84 chains. |
| 7.—(Third Ordinary Penny Section)—Corner Park and Clarendon Street to St. Kilda Road (catch traffic to entertainment halls and Princes Bridge) .. .. .   | 92 chains. |

NOTE.—(a) Through fare, 3d.; (b) Football traffic, Princes Bridge to Cricket Ground would be 2d.

The distance of 92 chains from the corner of Clarendon Street and Park Street to Princes Bridge would be covered by the electric cars in from 5 to 6 minutes, and as the terminus at Princes Bridge is within 5 minutes walk of the Melbourne Town Hall, the time taken in travelling from Clarendon Street corner to the Town Hall would average about 10½ minutes. The time taken by the Cable Tramway between these two points is about 11 minutes under the most favorable conditions. The relative fares on the two systems for this journey would be :—Electric Tramway, 1d.; Cable Tramway, 2d. Therefore good returns should be derived from this section.

People travelling to the Flinders Street Railway Station would prefer the electric to the Cable Car as the station is only two minutes walk from the terminus at Princes Bridge.

During certain portions of the year, and principally the Summer months, passengers from other centres will be desirous of visiting the South Melbourne Beach, Cricket Ground, Albert Park Lake, etc., and this travelling public will add very materially to the revenue. In our opinion the limited number of cars, which we have allowed for the beginning will be unable to cope with this particular rush traffic.

We have noted that the railway authorities expect to lose £4,356 during the first competitive year with the Electric Tramway. This would appear to be a high estimate, but, seeing that the Railway Department have the advantage of well-compiled statistics on the railway traffic, we must accept the figures as correct.

In connection with the railway traffic dealt with at the Albert Park station, we give for your information an extract from an article appearing in the "Age," of the 8th inst., entitled "Growth of Suburbs." A statement is included in this article, showing the number of passenger journeys to and from the principal railway stations in the Metropolitan area. We quote below the seven stations which head the list in point of traffic.

| Station.                | Number of Passenger Journeys<br>During Year, ended 30th June, |           |            |
|-------------------------|---|-----------|------------|
|                         | 1883.   | 1903.     | 1912.      |
| Flinders Street .. .. . | 3,808,649   | 4,346,912 | 10,006,537 |
| Spencer Street .. .. .  | 1,528,318   | 2,030,057 | 3,353,051  |
| Richmond .. .. .        | 1,617,910   | 1,769,826 | 2,810,091  |
| Footscray .. .. .       | 776,900   | 1,546,817 | 2,707,430  |
| Albert Park .. .. .     | 1,056,031   | 1,226,145 | 2,550,346  |
| Ascot Vale .. .. .      | 136,781   | 1,434,299 | 2,413,845  |
| St. Kilda .. .. .       | 1,461,987   | 948,529   | 2,345,155  |

Leaving out Flinders Street and Spencer Street, which are terminal stations, these figures show that Albert Park is the third largest suburban station as regards traffic.

The increase in passenger journeys to and from Albert Park station, from 1883 to 1903, was 16.1%, but for the nine years ending 30th June, 1912, the increase reached the enormous percentage of 108%.

From Middle Park to Clarendon Street, a splendid traffic should spring up to the advantage of all the merchants in this business thoroughfare.

The Adelaide Tramways last year showed a return of £2/1/5 as the average traffic revenue per head of population served. This figure is very high, but they have no competition with other tramways and practically no railway competition.

The Prahran and Malvern Tramways Report for 1912 shows, when worked out, that the average total revenue per head of population served per annum, is about 15/11.

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

We are not quoting the Brighton Tramway Figures as we do not think they do justice to a system similar to the one you contemplate installing.

We have taken the population of the area to be served at 23,500, being those residing within a quarter of a mile on either side of the proposed route. After mature consideration, and taking into account those who are not in your tramway area, and yet will use this line, we think to put the population down at 23,500 is conservative. We have estimated the annual revenue per head of population at 14/-, which, on 23,500, produces an annual gross return of £16,450.

**EXPENDITURE.**

We have consulted Mr. Clements, Chief Engineer and General Manager of the Melbourne Electric Supply Company, and also Mr. Harper, Chief Electrical Engineer to the Melbourne City Council, with reference to the possibility of obtaining a supply of electric energy from their respective systems. We could not give them, at this stage, any definite information as to the exact requirements of the supply, but Mr. Clements stated that he thought a supply would be obtainable from his Company, and Mr. Harper was of opinion that his Council would favorably consider such a proposal.

We therefore assume that electric energy could be obtained at a satisfactory price, but, as previously mentioned, a battery and an automatic reversible booster will be required to keep the load on the supply mains steady. The cost of the battery and booster is included in our estimate.

The level character of the route leads us to believe that the power consumption should not exceed, say, 1.3 units per car mile. The Prahran and Malvern Tramways used on the average, according to their 1912 report, 1.472 units per car mile. We mention this fact for the reason that, if your power cost you a little more than the supply to Prahran and Malvern, your low consumption per car mile will more than make up for any increased cost per unit.

In deciding upon the car mileage per annum, we came to the conclusion that you must provide early morning trams; the service to be augmented at about seven o'clock to cater for the early workers. The schedule then to be increased to a five minute headway in order to cope with the morning rush traffic, and gradually to drop back to a 7½ or even 10 minute service. A special service at mid-day, and also a service with a five minute headway from 4.45 to 8.15 p.m. The evening running to be a 7½ or 10 minute service, depending on the time of year and the traffic requirements. The annual car mileage arrived at from the above-mentioned service would amount to, approximately, 300,000.

With a gross annual revenue of £16,450, the return per car mile is 13.16d., which is very close to the figure obtained by the Prahran and Malvern Tramways in 1912, namely, 13.224d. per car mile. For the same year the Adelaide Tramways showed a return of 14.377d. per car mile.

We estimate that the working expenses of the system will be 9d. per car mile, therefore the annual working cost on 300,000 car miles will be £11,250. This working cost of £11,250, is equivalent to 68.3% of the gross receipts estimated, i.e., £16,450, while Prahran and Malvern's working expenses are 63.584 per cent. of the total receipts, and Adelaide's working expenses, 64.873 per cent. of the total receipts.

The annual interest on the total capital expenditure of £63,373, at 4½ per cent. would be £2,852.

We think you ought to provide a Renewals Reserve Fund on the following expenditure:—

|  |             |
|--|-------------|
| Permanent Way .. .. .                              | £32,415 0 0 |
| Special Work .. .. .                               | 2,248 0 0   |
| Overhead Construction .. .. .                      | 4,866 0 0   |
| Cars .. .. .                                       | 11,000 0 0  |
| Car Depot and Offices .. .. .                      | 2,500 0 0   |
| Battery, Automatic Booster and Switchboard .. .. . | 2,000 0 0   |
|  | <hr/>       |
|  | £55,029 0 0 |

If two per cent. (2%) per annum was charged on this sum of £55,029 for the Renewals Reserve Fund, it would amount to £1,101. The financial aspect of the proposed line would then be as follows:—

|   |             |
|---|-------------|
| Revenue per annum .. .. .   | £16,450 0 0 |
| Working expenses per annum, including maintenance, power, cost and management, 300,000 car miles at 9d. . . . . | £11,250 0 0 |
| Interest on £63,373, at 4½% .. .. .   | 2,852 0 0   |
| Renewals, Reserve Fund, 2% on £55,029 .. .. .   | 1,101 0 0   |
|   | 15,203 0 0  |
|   | £1,247 0 0  |

This leaves you with a nett profit of £1,247, which we think is very encouraging and shows that the system would be a paying concern in the first year, and there is no doubt that the revenue will increase from year to year.

### (c) ENGINEERING DIFFICULTIES (if any).

We have carefully examined the route for any obstacles that would present themselves as engineering difficulties, and fail to find any. There can be no question, from what we saw and from the plans prepared by your City Surveyor, that certain sewer man-holes will have to be altered, as well as gas and water plugs. The drains to be altered are not numerous, and can be easily attended to. To sum this up, this work is only what is required to be done in putting down any tram-line, and we have included a price in our estimate that should amply cover this work.

The Kerferd Road Subway is no obstacle, and only needs the Railway's Department's co-operation with you to obtain the requisite head room of 13ft. 6in., by means of a new subway on the Middle Park side of the present subway. The St. Kilda Railway has a rather heavy gradient on leaving the Albert Park Railway station, which increases until the maximum is reached at the beginning of the Subway. The top of the subway is level, and then the gradient falls away toward the Middle Park station. We believe if the Railway Department would agree, and we see no reason why they should not, that the present subway girders could be raised about 12in. on the Middle Park side, thus keeping the present gradient out of the Albert Park station. We would keep this gradient until the new subway was crossed, and then carry away this rise toward Middle Park by means of additional ballast on the railway.

The new subway we are suggesting would be about 34ft. from pier to pier, designed for the tramline and footpath only, and as mentioned previously, would be on the Middle Park side.

We want 13ft. 6in. clearance at the subway for the reason that sooner or later the line you propose to construct will be taken over by a Central Authority, and this subway should be capable of allowing the highest tramcar now running in Melbourne to pass underneath.

The clearance of the present subway is approximately 12ft., and as there is a large drain underneath which cannot be changed without some considerable expense, we suggest that the tram lines be carried through the new subway, and in such a case the road level of this subway could be dropped about 5in. below the present level, and still give good drainage facilities into the existing drain. By carrying on the gradient as previously mentioned, and by using a box girder construction for the new viaduct, we believe we could get another 18in. to 2ft. clearance, thus making our desired clearance of 13ft. 6in. under the subway. This clearance is all that is desired, and we do not think that our estimate for this work should be exceeded by the railway engineers, as we have been rather liberal in our estimate, knowing the difficulties they have to contend with in carrying out new work on a running line.

We believe that it will cost the Council about £538 to carry out grading work on both sides of the Kerferd Road subway, which should not be charged up to the tramway. It will be necessary to cut down the road on each side to make easy approaches, and then re-metal. From the advantages gained, we would consider this to be a fair charge on road construction.

You will note that we have put down in our estimate the whole amount of £2,088 for the alteration of the Kerferd Road subway, but this is not quite fair to the tramline.

### (d) ADVISABILITY OF EXTENSION SOUTHWARD THROUGH ST. KILDA TO JUNCTION WITH BALACLAVA ROAD TRAMWAY.

We have previously mentioned in this report that the tramway ending at Fraser Street will pay well, but this is not the natural ending for this line. It should be continued at least to Fitzroy Street, by way of Patterson Street, Park Street, Mary Street and Marine Parade, but preferably to Carlisle Street by Acland Street, and link up with the Balaclava line of the Prahran and Malvern System, making by this junction a complete line of electric tramway from Princes Bridge to Kew, and the various branches radiating from same. We think the advantage would be mutual, and even with transfers at the corner of Carlisle and Acland Streets, the exchange would be such as to assist both systems.

To have a complete system of electric tramways from Princes Bridge straight through to St. Kilda would bring to your line a very large through traffic that you would not otherwise obtain. It would also stimulate the local traffic between South Melbourne and St. Kilda, which is at present not as great as it might be, owing to the lack of proper travelling facilities. The various Summer entertainments at St. Kilda are attractions that will make traffic for your line, and we do not doubt that Beaconsfield Parade would also draw a large share of the people who would use the Balaclava line.

We have in our estimate for the extension of your proposed line to Carlisle Street included the cost of a double line connection with the Prahran and Malvern Trust's Balaclava line. The overhead work would be equipped with section insulators, and it seems that it may be possible for you to obtain tram cars and crews from the Prahran and Malvern Trust at a reasonable rate for days or nights of exceptional rush traffic on your line; or you might allow the Prahran and Malvern Trust to run through cars over your line, at a rate per car mile to be agreed upon, to deal with holiday traffic to Beaconsfield Parade or to the Cricket Ground for Football matches.

This arrangement is frequently arrived at in America by private Tramway Companies that inter-connect, and it is done for mutual benefit. This suggested inter-running would probably stimulate traffic to a very marked extent on both lines.

We have not estimated on this particular traffic for revenue purposes on the St. Kilda extension, but there can be little doubt that a very substantial amount would go to revenue from the above suggested arrangement.

### COST OF CONSTRUCTION OF THE ST. KILDA EXTENSION.

The length of the extension from Fraser Street, South Melbourne, along Patterson Street, Park Street, Mary Street, Marine Parade and Acland Street to Carlisle Street would be 88.3 chains.

The Permanent Way construction would be exactly similar to that proposed for South Melbourne.

The special work would consist of a crossover at Fraser Street instead of a turnout; double track crossing for crossing the Cable Tramline at corner of Fitzroy and Acland Streets; crossover in Acland Street, near Carlisle Street; double track connecting with the Prahran and Malvern line in Carlisle Street.

Overhead construction to be of the steel side pole type, similar to the work in South Melbourne.

The three additional tram cars for this extension would be of the same type as suggested for your line, and, with the tram cars already provided for, would give you 13 cars to operate the whole line. We believe that you would have to add to this number at an early date, because of the traffic that will be stimulated by the through line.

**PERMANENT WAY CONSTRUCTION :—**

|   |             |
|---|-------------|
| 88.3 Chains Double Track .. .. .                          | £11,012 0 0 |
| Allowance for Sewers, Gas, Water-pipes and Drains .. .. . | 250 0 0     |
|   | £11,262 0 0 |

**SPECIAL WORK :—**

|   |           |
|---|-----------|
| Two Crossovers .. .. .  |           |
| Special Crossing for Cable Tramline; Double line connection with P. & M. Balaclava line .. .. . | 1,632 0 0 |

**OVERHEAD CONSTRUCTION :—**

|   |           |
|---|-----------|
| 88.3 chains of Overhead side pole construction for double track, including Crossovers, Special Work, Alterations to Telephone, Telegraph and Electric Light wires .. .. . | 2,007 0 0 |
|---|-----------|

**CARS :—**

|  |             |
|--|-------------|
| Three Cars as Specified .. .. .  | 3,300 0 0   |
| Interest on Capital during Construction, Engineering Fees and unforeseen contingencies .. .. . | 1,507 0 0   |
|  | £19,708 0 0 |

**ESTIMATED REVENUE AND EXPENDITURE.**

Taking the estimated population on each side of the proposed St. Kilda extension to Carlisle Street, and a quarter of a mile beyond at 5,280, which figure has been supplied by the St. Kilda Municipal Authorities, and using the same annual return per head of population as on your line, it would give you 5,280, at 14/-, or £3,696 per annum. We think this is not the correct figure, for the reason that the proposed extension is contemplated for gaining a larger return on your own line, and this assumption will also apply to the St. Kilda extension. We have taken the figure of 15/- per annum per head of population served in the tramway area. This gives a return on the St. Kilda extension of £3,960; but this would give you on this assumption, 1/- more per head of population, or 23,500 x 1/-, equalling £1,175 more in your previous return as estimated for your South Melbourne Tramway.

Taking the St. Kilda extension as having the same car mileage basis as estimated for the South Melbourne main line, we arrive at 102,000 car miles per annum for the St. Kilda section, which, at 9d. per car mile, gives £3,825 as the working expenses. This does not include any revenue from the proposed connection with the Prahran and Malvern line or of any of the mutual benefits that might be anticipated.

We have taken into consideration in this portion of our report, that the through fare from St. Kilda to Princes Bridge would have to be three-pence, and that a penny section might be taken from corner of Carlisle and Acland Streets to Fraser Street, a distance of 88.3 chains, and perhaps another penny section from Fitzroy Street to Armstrong Street, thus over-lapping your first penny section. This, of course, is a matter for your consideration, and we assumed that you might adopt the above-mentioned fares.

The Renewal Reserve Fund ought to be provided on the following items :—

|                               |             |
|-------------------------------|-------------|
| Permanent Way .. .. .         | £11,012 0 0 |
| Special Work .. .. .          | 1,632 0 0   |
| Overhead Construction .. .. . | 2,007 0 0   |
| Cars .. .. .                  | 3,300 0 0   |
|                               | £17,951 0 0 |
| Total .. .. .                 |             |

If two per cent. per annum was charged on the sum of £17,951, for the Renewal Reserve Fund, it would amount to £359.

The financial aspect of the proposed extension to St. Kilda, based on the above figures, would be as follows :—

|  |            |
|--|------------|
| Revenue per annum .. .. .  | £3,960 0 0 |
| Working Expenses per annum, including maintenance, power, cost and management, at 9d. on 102,000 car miles .. .. . | £3,825 0 0 |
| Interest on £19,708, at 4½% .. .. .  | 887 0 0    |
| Renewal Reserve Fund, 2% on £17,951 .. .. .  | 359 0 0    |
|  | 5,071 0 0  |
| Difference .. .. .   | £1,111 0 0 |

This apparent loss on this section does not take into account the gain on your own line due to this extension, which we have given as £1,175; this would leave a nett profit of £64, nor does it take into account other revenue from the inter-connection with the Prahran and Malvern line that would undoubtedly result.

The returns of the complete system, including the St. Kilda extension, would be as follows :—

|  |             |
|--|-------------|
| Total Revenue .. .. .  | £21,585 0 0 |
| Working Expenses, 402,000 car miles per annum, at 9d. per car mile .. .. . | £15,075 0 0 |
| Interest on £83,081, at 4½% .. .. .  | 3,739 0 0   |
| Renewals Reserve Fund, 2% on £72,980 .. .. .                               | 1,460 0 0   |
|  | 20,274 0 0  |
| Total nett profit .. .. .  | £1,311 0 0  |

We may point out that the total gross income and car mileage of the line, as given above, compares as follows with the Prahran and Malvern system, as shown in their report of 1911 :—

|                            |                            |                |
|----------------------------|----------------------------|----------------|
|                            | S. M. Estimate.            | P. & M., 1911. |
| Annual Revenue .. .. .     | £21,585 which is 82% of—   | £26,314        |
| Annual Car Mileage .. .. . | 402,000 which is 85.7% of— | 468,724        |

The above figures indicate that our estimate is conservative.

We have not mentioned before that a considerable saving should result to the Council on account of a large portion of road maintenance being a charge on the tramway. The maintenance of the entire roadway from 18in. outside each outer rail, including the centre portion between tracks will be a charge on the tramway, and the saving in this way should be a very large reduction on the road maintenance in the streets the tramway traverses.

Present indications point to the Electrification of the Cable Tramways within the next few years, and when this work is taken in hand, the Authorities will no doubt take over all the tramways owned by the Municipalities, and the interlinking of these will mean a more complete and quicker transit to the City of Melbourne, as well as adding considerably to the revenue of each particular Municipality.

In conclusion, we desire to state that we think the construction of the tramway is justified. 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, so our estimate should be absolutely correct for the work specified. The estimate of Revenue and Expenditure is conservative, and proves that the undertaking will be a paying one from its inception.



The facilities for rapid transit that it will introduce to the population within your boundaries, as well as the advantages it will give to those outside of your city, to travel to your places of amusement and recreation grounds, are reasons that should weigh with you in establishing this line at an early date.

In conclusion, we beg to place on record our appreciation of your Town Clerk (Mr. E. C. Crockford), and especially your City Surveyor (Mr. A. E. Aughtie), for the accurate information placed before us. We have also availed ourselves of Cr. Strangward's excellent report.

We have the honor to be,

Gentlemen,

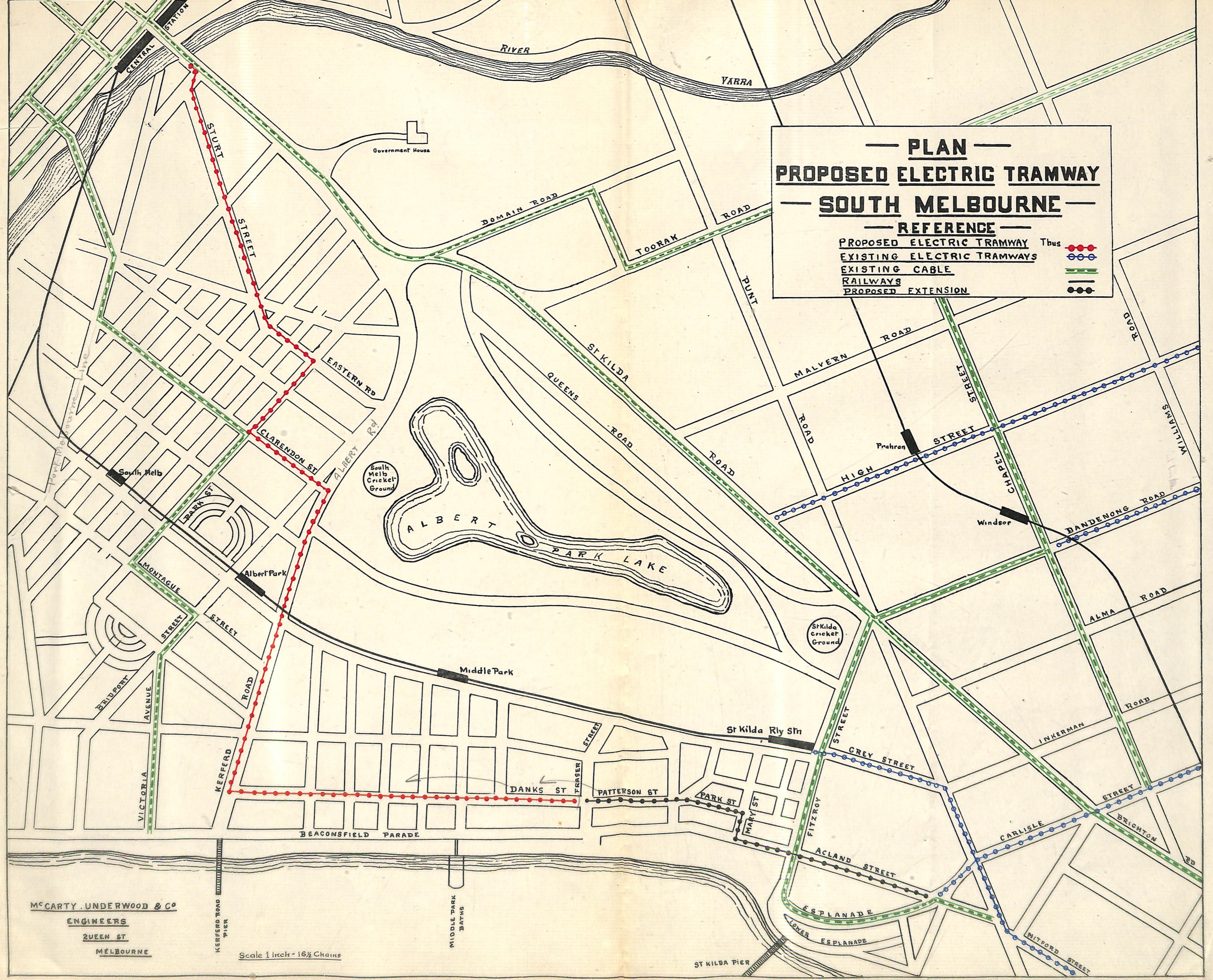
Your obedient servants,

(Signed) McCARTY, UNDERWOOD & CO.

To The Mayor and Councillors of the City of South Melbourne,  
Town Hall,  
Banks Street,  
South Melbourne.

**— PLAN —**  
**PROPOSED ELECTRIC TRAMWAY**  
**— SOUTH MELBOURNE —**  
**— REFERENCE —**

|                            |      |  |
|----------------------------|------|--|
| PROPOSED ELECTRIC TRAMWAY  | Thus |  |
| EXISTING ELECTRIC TRAMWAYS |      |  |
| EXISTING CABLE             |      |  |
| RAILWAYS                   |      |  |
| PROPOSED EXTENSION         |      |  |



MCCARTY, UNDERWOOD & CO  
 ENGINEERS  
 2 QUEEN ST  
 MELBOURNE

Scale 1 inch = 16 1/2 Chains

