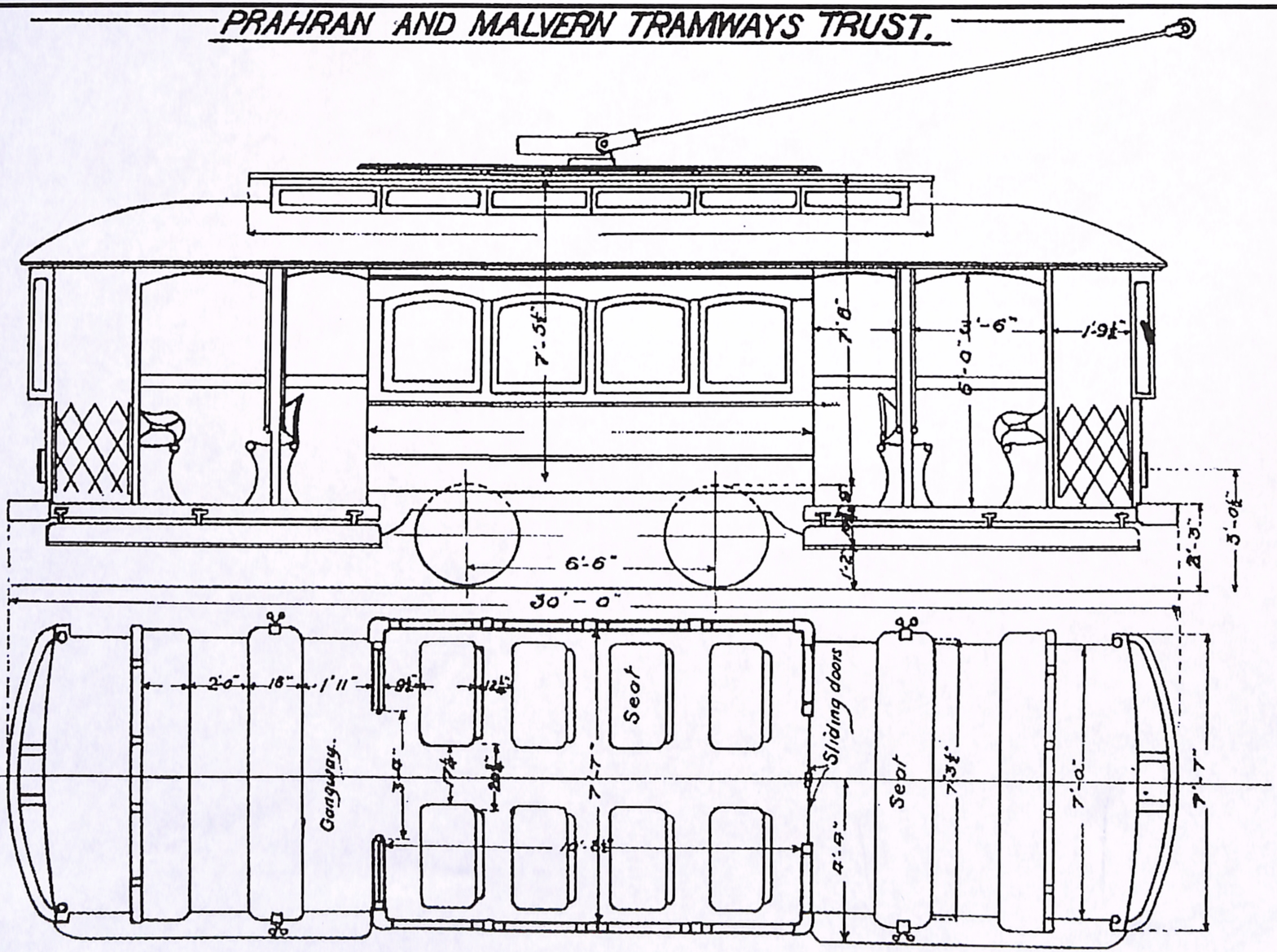
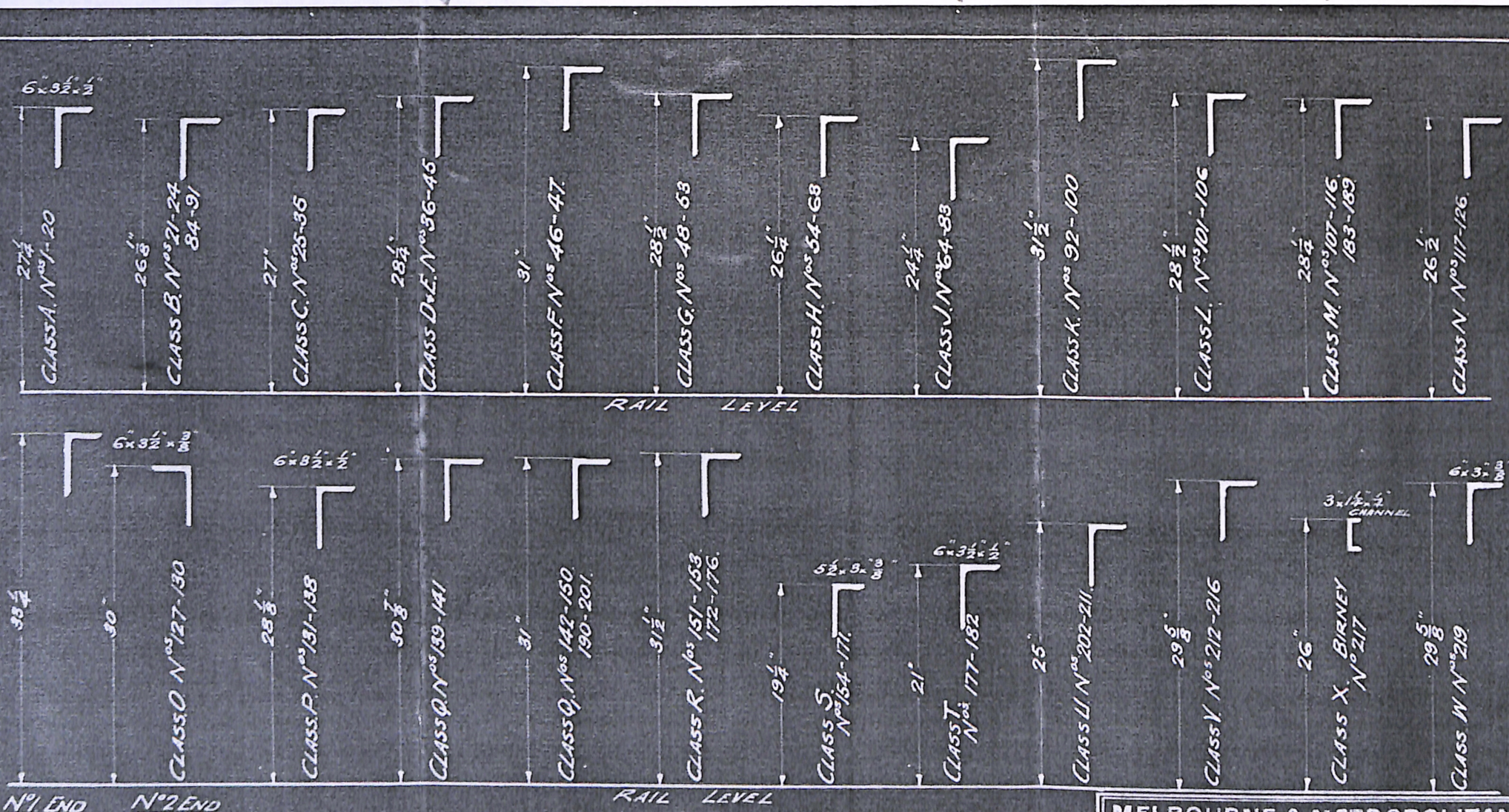
PRAHRAN AND MALVERN TRAMWAYS TRUST.



COMBINATION CAR

Bogie

but raised before the cars were sold to Geelong



NOTE-
ALL HEIGHTS SHOWN ARE WITH FULL TYRES

DIAGRAM SHOWING HEIGHTS OF BUMPERS OF TRAMCARS

MELBOURNE & METROPOLITAN TRAMWAYS BOARD

C. P. Merrett

Date 14.11.23 CHIEF ENGINEER

DRAWN.	TRACED.	CHECKED.	PASSED.
JO.	JO.	WS	

SCALE

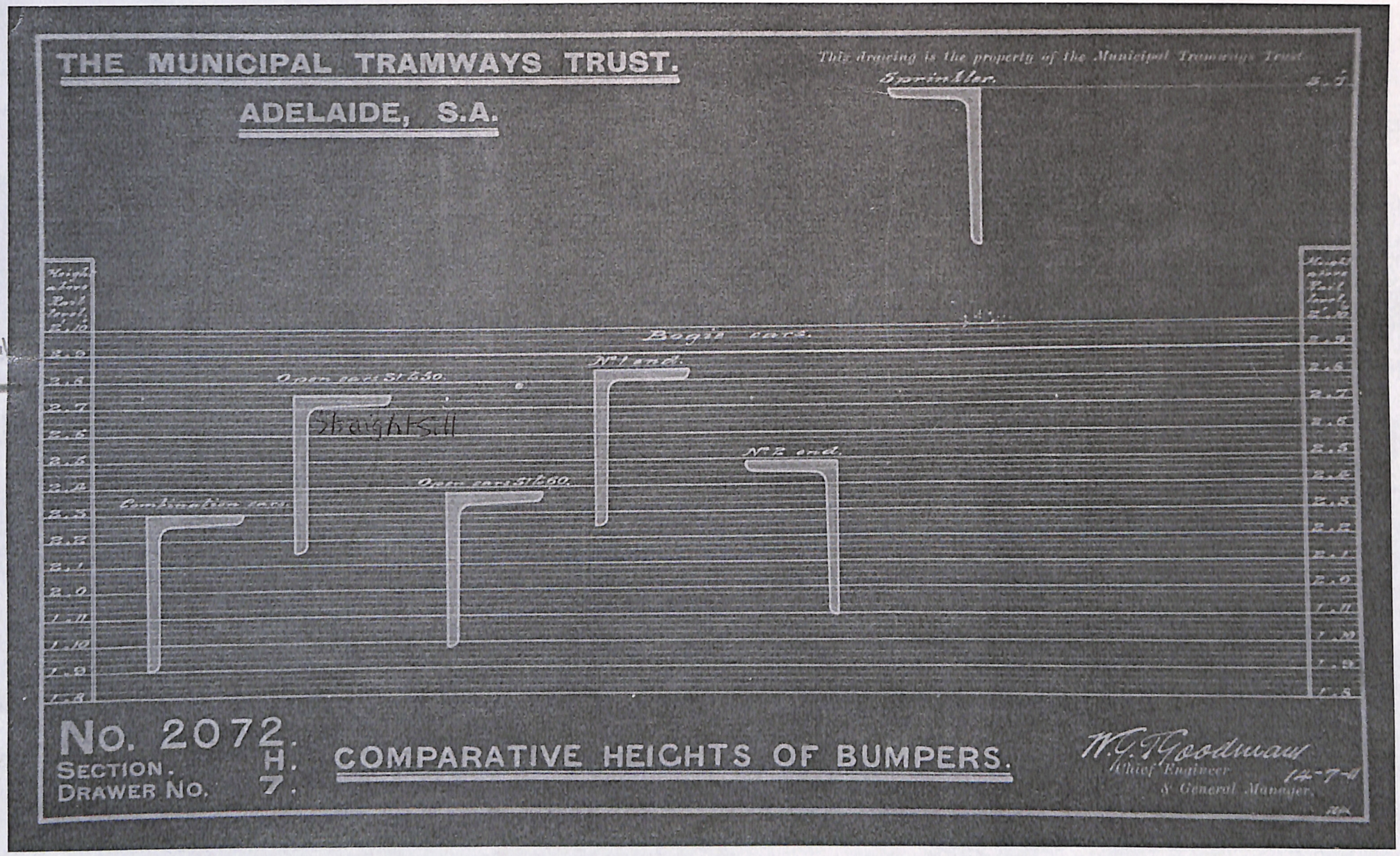
R 1199

m/242901

M&L Rowe

THE MUNICIPAL TRAMWAYS TRUST.

ADELAIDE, S.A.



No 2
5/19
no mechanical equip.
30"

NO. 2072.
SECTION. H.
DRAWER NO. 7.

COMPARATIVE HEIGHTS OF BUMPERS.

W. G. Goodman
Chief Engineer & General Manager.
14-7-4

costing a large amount of money, have been tried with Lines, Cars and different systems of working. We are prepared to advise with Companies and to submit prices for complete construction and equipment of Tram Lines, building Stables and Cars, purchasing Horses, Harness, etc., and, if required, to run the lines for three, six or twelve months after completion, handing the whole line over in working order; or we will undertake the building of Lines and Cars, or of supplying Cars only. We have supplied every Company in South Australia with our make of car, and completely stopped the importation of them from America. We are now supplying Cars for the Ballarat Tramway Company, Victoria.

DUNCAN AND FRASER.

Contractors : Coach Builders, South Australia : Victoria.

R.H.P. October, 1966

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A SHORT DESCRIPTION OF THE "A" CLASS TRAMCAR

By D.J. Prosser

The first group of tramcars operated by the Prahran and Malvern Tramways Trust were single truck open 'California' combination type cars, with a central saloon and drop-end platforms. The original order for 13 cars, (Nos. 1 - 13), was ready at the opening of the first two lines on 31st May, 1910, being built by Duncan and Fraser, and entered service between January and May, 1911. (These twenty cars had become the M. & M. T. B's "A" class by August, 1923). They were of impressive appearance, the interior appointments being as follows :- ceilings of natural wood with dark stained colour outlining on each divided section of the ceiling, patterned wood mouldings used for the advertising panel strips and at each end of the saloon, double co-acting sliding doors with the Trust's monogram embellished on the glass on the left hand side (looking from the centre of the saloon towards the outside compartments); seating in the saloon was of the Brill "Winner" type being four pairs of ratten covered tip-over seats, while the interior sides of saloon were faced with recessed panels suitably varnished and lacquered in natural colours. The clerestory windows were coloured Rose-pink and Green, fitted alternatively, and they could be opened to form roof vents. The bulkhead windows were fixtures, while they were protected by safety bars in the smoker's compartments. The middle section of the Motorman's bulkheads were a combination of stained glass strips on either side of the car, the remainder being panelled timber. Luggage racks were provided on the passenger's side of each Motorman's bulkhead, with the initials "P. M. T. T." cast into the brackets. Directly below the luggage racks the words "DUNCAN & FRASER, ADELAIDE, BUILDERS" were printed in gold leaf with black shading; this type of sign was also placed on the interior of the saloon bulkheads, directly above the doors. Drop end seats were of the facing cross-seat type, but they could not be tipped over.

Bumpers raised by M+MTB.

All notices and plates were baked enamel, with black letters on a white background. The car numbers were made of the same material, being oval shaped with a black oval outline.

The exterior colour scheme was chocolate and cream with tuscan red guttering and bulkheads. The rocker panels were painted cream and had the words "MUNICIPAL TRAMWAYS" printed on them in chocolate without any lining or shading. The roof colour was buff.

The cars were fitted with "BRILL" link and pin couplers, although the P. & M. T. T. never ran trailers. The life gate gear was made by "HUDSON AND BOWRING", and the braking was done by the 'B' type method, using WESTINGHOUSE WH TIF controllers combined with "NEWELLS" magnetic track brakes.

As these trams were built in South Australia, they were supplied to the Trust with the type of destination box and signs in vogue in Adelaide at that time, i.e. coloured symbols and names, modified, of course, to Prahran and Malvern names. This box was fitted on to the middle of the Apron or Dasher at each end of the car, between the plain-glassed headlight and the front window sill. Eventually, all of the cars received a modified form of destination box, of a type as used on the Victorian Railways Electric Street Railways, (but with a roller blind instead of a multi-sided block of wood), and this box became known as the "MALVERN" type. It incorporated colour-light destination symbols for night operation, e.g. :- Route 2, St. Kilda Road to Glen Iris, two red lights at night. This latter type of box was fitted on the end roof canopies of all the P. & M. T. T. trams at each end of the car (and on to some of the early M. & M. T. B. cars, notably the "Q" and "R" classes). A round piece of steel, measuring about 12 inches high and complete with a footrest on its top, was fitted to the top of each bumper bar. These extension pieces allowed an employee, who had to change the destination sign at a terminus, the height necessary to reach the operating mechanism.

After the M. & M. T. B. took over the Trust, most of the "A" class were transferred to the isolated Footscray system, and it was at this period that some of them received the new standard M. & M. T. B. type destination boxes. It is known that cars 3, 10, 14 and 16 were converted, whilst cars 2, 9 and 18 were not. Of the remaining 13 cars, it is not known whether the roofs were cut and new boxes inserted, or how many remained unaltered.

In an effort to standardise, the M. & M. T. B. removed the tip-over seats in the saloons and replaced them with longitudinal seats, using the top half of the recessed interior side lining panels as the seat backs. Several cars had G.E. K36JR controllers fitted for a while during the early 1920's.

When air brakes were fitted in 1920, the rheostatic braking notches on the controllers were placed out of use, and the magnetic track brakes discarded. Car No. 10 had a lower clerestory roof and a longer trolley base (U.S. 6), these non-standard modifications were presumably some of the provisions for conversion of the cars to double deck operation as the Trust had this rebuild under consideration. With the introduction of the then new "W"

class trams, the "A's" had their bumpers raised to conform with the height of the new trams. As more and more "W" class cars began entering service, the "A's" (in common with other single truck trams) became surplus, and eventually they were withdrawn from passenger service and disposed of. In 1927, car No. 8 was converted to a scrubber car and renumbered 3. A drivers instruction car was built in 1925 from No. 17 utilising the truck, motors and control gear, etc., and it was installed in the Drivers Instruction School situated at Hawthorn Depot. No. 7 was referred to as "Essendon Scraper Car" during 1926 to 1919 (when it was sold). The truck from No. 11 was placed under the P. & M. T. T's. scraper car in 1915, and No. 11 received a truck with 2 x 53 h.p. motors from No. 64. No. 11 subsequently reverted to W.H. 205N motors. The remainder were either scrapped or sold between 1928 and 1931.

SOME TECHNICAL DATA.	CLASS "A"
Type.	Single truck drop end combination.
Built	in 1910 by DUNCAN & FRASER, Adelaide.
Motors.	Westinghouse 205N. 2 x 33 h.p.
Controllers.	Westinghouse TIF.
Length.	30 feet 11 $\frac{1}{4}$ inches.
Truck.	Brill 21E, 6 feet 6 inch wheelbase. 33 inch diameter wheels.
Trolleybase.	U.S. 5.
Compressor.	W.H. D.H.10.
Tare.	11.85 tons.
Seat.	36 passengers.

I gratefully acknowledge the assistance received in compiling this article, from Mr. K.S. Kings and the Archives of the T. M. S.

D.J.P. October, 1966.

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PUBLICATIONS RECEIVED:

Trolley Flash. We have received, and are grateful to do so, back copies and the current issue of "Trolley Flash", the official publication of the Australian Electric Transport Museum (S.A.) Inc. Vol. 1, No. 1 contains a Message from the President, Past and Future work at the site, Report on the Annual General Meeting and Interesting news from U.S.A. I quote from "Trolley Flash" this item of news: "One of the Museum's Trustees, on his return from the United States of America, where he has been studying, reports that the condition of more progressive Tramway Museums there, is no better, and indeed, worse than ours, generally speaking. Apparently many institutions are burdened with vehicles that are little more than shells, and lack any definite plan for restoration and preservation". Unquote.

Vol. 1, No. 2 gives details of the Walkerville Horse Tram, Novel method of collecting Donations, Progress Report on Museum work. Night work parties, the "Green Goddess", 'H1' Trucks and Road one to be filled in.

Vol. 1, No. 4 notes that "Green Goddess is now at St. Kilda, Report of the General Manager, Subsidiary display set up - 'A2' class tram, No. 42

COPY FOR MR. DIXON

MELBOURNE & METROPOLITAN TRAMWAYS BOARD

DATE 21/3/34 NO 1094
DEPT.
DATE AND BY WHOM
673 Bourke Street, MELBOURNE.
16th March 1934

Chief Engineer & General Manager,
Electric Supply Company of Victoria Ltd.,
BENDIGO.

Dear Sir,

In reply to yours of the 15th inst. I am pleased to let you have the information asked for. Our standard height of ears above rail level is 18'6", and the span wires are attached to the poles at such a height as to allow of an inclination of 1 in 8 in the span wire between the ear and the pole. When running trolley wire we work as near as possible to the recommendations of the A.E.R.E.A., U.S.A. These particulars can be obtained from Richey's Handbook.

Yours faithfully,

TP.STRICKLAND

CHIEF ENGINEER.

Ack. 20/3/34

Mrs Mowatt
A.D.D.
23.3.34

Oct 1923

The rolling stock consists of ten single-truck combination cars, seating 36 passengers, and equipped with two 45 H.P. motors; two open-type cars with similar equipment, seating 40 passengers; and two open-type trailer cars. The car bodies were manufactured by Messrs. Duncan and Fraser, of Adelaide, and are mounted upon Brush Type 21E Flexible Wheelbase trucks, with British Westinghouse equipments.

The track is laid with 90 lb. per yard grooved rails, laid on concrete stringers or wooden sleepers. A two-mile section of track has recently been constructed with 80 lbs. Tee-headed rails of EAST line Australian manufacture, laid on wooden sleepers. Track rail joints are electrically welded, and tracks are cross bonded".

In the centre of the city, where the streets are wide, the No. 00 B. & S. grooved copper trolly wire is supported by centre poles, while further out span-wires construction is used. I he trolly voltage is 550.

1 he system is very shortly to be extended, and the rolling stock will be increased by eight new combination cars, and two Birney light-weight Safety cars.

The Company's activities include an Installation Department dealing with the supply and maintenance of industrial power requirements and domestic power, heating and lighting. 'Phis department is equipped with show rooms, motor vehiclesr and a permanent staff of wiremen.

The Mains and Installation Departments and Tramways operate ten motor vehicles, comprising three-ton and one-ton lorries, tower waggons, a motor road-roller, and a portable air compressor for pneumatic tools.

Engine Room and Switchboard.

Electric Supply: first established in 1902 - in operation until 1920 as a purely DC system, when in anticipation of the industrial development of Geelong was entirely replaced by a 3 phase 6000v 50 cy generation + distribution

f

HARVEST OPERATIONS.

Men throwing Salt on to Portable Conveyors, which deliver it into Elevators.

The Manufacture of Salt

THE Works of THE CHEETHAM SALT PROPRIETARY LIMITED, situated on Stingaree Bay, near Geelong, were started by the late Mr. Richard Cheetham and the late Mr. A. W. Cunningham, some 34 years ago. The former came out from England, and, after touring the world, fixed on the site where the present works stand as being the best spot of any he had seen for a Solar Salt Works. Some hundreds of acres were leased, and work was commenced on a small scale by Solar Evaporation. The works now cover an area of 1,200 acres.

The process of making Solar Sea Salt consists essentially of evaporating sea-water by natural means. Sea-water contains 3%% solids, of which '¿y2% is salt. At Geelong the average rainfall is 19^2 inches, while the evaporation varies from 24 to over 30 inches.

Stingaree Bay has been enclosed by a Coffer Dam a mile long. Into this "Receiving area the rising tides ilow through sluice gates. Erom this area electrically-driven pumps remove the seawater to a series of paddocks at higher levels. There are 50 miles of walls in this section of the Works. After flowing in and out of many paddocks, the density of the sea-water rises, until it commences to give up Gypsum (Calcium

21st September, 1934.

TW 12/86

State Electricity Commission of Victoria.

GEELONG ELECTRIC TRAMWAYS.

GENERAL DESCRIPTION OF TYPICAL TRAMCAR

The cars used are of the single truck, single deck, combination type, arranged for one-man-two-men operation, the seating capacity being 32. The trucks are of the Brill 21E type, having a wheel base of 6'6" and a track gauge of 4'8½".

The attached photographs shew the type of body in use, the upper photograph and upper plan depicting the combination car before being altered, and the lower photograph and plan depicting the car after having been converted for one-man operation. Since the lower photograph was taken, an additional rear entrance has been provided on each side immediately at the rear of the saloon, between the saloon bulk head and the transverse seat.

No 26 MESCo — No 29 GET — Repainted early '31.

The light coloured panels shewing in the photo are painted buff, i.e. middle chrome yellow toned down with white, and the border lining is done with Indian red, there being a thick and a fine red line. The dark coloured panels are painted light bronze green with a thick black border lining which is relieved by a fine light green line on each side of it. On the inside of this black lining there is a single fine yellow line which matches the light coloured panels.

The car number and the monogram are finished in gold leaf, and the window and door pillars are painted buff, the same as the light coloured panels. All window frames shew the natural colour of the wood, the clear varnish used on them serving only as a weather protection.

All truck parts and hand-rails are finished in black, and the whole of the roof and monitor is painted dark stone colour.

The principle dimensions of the cars depicted in the attached photographs are as follows.-

Length (over bumper bars)	...	31'0"
Width at floor level	...	6'8"
Width at roof level	...	8'3"
Height from rails to floor	...	1'10" — 1'0" here at home
Height from floor to weather rail	..	6'0"
Height from rails to top of saloon monitor (overall height of car)	..	10'0"

18" clearance to roof

END

CR 100
DEPARTMENTAL

9/8716

STATE ELECTRICITY COMMISSION OF VICTORIA.

GEELONG ELECTRICITY SUPPLY

Ref. CMcI.EER

To ENGINEER & MANAGER.

From MANAGER, GEELONG. 21st September, 1934.

TRAMWAYS - MISCELLANEOUS.

Some time ago we received a communication from a person in Melbourne who asked for samples of tramway checks, his hobby being that of collecting same. Strange to say, we have now received a letter from a Mr. Clifford Newman of 1 Lessington Ave., London Road, Romford, Essex, England, in which he asks for samples of our checks together with any photographs and other particulars relating to car dimensions, car painting, etc. He further states that his rather unusual hobby is that of collecting checks and making coloured drawings of tramcars and omnibuses from all parts of the world. However, as any information given to Mr. Newman has a certain publicity value as far as the Geelong Electric Tramways and the city of Geelong are concerned, we have forwarded to Mr. Newman samples of our used checks and sample photographs of our one-man cars, together with a general description covering the dimensions and the painting of the cars, copy of which is attached.

A.T. Meakin

ATT WARRINGTON CAMRON

Inst of Engineers Aust. 1934 1933

14. Electricity Supply in Victoria.

By E. Bate, B.Sc., Whit.Sch., A.M.I.E.Aust.

Electrical Engineer and Chief Assistant, State Electricity Commission.

From a Watchmaker's Hobby to a Great State Utility.

Modern industries possess a startling faculty for growth derived from the power to create and supply the needs of the great majority of the population, and to recognize no barriers, financial or technical, to their purpose.

Compared with these ultra-modern industries of almost explosive propensities, the development of the electricity supply utility has been comparatively deliberate, for the classic researches of Faraday, the father of electro-magnetism, were made 100 years ago, almost coincident with the first settlement in Melbourne.

Reflected in a study of electricity supply in Victoria are the successive vital discoveries and applications of the science of electro-magnetism and thermo-dynamics, and in this survey there is a great deal to interest those engaged in the industry, for along with the changes of technical methods, public and financial control of the industry, there is an intimate interest in the men associated with the growth of the industry and its progress to a position of great service to the community.

Rarely has the State of Victoria lagged seriously behind world standards in the technical or commercial progress of the industry, thanks to the foresight and vision of its technical leaders, for this industry proclaims above all the triumphs of the engineer in the service of man.

The public début of electric lighting in Melbourne and, therefore in Victoria, is said to have been in the year 1863, when, in celebration of the marriage of the Prince of Wales, a scheme of illumination comprising one arc lamp at the Post Office, Telegraph Office and Parliament House respectively was devised. These lamps were supplied with current by chemical batteries adjacent to each lamp, but the arrangement, while beautiful and satisfying as an exhibition, did not emerge as a commercial enterprise.

Seventy years have passed since that day, during which the shackles have fallen from the forces then imprisoned in ignorance, and an industry and utility of great magnitude has arisen, not indeed to full stature—far from it—but to a great position of immense usefulness to the community. At this time few will aver that the ultimate in electricity supply has even been grasped; many will prophesy; few, probably, will see far enough.

So long as the only known form of electric lighting was the arc lamp, the operations of public supply were mainly restricted to street and public lighting; and, moreover, during this era little was known of the possibilities of transmission of electricity over considerable distances. It is not surprising, therefore, to find that between 1880 and 1891 a number of small generating stations was established in Melbourne, each station serving a restricted area, and all doomed to perish as a consequence of the revolutionary technical progress of the decade 1890-1900.

Among the pioneers of this period was Mr. R. E. Joseph, a watchmaker of Swanston Street, who, moved by his deep interest in scientific progress and its application, inspired the formation of the Victorian Electric Lighting Company in 1881. The chairman of this Company was Professor W. C. Kernot, and the business manager Mr. Byron Moore, and the factory premises were in Russell Place—Bourke Street. Although this company operated under the above name for a time, a prospectus dated 1881 describes it as The Australian Electric Company, Limited, and under this name the business was certainly conducted from 1883 onwards, if not earlier.

The history of this company is interesting, for its operations eventually led to the formation of the Melbourne Electric Supply Company.

Two additional companies—The Australian Electric Light, Power and Storage Company and the Indian and Colonial Edison Company—appeared in 1883, of which the latter had a very brief existence, and the former, after lighting Elizabeth Street from Flinders Street to Victoria Street, was forced to merge with the Australian Electric Company.

In 1886 Mr. A. U. Alcock commenced to operate a small lighting plant in Corr's Lane—Little Bourke Street, and in 1888 the same pioneer established a station in South Melbourne, and in 1889 formed the A. U. Alcock Electric Light and Motive Power Company, whose directors were Mr. W. J. Mountain (whose son was later Secretary of the Melbourne Electric Supply Company), Mr. Fincham, Mr. Simon Fraser and Mr. A. U. Alcock.

Messrs. Masters and T. Draper, who were agents for the Thomson-Houston arc light machines, also formed a small company—The Union Electric Company—in 1881, and operated a small station in Heffernan Lane—Little Bourke Street.

In 1886 the Postmaster-General's Department of the State of Victoria fitted up a power plant at the General Post Office to light the building and exterior to the extent of:—

350 — 52 volt incandescent lamps;
8 — Thomson-Houston arc lamps.

This work, carried out under Mr. Smibert, placed the Post Office in the position of being the only building in Melbourne completely electrically lighted for the Queen Victoria Jubilee celebrations in 1887. The building was decorated with huge letters and a crown, all fitted with incandescent lamps, the only rival in this loyal and magnificent display being the Victorian Railways at Spencer Street with an illuminated crown. All other external illuminations used gas jets and suffered great inconvenience under the winter conditions.

It is related that, on the gala night, the pride of one of the Post Office electricians, Mr. E. C. Brewster, who had attended in all the masculine finery of the period to bask in the glory of the department's achievement, was rudely shocked by the orders of his anxious chief to make

a final temperature survey of the fuse installation, which was located underneath the floor boards in a most inaccessible and unclean position.

In the following year, 1888, the Victorian Railways lent the services of Mr. K. L. Murray to supervise the lighting of the Centennial Exhibition by a plant supplying current to 1,000 arc lamps, 3,000 six candle power lamps and forty 400 candle power Sunbeam lamps. This lighting effort was ahead of anything previously attempted in Australia, and the plant at the close of the exhibition in 1889 was transferred to Spencer Street to the building near Latrobe Street, and used by the Victorian Railways.

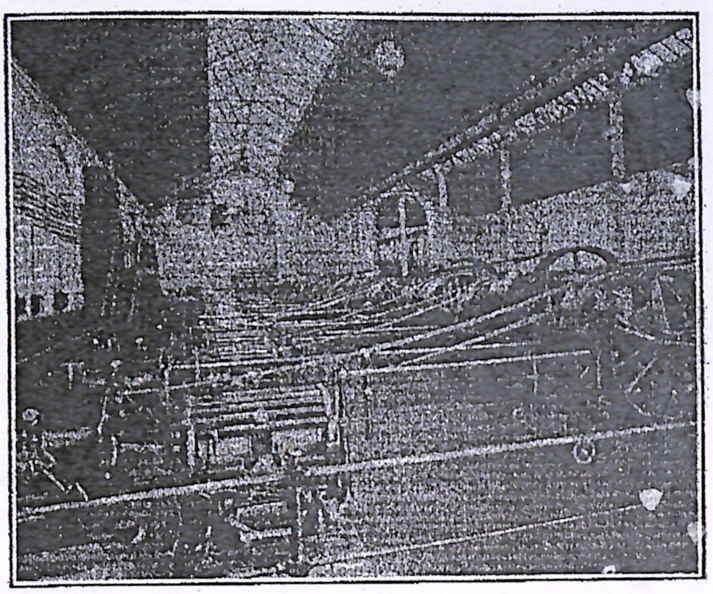
In 1889 the Australian Electric Company was reconstructed and became the New Australian Electric Lighting Company. This Company built a power plant at Green Street, Richmond.

The generating plants of the period operated from reciprocating steam engines, or occasionally gas engines, driving by ropes or belts arc lighting generators, or alternators. In general the frequency of the alternating current was standard for a particular station only. Thus the New Australian Electric Light Company installed alternators operating at 2,000 volts, 97 cycles, in their plant at Green Street, Richmond, in 1890, and in 1891 the A. U. Alcock Electric Light and Motive Power Company installed 42 cycles plant at Burnley Street.

An immense stride had been made in 1888 by the introduction of the first transformers for parallel operations, actually manufactured by Messrs. Ganz of Buda-Pesth, which made possible the supply of electricity from a central plant and the elimination of many isolated installations, which were costly to operate.

It must be remembered that, in these very early days, the energies of companies such as the Australian Electric Company were directed to manufacturing and selling small lighting sets, though in some instances the company maintained and operated the machines for the client. As yet electricity supply as a public utility could hardly develop under the technical limitations of the available apparatus, so that many bodies such as the Postal Department, the Victorian Railways and the Melbourne City Council decided to build and equip stations for the purpose of supplying their own requirements, at that time quite restricted. Since every year, indeed, almost every month at this period, brought new and larger ideas, it is not surprising to find that by 1894, when the Melbourne City Council power station was put into operation for the first time, the installation was of quite formidable size and supply range, though designed for and operated solely on public lighting. This municipal venture quickly took firm root, and its position was consolidated by the provisions of *The Electric Light and Power Act*, 1896, and subsequent compulsory purchase of the assets of the undertakings within the city area of the A. U. Alcock Electric Light and Motive Power Company, T. T. Draper & Company and the New Australian Electric Lighting Company.

In the meantime the two more robust private companies, the A. U. Alcock Electric Light and Motive Power Company and the New Australian Electric Lighting Company, had each moved their main generating plants out of the city, and, being able, by virtue of the new principle of transformation, to supply relatively large areas, selected sites in Burnley Street and Green Street, respectively, both in the suburb of Richmond, and for some years the two companies were in active competition, mainly in the city area.



Typical of 1894. Generating Station of the Melbourne City Council at Spencer Street.

Public lighting was then the backbone of the electricity supply business, and the contracts for street lighting in a municipality became the basis of a virtual franchise for electricity supply over the area, since it was not until 1896 that the first *Electric Light and Power Act* was passed in Victoria to establish statutory control over undertakings, and the delimitation of areas of supply by Order-in-Council.

The New Australian Electric Lighting Company in its plant at Green Street started with a number of 200 h.p. Robey compound engines driving Elwell-Parker 2,000 volt alternators and several Thomson-Houston direct current arc lighting machines. This company and the A. U. Alcock Company at Burnley Street (now the Weymouth Engineering Works) transmitted energy to the city at 2,000 volts pressure, the former using Elwell-Parker step-down transformers, and the latter Ganz alternators and transformers.

These two companies competed actively in the city area in the business of public lighting and general supply, and in 1898 were each obtaining an annual revenue of about £12,000 from business within the city of Melbourne proper. Outside the city area, the Alcock Company operated in the northern part of Richmond, including Victoria Street and Bridge Road, Collingwood and Fitzroy, while the New Australian Company supplied the southern portion of Richmond, a portion of Prahran, and South Melbourne.

Shortly after the passing of *The Electric Light and Power Act*, 1896, both the Alcock Company and the New Australian Company, owing to difficulty in financing the growing business from local sources, entered into a provisional contract with the Brush Electrical Engineering Company, London, for the purchase of their undertakings, and the flotation of a new company to conduct the combined business. The new Company—The Electric Lighting and Traction Company of Australia Limited (renamed The Melbourne Electric Supply Company in 1908)—was registered in 1899, though the purchase and transfer of the undertakings was not completed until January, 1901, when at a cost of £40,000, the transfer to the City Council of those portions of the assets and undertakings

1901

of the companies situated within the City of Melbourne was effected.

The new company sent to Melbourne as General Manager Mr. F. W. Clements, who guided its activities until the acquisition of the Melbourne Electric Supply Company by the State Electricity Commission in 1930, and is at present the chairman of the Commission. Under the guidance of Mr. Clements the company not only vigorously developed its business in the suburbs of Melbourne, but established, and for some time operated, supply undertakings in Adelaide and in Geelong which have figured prominently in electrical development in Australia.

In the early years of the century, a number of men came to Melbourne, several as the result of the stimulus to expansion started in London, who were destined to have great influence upon the development of electricity supply in Victoria. Mr. H. R. Harper came to take charge of the Green Street Station, and after a short period was called upon to succeed Mr. A. J. Arnot as City Electrical Engineer, the latter (who, previous to his appointment as City Electrical Engineer in 1891, had been Engineer to the Union Company) having moved to Sydney to manage the affairs of Messrs. Babcock & Wilcox. Mr. Harper controlled the Melbourne City Council Electricity Department until 1918, when he was chosen to guide the engineering fortunes of the State Electricity Commission of Victoria. Mr. J. E. Donoghue, who came to lay the first high-tension underground cables for the company, succeeded Mr. Harper at the Green Street power station, but soon went to Sydney, first with the Sydney Municipal Council as assistant to Mr. Thomas Rooke, later joining the Electric Light and Power Supply Corporation Limited, of which company he is Managing Director at present.

In 1900 steps were taken to change the high-tension voltage at Green Street from 2,000 to 4,000 volts and to standardize on alternating current. At this time a complete re-organization and extension of plant was necessary and many transformer stations were constructed throughout the supply area and, in short, the foundations of the modern supply system were then laid.

It is interesting to note that to the circumstance that the Electric Lighting and Traction Company of Australia Limited was financially closely associated in these early years with the Brush Electrical Engineering Company, we owe the fact that the frequency adopted in the re-organization of the Richmond Station is the present Australian and British standard; for at that time 50 cycles had been adopted as standard by the Brush Company.

During the period when Mr. A. J. Arnot pioneered the undertaking of the Melbourne City Council, supply efforts were principally confined, as in the case of the companies, to public lighting, for which duty the Council in its first installation, completed in March, 1894, provided 24 Thomson-Houston continuous current arc lighting machines, arranged in groups of six, each group driven by a 300 h.p. Austral-Otis horizontal compound slow speed steam engine. Each engine drove by ropes a section of 6 inch counter shaft to which the relevant arc lighting machines were belted, a fast and loose pulley being used for each machine.

At this time fifteen outgoing circuits satisfied the demands of the installation. Each circuit supplied about fifty Thomson-Houston arc lamps and about the same number of Sawyer-Mann 32 candle power incandescent lamps.

Not until 1897 were the first generators for supply of electricity to private consumers installed. This addition consisted of four 75 kW. General Electric Company, United States America, single-phase alternators generating at 2,000 volts, 72 cycles, and these alternators were belted on to each of the four existing sections of counter shaft without increase in engine power.

In 1899 an additional installation, a 120 kW. Johnson & Phillips alternator, direct coupled to a "Peache" high speed engine, was made.

The low-tension supply pressure was then 100 volts, a fact which a few years later made necessary a considerable expenditure by the Council on rewiring consumers' premises suitably for 230 volt pressure.

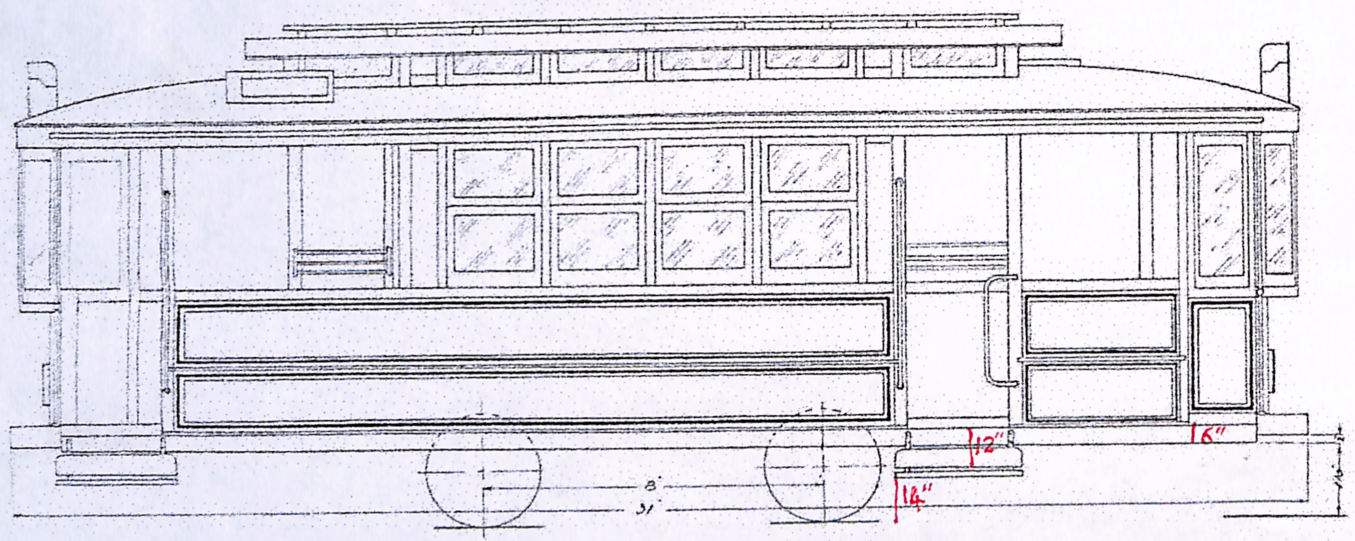
Under Mr. Arnot the prevailing wave of technical sentiment in favour of direct current found expression in the decision to extend the plant by the installation of one 200 kW. and four 350 kW. vertical high-speed engines driving 440/220 v. direct current generating sets, together with motor balancers, this extension being necessary because of the acquisition of the business of the Alcock, New Australian and T. T. Draper companies. The justification for what now appears to have been an aberration lay in two things, first the better qualities of direct current motors at that time, particularly for elevator operation, and secondly the fascination which then attached to battery operation for standby and load regulating purposes. Thus a direct current, 3 wire, 460/230 volt system operated in the central city area, the old 2,000/100 volt, single-phase lighting supply was later changed to 4,400/200/400, 3 wire, 50 cycle, single phase for the outer city areas, and a large sum was spent in rewiring consumers' installations to suit the increased pressure.

It is purely philosophical to reflect that circumstances at the time appear to have amply justified the designers of these bugbears of later standardizers.

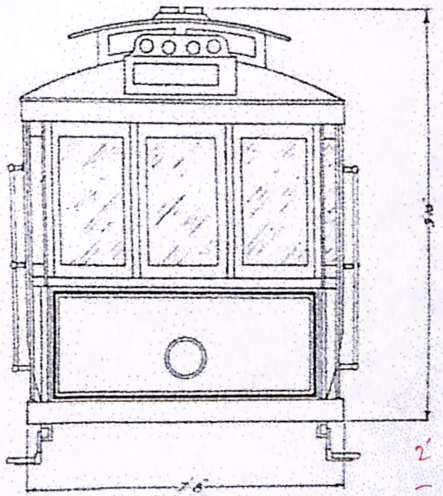
In 1907 the first steam turbines, two 750 kW. British Westinghouse Parson type machines generating 4,400 volts single phase, were installed at Spencer Street, and in 1912 the decision was made to abandon low-voltage direct-current generation in favour of generating at 6,600 volts, 3 phase, 50 cycles, at the same time changing in the outer areas to 400/230 volts, 3 phase, 4 wire supply to consumers.

The Electric Lighting and Traction Company of Australia became interested in supply in Geelong at the same time as the acquisition of the two Richmond companies was in progress, and in May, 1901, commenced supply from the station on Corio Terrace, which, after later remodelling to generate at 6,600 volts, 3 phase, 50 cycles, is operating to-day as part of the State Electricity Commission's supply system. The 1901 plant generated direct current, 440/220 volts, 3 wire, in two 100 kW. Bellis-Brush steam engine sets.

Electricity supply in other country towns, with the exception of Bendigo and Nhill, did not exist in 1903, the next step of any importance being the establishment of the undertakings of the Electric Supply Company of Victoria in Ballarat and Bendigo in 1905 and 1903, respectively. Supply from these plants was also direct-current 440/220 volts, 3 wire, and was generated at this pressure until 1925-26, when Brush-Ljungström turbo-alternators, generating at 6,600 volts, 3 phase, 50 cycles, were installed.



ELEVATION



END ELEVATION

11'10"
3.61 m
Cf Adelaide A
10'9½"
PMTT 10'8"

33" wheels.

26" to sill
25" PMTT Brady p 66

Actual loaded
15 = 20
15 = 17
19/2 1940

REMARKS	CHECKED	PASSED	DRAWING SCHEDULE	TITLE	DRAWING No.
				ELEVATIONS OF BODY. DUNCAN & FRASER TRAM NOS. 1–10.	

SCALE:- ½ IN = 1 FT.

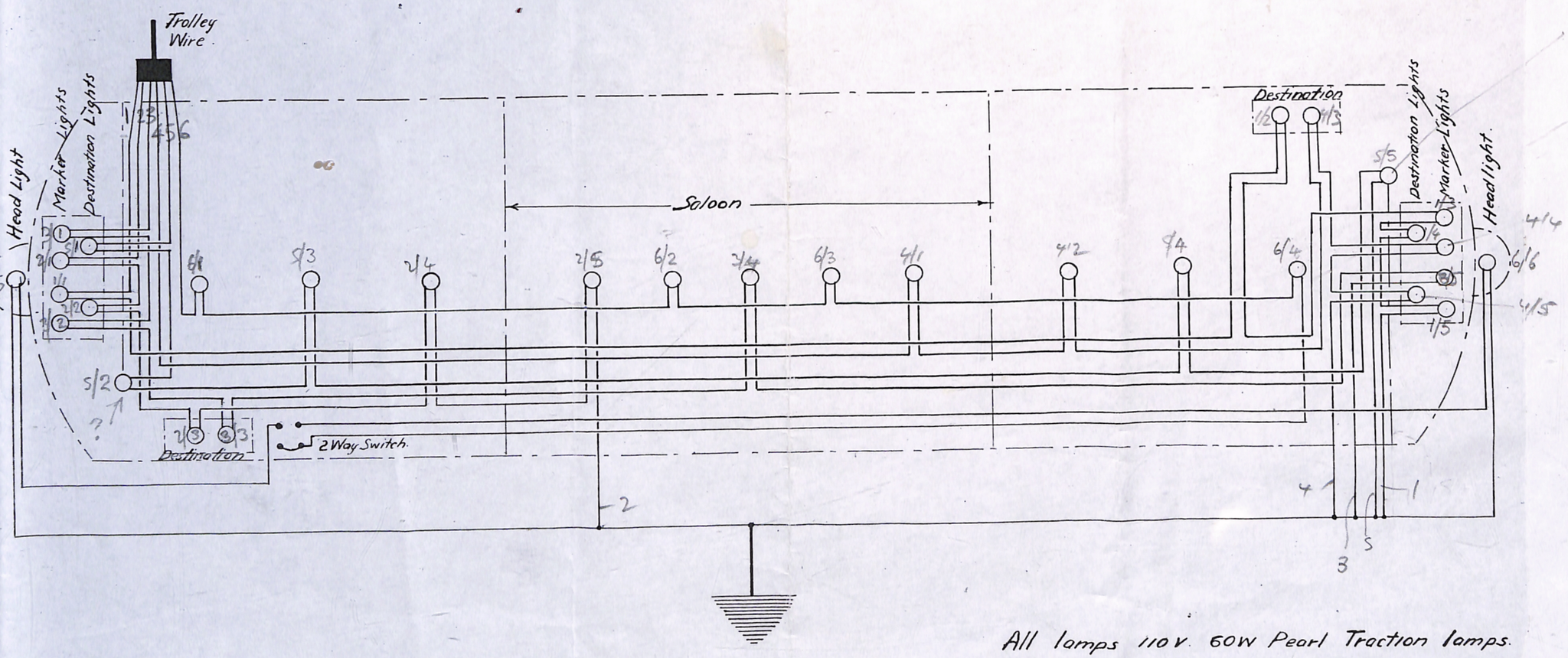
SECTION No.

DRAWN P.L.C. 16-10-34
TRACED P.L.C. 16-10-34
CHECKED A.E. 16-10-34
PASSED E.W. 17-10-34

DRG. No. GE-T9-8360

MANAGER GEELONG BRANCH
W.J. Blanchett 17/10/34

Saloon 11'6" 3'0
Pengelly 13'6" 3'0



31 lights
Circuit 1-5 5 lights.
Circuit 6 6
Car 2 has 6 fewer lights

MARKS	CHECKED	PASSED

LIGHTING CIRCUITS
DUNCAN & FRASER TRAM NOS. 1 TO 10.
MEADOWBANK TRAM NOS. 24 TO 26.

SECTION No.	
DRAWN P.L.C	3-10-39
TRACED P.L.C	3-10-39.
CHECKED	3-10-39
SENIOR DRAUGHTSMAN	5-10-39

DRG. No. GE-T8-8108

MANAGER
GEELONG BRANCH.
W. H. Wheadlook.
5/10/39

D