

(1966)

**MELBOURNE AND METROPOLITAN TRAMWAYS BOARD**

**VICTORIA, AUSTRALIA**



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**TENDER SCHEDULE FOR**

**ALL-ELECTRIC TRAMS**

**Melbourne and Metropolitan Tramways Board  
Victoria, Australia**

**MANUFACTURE  
SUPPLY and DELIVERY  
OF  
100 ALL-ELECTRIC TRAMS**

**Contract No. 2500**

**SEALED TENDERS, endorsed as above, are to be addressed to  
"The Secretary, Melbourne and Metropolitan Tramways Board",  
and must be delivered at the Office of the Board, 616 Little  
Collins Street, Melbourne, Victoria, not later than 2 p.m. on  
Monday, 12th September, 1966.**



# Melbourne & Metropolitan Tramways Board

## Melbourne, Victoria

### MANUFACTURE, SUPPLY AND DELIVERY

#### OF

#### 100 ALL-ELECTRIC TRAMS.

#### CONTRACT NO. 2500.

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# Melbourne & Metropolitan Tramways Board

Melbourne, Victoria

MANUFACTURE, SUPPLY AND DELIVERY

OF

100 ALL-ELECTRIC TRAMS.

CONTRACT NO. 2500.

CONDITIONS OF TENDERING

1. Tenders are to be sealed and legibly endorsed with the name of the work for which the tender is submitted, and the number of the Contract.
2. Tenders shall be addressed to the Secretary of the Melbourne and Metropolitan Tramways Board, 616 Little Collins Street, Melbourne, Victoria, Australia.
3. No tender shall be received after 2 p.m. on the day named for the receipt of such tender unless there are circumstances which, in the opinion of the Board, render it desirable to do so.
4. The Board shall not be bound to accept the lowest or any tender and shall have the right to accept any tender or tenders in respect of any item or items offered, and reserves the right to accept two or more tenders for machinery, plant, materials, goods or services of the same kind and to make concurrent Contracts accordingly.
5. In the event of any successful Tenderer failing to take up his tender, lodge the required Security Deposit, complete the necessary Contract documents, and proceed with the Contract within the time specified in the Contract, or any Tenderer withdrawing his tender after it shall have been opened, whether such tender shall have been accepted or not, all moneys deposited on account thereof or in connection therewith shall be forfeited to the Board.
6. In submitting a tender other than a tender by a Corporation, the full Christian name, surname, and place of residence of the Tenderer must be inserted in the tender form, or when the tender is submitted by a firm, the name in full of each member of the firm must be so inserted. The omission of this information will render the tender liable to be declared informal and rejected.
7. Each Tenderer shall specify in his tender any goods, machinery or materials and the value thereof which he proposes to sell to the Board or to purchase for any works which he proposes to undertake for the Board, which are not manufactured or produced in the Commonwealth of Australia.
8. Tenderers shall send in their tender on the form of tender applicable to the machinery, plant, materials, goods or services in respect of which the tender is made. The rates tendered must be clearly set out in the appropriate places in the schedule attached to the tender and any other information asked for in the schedule must be supplied by the Tenderer. All signatures and entries shall be made in ink. Any tender which does not comply with this condition may be considered informal and be rejected.

These are Conditions of Tendering marked "A" referred to in the annexed Contract with the Board.

WITNESS .....

CONTRACTOR .....



# Melbourne & Metropolitan Tramways Board

Melbourne, Victoria

MANUFACTURE, SUPPLY AND DELIVERY

OF

100 ALL-ELECTRIC TRAMS.

CONTRACT NO. 2500.

CONDITIONS OF CONTRACT.

1. INTERPRETATION OF TERMS.

Whenever the terms hereafter defined in the present clause occur in the Contract as hereinafter defined, they shall, unless inconsistent with the Contract, be construed as follows:-

- "BOARD" shall mean Melbourne and Metropolitan Tramways Board.
- "CHAIRMAN" shall mean the Chairman of the Board, or the person discharging the duties of the Chairman.
- "SECRETARY" shall mean the Secretary of the Board, or the person acting as such for the time being.
- "INSPECTOR" or "INSPECTING ENGINEER" shall mean the person from time to time duly authorised and appointed by the Board to supervise the carrying out of the Contract.
- "CONTRACTOR" shall mean the person whose tender is accepted by the Board, and who executes the Contract referred to therein, his executors or administrators, successors and assigns.
- "SUB-CONTRACTOR" shall mean the person named in the Contract as such for any part of the work, or any person to whom any part of the Contract has been sub-let with the consent, in writing, of the Board, and the executors or administrators, successors and assigns of such person.
- "WORK" or "WORKS" shall mean and include all or any machinery, plant, materials or goods to be provided, or services to be performed under the Contract.
- "CONTRACT" shall mean the documents comprising the Agreement between the Board and the Contractor to provide or perform the work including these General Conditions, the Specification, Schedules, Drawings, Form of Tender, and any other document or letter varying or amending the same and the Form of Agreement to be entered into under the General Conditions.
- "SCHEDULE OF PRICES" shall mean the rates at which the Contractor has agreed to execute the Contract.
- "ITEM" shall mean any of the items enumerated in the Schedule of Prices.
- "SPECIFICATION" shall mean the Specification annexed to these General Conditions.
- "TENDER DRAWINGS" shall mean all Drawings issued with the Board's Specification, together with all Drawings submitted by the Tenderer with his tender to illustrate the type and general arrangement of the work and which are approved by the Board.
- "CONTRACT DRAWINGS" shall mean such Drawings as the Contractor is required under the provisions of the Contract to supply to the Board.
- "TESTS ON COMPLETION" shall mean such tests as are prescribed by the Specification to be made by the Contractor before the work is taken over by the Board.
- "TOTAL AMOUNT OF THE TENDER" shall mean the total cost to the Board of the works to be provided or performed under the Contract.
- Each of the words "SPECIFICATION" and "DRAWING" shall be respectively construed to comprise both.
- "MONTH" shall mean a calendar month.
- Words importing the singular number shall include the plural number, and words importing the plural number shall include the singular number.
- "PERSON" shall include a company, corporation or partnership.
- Words importing the masculine gender shall include the feminine.

2. CONTRACT DRAWINGS.

The Contractor shall, if the nature of the work is such as to make it necessary so to do, supply two sets of copies of contract drawings mounted on cloth, giving full dimensions and details of the work for the information and use of the Board.

These contract drawings shall become the property of the Board and be deposited with the Secretary, and shall not be departed from in any way whatsoever, except with the written permission of the Board.

The Inspector or his duly authorised representative shall have the right at all reasonable times to inspect, at the Contractor's premises, contract drawings which are in course of preparation for any portion of the work.

The Contractor shall be responsible for any discrepancies, errors, or omissions in contract, tender or other drawings or other particulars supplied by him, whether such drawings or particulars have been approved by the Inspector or not, provided such discrepancies, errors or omissions be not due to inaccurate information or particulars supplied to the Contractor by the Inspector; but the Board shall be responsible for drawings and information supplied by the Inspector relating to special details supplied by him.

### 3. EXTENT OF CONTRACT.

The Contractor, in consideration of the Contract Price as hereinafter stated, will supply and deliver to or perform for the Board all the work set out and described in the Specification or implied in or by the same.

The whole of the work shall be of the best quality, and the manufacture or performance of the same in strict accordance with the Conditions of Contract and the Specification, to the full extent and meaning of the same and shall be provided or performed to the entire satisfaction and approval of the Inspector and under the supervision and subject to the inspection of such representative or representatives as the Inspector may nominate for the purpose.

### 4. COUNTRY OF MANUFACTURE.

In the event of the Board accepting a tender for goods, machinery or materials not manufactured or produced in the Commonwealth, such acceptance shall be conditional upon the Board obtaining from the Minister the certificate referred to in Section 4 (1) of the Public Contracts Act 1958.

### 5. CONTRACTOR TO INFORM HIMSELF FULLY.

The Contractor shall be deemed to have carefully examined the General Conditions, Specification, Schedules, and tender drawings. If he shall have any doubt as to the meaning of any portion of these General Conditions, or of the Specification, he shall, before tendering, set forth the particulars thereof, and submit them to the Secretary in writing, in order that such doubt may be removed, and he shall be deemed to have entered into the Contract upon the basis that the meaning attributed to any such portion by the Secretary in a written reply to such submission is the meaning of the same.

### 6. PATENT RIGHTS.

The Contractor shall fully indemnify the Board against any action, claim, or demand, costs, or expenses, arising from or incurred by reason of any infringement or alleged infringement of any letters patent, design, trade mark or name, copyright, or other protected right, in respect of any work or any system or method of using, fixing or working the same or any arrangement used in connection therewith or fixed or supplied by the Contractor to or with the same; but such indemnity shall not cover any user of any work by the Board otherwise than in accordance with the provisions of the Specification. All payments and royalties payable in one sum or by instalments or otherwise shall be included by the Contractor in the prices named in his tender, and shall be paid by him to those to whom the same may be due or payable.

In the event of any claim being made or action brought against the Board in respect of any such matters as aforesaid, the Contractor shall be immediately notified thereof, and he shall, with the assistance, if he so require, of the Board, but at the sole expense of the Contractor, conduct all negotiations for the settlement of the same, or wherever practicable, any litigation that may arise therefrom or be occasioned thereby.

### 7. SECURITY.

Within seven days after the notice of the acceptance of this tender has been given to the Contractor, he shall deposit at some approved Bank in Melbourne, upon Fixed Deposit in the name of the Board, or lodge with the Secretary a Bank cheque or other approved security representing a sum calculated at the rate of Ten dollars (\$A10) per cent on the total amount of the tender if it does not exceed \$A4,000; when the total amount of the tender exceeds \$A4,000, the amount of the deposit must equal 5 per cent of \$A4,000, plus 2½ per cent of the amount over \$A4,000 and up to \$A20,000; where the total amount of the tender exceeds \$A20,000, the amount of the deposit must equal 5 per cent on \$A4,000, an additional 2½ per cent on \$A16,000, and an additional 1 per cent on the amount above \$A20,000; which sum so deposited shall be held by the Board as security for the proper completion of this Contract.

The Contractor shall be entitled to receive any interest as it becomes payable upon money so placed on Fixed Deposit; but it is expressly declared that the Board, its Chairman, or Secretary shall not be liable or answerable in any way for any loss occasioned by such deposit, or for any loss of interest arising from such Fixed Deposit not being renewed.

### 8. INSPECTION AND TESTING.

The Inspector, or his duly authorised representative, shall have, at all reasonable times, access to the Contractor's premises, and shall have the power, at all reasonable times during the manufacture or construction of any work by the Contractor, to inspect, examine, and test the materials used and quality of workmanship performed in or in relation to the manufacture or construction of any work, and if such work is being manufactured or constructed on other premises, the Contractor shall obtain for the Inspector or his duly authorised representative, permission to have access to such other premises and to inspect, examine and test as aforesaid.

As to any work with respect to which tests on completion are prescribed, the Contractor shall give to the Secretary notice when the same is ready for testing. Unless otherwise agreed, the Inspector or his representative shall, within seven days of the receipt of such notice and after not less than twenty-four hours' notice from the Board to the Contractor, be entitled to attend at the Contractor's premises or the premises of any Sub-Contractor for the purpose of witnessing such tests. If no such notice is given by the Board, or the Inspector does not attend at the said premises within the said period of seven days, the Contractor may proceed with such

tests which shall be deemed to have been made in the Inspector's presence, and the Contractor shall forthwith forward to the Board duly certified copies of the records of such tests in duplicate.

In all cases where the Contract provides for tests by the Inspector before delivery at the premises of the Contractor or of any Sub-Contractor, the Contractor, except where otherwise specified, shall provide free of charge, such labour, materials, electricity, fuel, stores, apparatus and instruments as the Inspector may consider requisite from time to time, and as may reasonably be demanded, efficiently to carry out such tests, in accordance with the Contract, and shall, at all times, give facilities to the Inspector or his authorised representative to carry out such tests.

In all cases where the Contract provides for tests after delivery but before such work is put into service by the Board, the Board, except where otherwise specified, shall provide, free of charge, such labour, materials, fuel, stores, apparatus, and such instruments as it has in its possession, as may be requisite from time to time, and as may reasonably be demanded, efficiently to carry out such tests of the work in accordance with the Contract. All special instruments shall be provided by the Contractor.

In the case of Contracts requiring electricity for such last mentioned tests, such electricity as is available shall be supplied free to the Contractor at the pressure of the ordinary supply.

#### 9. CONTRACTOR NOT TO ASSIGN OR SUB-LET CONTRACT.

The Contractor shall not assign or sub-let this Contract or any part thereof without the consent in writing of the Board. Any consent to assign or sub-let work to be done under this Contract shall not discharge the Contractor from any liability in respect to such work, and shall extend only to the work specified in such consent.

#### 10. RATES OF WAGES.

In the carrying out of the Contract, the Contractor shall pay to his employees engaged in carrying out this Contract, for the work performed by them, wages at rates not less than those prescribed by any relevant Arbitration Court Award or Wages Board Determination applicable in relation to the work so performed.

#### 11. REPLACEMENT OF DEFECTIVE WORK OR MATERIALS.

If during the progress of the work, or upon its completion or delivery, the Inspector shall decide that the Contractor has performed any unsound or imperfect work, or has provided any work inferior in quality or quantity to that specified and the Board notifies the Contractor in writing of such decision together with particulars of the work to which the same relates, the Contractor shall at his own expense, within seven days of his receiving such notice, proceed to put such work into sound and proper condition, or remove the same, or provide fresh work up to the standard specified, and in case the Contractor shall fail so to do the Secretary may, on giving the Contractor seven days' notice in writing of his intention so to do, proceed to remove the work complained of, and at the cost of the Contractor, perform or provide all such work provided that nothing in this Clause shall be deemed to deprive the Board of or affect any other rights under the Contract which it may have in respect of such work.

#### 12. MAINTENANCE OF WORK.

For a period of 24 months after delivery of any work to the Board, the Contractor shall be responsible for any defect that may develop or become apparent therein in the course of the proper use of the same, arising from faulty materials, design, or workmanship in manufacture or construction of the same, but not otherwise, and shall remedy such defect when so required by the Board, by notice in writing, which notice shall specify the nature of such defect.

If it shall be necessary for the Contractor to replace or renew totally or in part any defective work or portion thereof under this Clause, the provisions of this Clause shall apply to the work or portion of the work so replaced or renewed until the expiration of 12 months from the date of such replacement or renewal or until the end of the abovementioned period of 24 months, whichever may be the later. If any defect be not remedied within a reasonable time after such notice from the Board, the Board may proceed to remedy the same at the risk and expense of the Contractor but without prejudice to any other rights which the Board may have against the Contractor in respect of such defect.

All inspections, adjustments, replacements, or renewals carried out by the Contractor during the maintenance period shall be subject to these General Conditions.

Until the final Certificate shall have been issued, the Contractor shall have the right to enter, at his own risk and expense, by himself or his duly authorised representatives, whose names shall have previously been communicated in writing to the Secretary, at all reasonable times, upon all necessary parts of the premises of the Board for the purpose of inspecting any work provided by him, and if he desire, at his own risk and expense, making any tests, subject to the approval of the Board, which shall not be unreasonably withheld. Upon the issue of the final Certificate, the security provided pursuant to Clause 7 shall be surrendered to the Contractor.

#### 13. INSURANCE.

The Contractor shall, from time to time, insure against fire in the name of the Melbourne and Metropolitan Tramways Board in some approved Insurance Office, all work upon which any progress certificate has been granted by the Board, and also all materials which may be supplied by the Board to the Contractor for use in connection

with the work, and shall lodge with the Secretary, policies and receipts for such insurance, and shall maintain such policies in force until the possession of the work is given up to and accepted by the Board.

The amount of the said insurance shall be not less than the full cost of the labour employed and materials provided by the Contractor or the Board in relation to the same as shown in the accounts of the Contractor or the Board as the case may be.

If the Contractor shall fail or omit to insure such work as aforesaid, or to pay any premium or premiums thereon, the Board may insure the same and pay any such premium or premiums and the cost and charges of such insurances and all sums expended on or about the same shall be repaid by the Contractor to the Board which shall be at liberty to deduct the same from any sum or sums due to the Contractor under this or any other Contract with him.

#### 14. TIME FIXED FOR COMPLETION.

The time fixed for the completion of the Contract is that named in the Contract, and on that day the Contractor shall hand over to the Board, the work completed and finished in every respect, provided always that the Board may by writing extend the time for completion, and then the Contractor shall so complete and hand over the work on the day fixed in such writing.

#### 15. DAMAGES FOR DELAY IN COMPLETION.

If the Contractor fail in the due performance of this Contract within the time fixed by the Contract or any extension thereof granted under Clause 14, the Contractor hereby agrees to pay to the Board by way of liquidated damages, a sum calculated at the rate of one per centum per week on the Contract price for each week between the fixed or extended time and the actual time of delivery, and the Board may deduct such sum from any money in its hands due or to become due to the Contractor. The payment or deduction of such sum shall not relieve the Contractor from his obligations and liabilities thereunder.

#### 16. CANCELLATION OF CONTRACT.

If the Contractor shall become bankrupt or insolvent, or shall make any arrangement with or assignment in favour of his creditors, or his estate shall become subject to the Bankruptcy laws, or if (in the case of the Contractor being a Company), any proceedings either voluntary or compulsory be taken to wind up the Contractor, or if the Contractor shall assign or sub-let the Contract contrary to the provisions hereof, or if execution be levied against any property of the Contractor, or if the Inspector shall certify under his hand to the Board that in his opinion the Contractor:

- (a) Has abandoned the Contract, or
- (b) Has failed to give the Board's Inspector, Engineers or Officers proper facilities for inspection and testing of the work, or
- (c) Has failed to effect delivery within a reasonable time of the dates fixed for delivery, or
- (d) Has delivered material of such a quality that more than 25 per cent thereof has been rejected under the terms of the Contract,

then the Board may by notice in writing to the Contractor determine the Contract and the same shall be determined accordingly save as to the rights and powers conferred upon the Board and the Inspector thereby and save as otherwise provided in Clause 17.

The Inspector's certificate under this Clause shall be conclusive proof as between the Board and the Contractor of the statements contained in it.

Upon this Contract being determined the whole of the security provided under Clause 7 hereof or such portion thereof as the Board shall determine shall vest in and become the absolute property of the Board.

#### 17. SETTLEMENT OF DISPUTES.

In the event of any dispute arising under or in connection with this Contract or the execution thereof, including any dispute as to the construction of the Contract or arising on or by reason of its determination, either party may forthwith give to the other notice in writing of the existence of such dispute, and the same shall be referred to arbitration. The Contract shall be deemed to be a submission to arbitration within the meaning of the Arbitration Acts for the time being in force in the State of Victoria.

The award of the Arbitrator shall be final and binding on the parties. Upon every or any such reference, the cost of and incidental to the reference and award respectively shall be in the discretion of the Arbitrator, who may determine the amount thereof or direct the same to be taxed as between solicitor and client, or as between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid.

Work and deliveries of goods under the Contract shall, if reasonably possible, continue during any such arbitration proceedings, and no payment due or payable by the Board shall be withheld on account only of such proceedings.

#### 18. NOTICES AND CERTIFICATES.

All notices, consents, certificates, approvals, disapprovals, permissions, decisions, applications and extensions provided for by these Conditions shall be in writing, and, if given or made by or on behalf of the Board, shall be signed by the Secretary and shall be deemed to be given to or served on the Contractor if delivered

to the Contractor, or posted in the ordinary course of post, addressed to the Contractor at the address given in the tender, and if given or made by or on behalf of the Contractor shall be deemed to be given to or served on the Board if delivered to or posted in the ordinary course of post addressed to the Secretary.

19. TERMS OF PAYMENT.

Subject to any deductions which the Board may be authorised to make under the Contract, the Contractor shall be entitled upon obtaining the certificates of the Inspector or other authorised representative of the Board to payments by the Board in accordance with the following provisions:-

- (a) Within three days of delivery of any work, or due performance of any services, an invoice shall be furnished by the Contractor to the Secretary at the Board's Head Office. Invoices shall clearly show the amount claimed, the date or dates of delivery or deliveries, the place or places of delivery or deliveries, and a description of the work delivered or services performed. The invoice must show full particulars of the work or services. In all cases the Board's official order number shall be shown.

With the exception of invoices for spare parts and any special equipment ordered, invoices shall be for one or more complete trams. The invoiced value of one tram shall be one per cent of the contract price for one hundred trams.

- (b) Such payments as are authorised under Clause (c) shall be made, where possible, 28 days after the relevant certificate of the Inspector or other authorised representative of the Board shall have been issued.
- (c) 90 per cent of the invoiced value of material delivered and accepted will be paid within 28 days.

10 per cent of the invoiced value will be paid 28 days after the final accepted delivery.

The Contractor's Security Deposit will be returned on the expiration of the maintenance period for the last tram delivered.

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These are the Conditions of Contract marked "B" referred to in the annexed Contract with the Board.

WITNESS .....

CONTRACTOR .....

# Melbourne & Metropolitan Tramways Board

## Melbourne, Victoria

### MANUFACTURE, SUPPLY AND DELIVERY

#### OF

#### 100 ALL-ELECTRIC TRAMS.

#### CONTRACT NO. 2500.

#### NOTES FOR TENDERERS

##### A. ISSUE OF SPECIFICATION.

A copy of these Documents will be issued to prospective Tenderers on payment of a deposit of \$A10. A refund will be made for all copies issued to the Tenderer - up to a maximum of five copies - on receipt of a valid tender.

##### B. CONDITIONS OF TENDERING AND OF CONTRACT.

Before inserting prices, the Tenderer should read carefully the Conditions of Tendering and the Conditions of Contract.

##### C. SALES TAX.

When submitting tenders, Commonwealth of Australia Sales Tax should not be included in the prices tendered. Materials used on all operations of the Melbourne and Metropolitan Tramways Board are exempt from such tax. Certificates of exemption will be quoted on the official order issued by the Board to the Contractor.

##### D. SUBMISSION OF TENDER INFORMATION.

Tender information shall be presented in the sequence indicated by clause numbering in Section III of Schedule "C" (Specification).

Attention is drawn to the necessity to provide all of the specific information requested in Schedule "G" - in the sequence shown in the Schedule.

##### E. TERMS OF PAYMENT.

Clause 19 of Schedule "B" (Conditions of Contract) indicates the Board's proposed terms of payment.

However, Tenderers are invited to submit for consideration alternative offers, fully inclusive of interest charges, providing for full payment for each tram to be spread over a period of three years (or longer should the Tenderer so submit) and repayable in twelve (or more) equal quarterly instalments from the quarter in which each tram has been passed and accepted.

Tenderers are invited to comment on such a proposal and to offer details of any other spread payment conditions which are acceptable to them.

##### F. RATE OF DELIVERY.

Schedule "D" (Prices) calls for the supply of information relative to rates of delivery.

It is the Board's desire to obtain experience (over a brief period - three to six months) by operating the first five trams delivered before accepting delivery of further units.

Tenderers are invited to comment on this proposal insofar as it may affect their offer to supply.

##### G. CONTRACTOR'S STORAGE AND/OR INSPECTION AREA.

Should the Contractor so desire, the Board will make available - for the duration of the Contract - an area which may be suitable for storage, inspection, and minor construction purposes.

This area (approximately 11,500 square feet - 1,070 square meters) is under cover and is equipped with tram tracks and inspection pits. All tracks are connected to the main tramway system.

The rental for the use of this facility will be \$A40 per week.



"C"

SECTION I - NATURE OF CONTRACT.1-1. CONTRACT.

The Contract for which the Board now calls tenders (and to which this Schedule refers) includes the design, manufacture and delivery of One Hundred (100) All-Electric Trams to an established and well-proven basic design. Tenders submitted on any other grounds will not be considered. Each tender shall be for complete vehicles. The Board will not accept tenders for incomplete vehicles or for quantities less than 100.

1-2. ACCEPTANCE.

Trams shall be constructed and delivered subject to the inspection, approval and acceptance of the Board and of such Inspectors as it (the Board) may appoint for this Contract. The Board will inform the Contractor of the appointment of all inspection staff.

1-3. OPERATIONAL REQUIREMENTS.

The type of tram offered shall be suitable for operation from either end of the vehicle and for expeditiously loading and unloading passengers from either side (at any one time) on any and all sections of tramway routes operated by the Board within the metropolitan area of Melbourne. The following Sections of this Schedule contain information relative to those factors which will assist in determining dimensions and design of the vehicle.

All equipment, bodies and fittings shall be so designed, manufactured and assembled as to be capable of operation (under the stated conditions) with certainty and reliability and shall be suitable for passenger transport quietly and in comfort on the Board's existing concrete tracks at all speeds up to the stated maximum.

1-4. COUNTRY OF ORIGIN.

Tenders shall clearly state the country of origin of each and every major component of the type or types of vehicle offered.

1-5. PLACE OF DELIVERY.

Delivery shall be made to the Board's Workshops, Miller Street, Preston, Victoria, Australia.

1-6. DATE OF DELIVERY.

Tenders shall state the time required for delivery of the first tram and the rate of delivery thereafter. Attention is drawn to the attached Notes for Tenderers.

1-7. CONDITION OF DELIVERY.

Trams shall be delivered complete in every respect and ready for service operation.

1-8. INFORMATION TO BE SUPPLIED BY TENDERERS.

Tenderers shall submit full details of all equipment offered. These details shall include all information specifically requested herein and such other information considered relevant by the Tenderer. Two copies of correct and correctly scaled outline drawings and full descriptive matter (in English) relating to the equipment offered shall be submitted. The Board can not undertake the work of translation.

Tenderers are invited to pay particular attention to this Clause as initial analysis of tenders received will be undertaken by reference to the information provided in Schedule "G" of this Specification.

1-9. INFORMATION TO BE SUPPLIED BY CONTRACTOR.

Within three months after acceptance of the tender, the Contractor shall supply one set of paper transparencies of drawings supplementing those submitted with the tender, particularly drawings of items nominated for approval.

Prior to delivery of the first tramcar, the Contractor shall supply three sets of complete instructions covering the safe and efficient operation, maintenance and repair of all items of equipment. All relevant wiring diagrams and adjustment dimensions shall be included.

In addition, the Contractor shall deliver a set of linen transparencies or velographs of drawings showing complete and accurate details of the equipment as manufactured for this Contract.

The supply of drawings, details, information and instructions is essential to the Contract and the Contractor shall be responsible for all damage or loss incurred by the Board by reason of late or non delivery of any such or by reason of any error therein.

SECTION II - BACKGROUND INFORMATION.

2-1. GEOGRAPHICAL.

The City of Melbourne is the capital of the State of Victoria. Victoria is situated at the south-eastern extremity of the Australian continent - of which it occupies about one thirty-fourth part. Victoria contains about 88,000 square miles.

Melbourne is a city of approximately 2,000,000 people (including suburban areas). Its population is increasing rapidly - by 1985 it may reach 3,500,000. The City is situated on the coastline of Port Phillip Bay at latitude 37 degrees 49 minutes South, longitude 144 degrees 58 minutes East and at a height above sea level of 114 feet (34.75 meters).

2-2. CLIMATE.

(a) Temperatures.

Its proximity to Port Phillip Bay has a direct influence on the City's climate. The hottest months in Melbourne are usually January and February when the average temperature is 78 degrees Fahrenheit. The highest temperature on record in Melbourne is 114.1 degrees Fahrenheit. The average number of days per year when the temperature exceeds 100 degrees Fahrenheit is four, but there have been years with up to twelve. The average annual number of days over 90 degrees Fahrenheit is nineteen.

During the summer months, minimum temperatures never fall below 40 degrees Fahrenheit. In winter, however, wide variations in the frequencies of occurrences of low temperatures are noted throughout the metropolitan area. There are approximately ten occurrences per year of 36 degrees Fahrenheit around the bay coastline; but such temperatures can occur up to thirty times per year further inland. Absolute minimum temperatures for any year are of the order 29 degrees Fahrenheit - 32 degrees Fahrenheit.

(b) Rainfall.

The average annual rainfall in the City is 25.91 inches (65.8 centimeters) over 143 days. Monthly variations in rainfall are quite small, averaging 2 inches (about 5 centimeters) each month from January to August, then rising to a maximum of about 2.75 inches (about 7 centimeters) in October.

The largest number of wet days ever recorded in any one month is 27 - in August. A wet day is defined as a day on which 1/100th of an inch or more (0.254 millimeter) of rain falls. It should be noted that there has been recorded only one rainless month in the history of Melbourne's records.

Fogs occur on at least four or five mornings each month in May, June and July. Foggy mornings average 21 days for any one year.

(c) Cloud and Sunshine.

Cloudiness varies between a minimum in the summer and a maximum in the winter. The total possible monthly sunshine hours at Melbourne range from 465 hours in December to 289 hours in June. Expressed as a percentage of these possible maxima, the average monthly hours of sunshine range from 55 per cent for January to 34 per cent for June.

(d) Wind.

The greatest average wind speed recorded at Melbourne (for a 24-hour period) is 22.8 miles per hour (36.7 kilometers per hour). Average wind speeds exceeding 20 miles per hour (32.2 kilometers per hour) are on record for each winter month. It is important to remember that these are average values - the wind is never steady. Continual oscillations occur ranging from lulls - during which the wind speed may drop to or near zero - to strong surges which may contain extreme gusts (lasting for a few seconds only) up to and more than 60 miles per hour (about 96 kilometers per hour).

At Melbourne, gusts exceeding 60 miles per hour have been registered during every month - with a few gusts near or over 70 miles per hour (about 113 kilometers per hour).

(e) Hail and Snow.

Hailstorms have occurred in every month of the year - the most probable time of occurrence being from August to November. In one year there occurred seventeen hailstorms, seven of which were in one month - November.

Snow has fallen in the City only occasionally - and then only very light falls of the order one-half to one inch (1.25 to 2.5 centimeters).

(f) Climatological Statistics.

The following statistics are supplied in Appendix A attached hereto.

- (i) Melbourne - Wind, Evaporation and Lightning Data.
- (ii) Melbourne - Humidity and Rainfall Data.
- (iii) Melbourne - Temperature and Sunshine Data.

### 2-3. MELBOURNE'S STREET TRANSPORT SYSTEM.

#### (a) General.

Melbourne's basic public transport system consists of a network of electric railway lines radiating in all possible directions from the central City area and extending distances varying from about twelve to about thirty miles (about 20 to about 50 kilometers).

Supplementing this railway system are the street public transport systems. These consist mainly of the tram system; and, to a lesser extent, the motor bus system. All trams (703) and a proportion of the motor buses (223 - one third of the total number of motor buses in Melbourne) are owned and operated by the Melbourne and Metropolitan Tramways Board. The remainder of the motor buses are owned and operated by a large number of small private companies.

The Melbourne and Metropolitan Tramways Board is a State-owned organisation set up by Act of Parliament to purchase, operate and maintain in good condition those types and numbers of public transport vehicles required to satisfactorily supply the street transport requirements of the greater part of the metropolitan area of the City of Melbourne. The Board is a completely self-supporting organisation comprising a Chairman, a Deputy Chairman and Board Member - all Government appointees. The following statistical information (for the year ended 30th June, 1965) is given to indicate the size and capacity of the Board's organisation and the extent of its operations:

Item	Tram		Bus		Total	
	Miles	Kilometers	Miles	Kilometers	Miles	Kilometers
Operating Receipts	\$A14,551,948		\$A3,199,168		\$A17,751,116	
Miles of Double Tram Track	133.98	215	-	-	133.98	215
Miles of Single Tram Track	3.75	6	-	-	3.75	6
Miles of Bus Routes	-	-	122.6	197.3	122.6	197.3
Total Miles Travelled by All Vehicles	16,919,810	27,071,696	7,267,341	11,627,744	24,187,151	38,699,440
Passengers Carried	147,890,979		29,811,674		177,702,653	
Number of Vehicles Available for Operation	703		223		926	
Total Number of Employees					4,635	

#### (b) Tram Routes.

The Board's 133.98 miles (215 kilometers) of double and 3.75 miles (6 kilometers) of single tram tracks provide street transport between the main City area and suburbs to the north-west, north, north-east, east and south-east. Most tram routes extend some 7 miles (12 kilometers) from the centre of the City.

The movement of passengers is largely into and out from the central City area; but there are also cross-city and inter-suburban movements. On most routes there are quite pronounced morning and evening peak loads; but some routes - in the inner suburbs - are fairly busy throughout the day. Drawing T.2500-1 shows the extent and disposition of Melbourne's tramway system.

#### (c) Terrain.

Melbourne is situated in flat to undulating country. The percentage of tram tracks having a gradient of 1 in 15 (6.7 per cent) or steeper is only about 1.0 per cent. There are about 30 locations where this is so. The maximum continuous length of track at 6.7 per cent grade is about 1,300 feet (about 396 meters).

The longest continuous grade is 4,200 feet (1,280 meters) of 1 in 28 (3.6 per cent) whilst the next longest is 1,600 feet (488 meters) of 1 in 16.5 (6.1 per cent). The steepest grade in the tramways system (climbing to cross a railway line) is 1 in 11.2 (8.9 per cent) over a track length of 35 feet (about 11 meters).

A longitudinal section of typical City tram route is shown on Drawing T.2500-2.

The Glenferrie Road route may be taken as the route which imposes the most severe suburban operating conditions from traction effort and braking points of view. A longitudinal section of this route is shown on Drawing T.2500-3.

The limiting radius for vertical curves (convex and concave) is 600 feet (about 183 meters).

(d) Track Design.

Double tracks are laid so that the distance between centre lines of tracks is 11 feet (3.353 meters).

The standard track gauge is 4 feet 8½ inches (1,435 millimeters). The track gauge is reduced to 4 feet 8¼ inches (1,428 millimeters) at rectangular crossings - whilst limiting gauges for track maintenance purposes are 4 feet 9 inches (1,448 millimeters) maximum and 4 feet 8-3/16 inches (1,427 millimeters) minimum.

Drawing T.2500-4 gives details of cross-section and material composition of the standard type of grooved rail in use - together with the condemning line indicating a worn out rail.

Track reconstruction now proceeds at the rate of about 5 miles of double track per year. The standard method is as shown on Drawing T.2500-5. The rails are set in concrete (to the surface) without fastenings, anchors or reinforcement of any sort. Tiebars (between rails) are at 10 feet (about 3 meters) spacing. Rail joints are thermit-welded and ground flush with head of rail.

(e) Electrical System.

The Board purchases electrical energy at 6,600 volts (alternating current) and transforms and rectifies it to 600 volts (direct current) in 26 substations. Rotary convertors, glass bulb rectifiers and pumpless steel tank rectifiers are used for rectification - capacities of individual units being either 500 kilowatts or 1,000 kilowatts (rotary convertors) and 600 kilowatts (static rectifiers). Substation capacity varies with location and load distribution. The largest substations are equipped with three 1,000 kilowatt units whilst the smallest have a single 500 kilowatt unit. Most of the converting units are provided with overload protection which inserts load limiting resistors in the direct current circuit in the event of excessive load demand. The latest steel tank rectifiers are equipped with grid control for load limiting protection. Maximum short circuit currents between overhead trolley wire and rail are of the order 10,000 amperes.

The whole of the direct current distribution system is divided into 85 sections. 64 of these sections are supplied from more than one substation simultaneously. Each of these 64 sections is thus used to interconnect the supply substations on the direct current side. The sections vary in length from 0.5 to 2.0 miles (0.8 to 3.2 kilometers).

Direct current circuits to supply the overhead trolley wires are fitted with contactors which are opened by means of impulse transformers. The circuit contactor will not open under overload conditions provided the overload is applied gradually; but it will open with a sudden increase of load. It is calibrated to open on the sudden application of a non-inductive load of 500 amperes.

When the circuit contactor opens, a resistance of 15 ohms (in series with the current coil of a restraining relay) is inserted across its contacts. The circuit contactor will automatically reclose, after a time delay of 10 to 15 seconds, provided the total fault resistance is not less than 1.5 ohms; but the contactor will not reclose until the fault resistance rises to 1.5 ohms.

In addition to direct connections between substations and trolley wire sections, via circuit (or feeder) contactors, some sections of the trolley wire system are connected to other sections by means of automatic sectionalising switches. These switches function in the same way as do circuit (or feeder) contactors in substations.

Four aspects must therefore be emphasised:

(i) A short circuit on any tram will withhold supply from every other tram on the section unless the fault is automatically cleared by the protective equipment on the tram.

(ii) If a circuit (feeder) contactor opens because of a fault on a tram (or a fault on the feeder system), supply to the section may be withheld if those trams on the section have auxiliary equipment connected to the supply line such that the combined resistance is less than 1.5 ohms.

(iii) Because of the use of automatic points controllers (by way of contactors fitted on the overhead trolley wire) the total current drawn at any time by all auxiliary equipment (that is, excluding the traction motors) cannot be in excess of 18 amperes. If it is, the proper operation of automatic points will not be possible.

(iv) The trolley wires are still alive even when the circuit (feeder) contactor is open. (They are alive via the 15 ohms resistance which is automatically inserted.)

As already stated, the nominal direct current voltage is 600 volts; but the voltage may vary between the limits 450 to 650, depending on load conditions and the location of trams with respect to substations. On occasions when alternating current supply to some substations has failed, the direct current voltage at some line termini has fallen to 330 volts.

Two sizes of overhead grooved trolley wire are in use, namely, 0.2 square

inch (1.2902 square centimeters) in cross-sectional area in the City proper (about one mile - 1.6 kilometers - square) and 0.126 square inch (0.8128 square centimeter) in the suburban areas. The trolley wires on each track of a double track line are connected together every 500 feet (152.4 meters).

The nominal height above ground of the trolley wire at points of support is 18 feet 6 inches (5.63 meters); but the trolley wires are lower at major track intersections and at a number of bridges where the tram track passes under railway tracks. The lowest section of trolley wire is at a height (under a bridge) of 12 feet 8 inches (3.86 meters). Thus, the current collector on the tram trolley pole must be suited to these variations in trolley wire height. Trolley wire points of support are spaced distances varying from 100 to 120 feet (30.4 to 36.5 meters).

The overhead trolley wire system is designed to operate satisfactorily with trams equipped with overhead collector poles.

(f) Existing Rolling Stock.

With one exception, all existing trams are fitted with cast iron brake shoes operated by air pressure (65 pounds per square inch - 4.57 kilograms per square centimeter). Brake application is made by driver operation of a Westinghouse self-lapping valve Type "W". Excessive braking and frequent emergency stopping produce a great deal of skidding with resultant flats on wheels and, consequently, much noise and increased maintenance work. The brake equipment (air compressor, air cylinder and piston-operated link mechanism) is also noisy and requires excessive maintenance to keep it in good order and reasonably free from noise. Hence, replacement vehicles must be all-electric. Slow speed and/or parking brakes should not be air-operated.

All of Melbourne's trams are fitted for driving from either end. Unlike European tram systems, trams in Melbourne do not traverse a loop at a terminus. They use a cross-over between tracks and shunt from one track to the other. Thus, when they reach a terminus and proceed to return, what was, on the outward journey, the trailing end of the tram becomes the driving end for the return journey. Hence, new trams will require duplication of driving controls - full facilities at each end. This is essential. It then follows, because of this reversing action, that the trams must have doors on both sides.

Melbourne's trams are not equipped with pantographs. They are fitted with two trolley poles (spring loaded, with carbon block current collector slides). When the tram reaches a terminus, the trailing pole is lowered (and placed under a hook) and the other pole raised ready for travel in the reverse direction. It is essential that this method of current collection be retained as alterations to the existing overhead network (special fittings, crossings, turn-outs, bridges) would be too extensive and too costly to permit any consideration being given to a pantograph at this stage.

Existing driving controls are hand operated. It is desired that replacement vehicles be fitted with foot operated controls.

(g) General Comments.

Because of its terrain and street layout, Melbourne is well suited to tram operation. Steep grades are few and City streets are wide (99 feet - about 30 meters), straight and intersect at right angles. The central business district contains an area about one mile (1.6 kilometers) square and tram tracks are laid along the centres of most major City streets in this area. All traffic travels on the left side of a street, not the right as in most European countries.

Traffic in Melbourne is increasing rapidly and peak hour congestion is becoming an ever-increasing problem. For this reason, it is probable that, at some future time, it will be advisable to place underground some, if not all, tram tracks in the central City area. If this is done, such underground tracks would be laid - at shallow depth - more or less at surface grades. It is, therefore, unlikely that undergrounding would amend, in any way, the grade figures quoted.

This probable undergrounding of trams in Melbourne should be kept in mind when Tenderers are preparing designs. It is essential that the type of vehicle offered is suitable for operation on underground routes. Any one underground route would have a length not exceeding 2 miles (3.2 kilometers).

CITY OF MELBOURNE, VICTORIA, AUSTRALIA.

WIND, EVAPORATION AND LIGHTNING DATA.

Month	Wind Velocity - Height of Anemometer 93 feet (28.35 millimeters)						Average Amount of Evaporation		Number of Days of Lightning	Number of Clear Days	
	Average		Highest Average Velocity During One Day		Highest Gust Velocity						
	Miles Per Hour	Kilometers Per Hour	Miles Per Hour	Kilometers Per Hour	Miles Per Hour	Kilometers Per Hour	Inches	Milli-meters			
January	8.8	14.2	21.1	34.0	66	106	6.55	166.4	1.8	6.8	
February	8.4	13.5	19.0	30.6	74	119	5.10	129.5	2.3	6.4	
March	7.8	12.6	18.0	29.0	66	106	4.26	108.2	1.8	5.5	
April	7.1	11.4	19.9	32.0	67	108	2.53	64.3	1.2	4.6	
May	7.4	11.9	21.8	35.1	72	116	1.57	39.9	0.5	3.4	
June	7.2	11.6	22.8	36.7	62	100	1.18	30.0	0.4	2.7	
July	8.7	14.0	22.7	36.5	68	109	1.16	29.5	0.3	2.9	
August	8.2	13.2	21.3	34.3	65	105	1.54	39.1	0.9	3.1	
September	8.5	13.7	21.0	33.8	69	111	2.41	61.2	1.3	3.3	
October	8.4	13.5	18.6	30.0	69	111	3.54	89.9	1.8	3.8	
November	8.6	13.8	21.2	34.1	71	114	4.62	117.4	2.3	3.6	
December	8.7	14.0	21.0	33.8	61	98	5.85	148.6	1.9	4.5	
Year	(Totals Averages Extremes)	- 8.1 -	- 13.1 -	- 22.8 -	- 36.7 -	- 74 -	- 119 -	40.31 - -	1024.0 - -	16.5 - -	50.6 - -

APPENDIX A (1)



CITY OF MELBOURNE, VICTORIA, AUSTRALIA.

HUMIDITY AND RAINFALL DATA.

Month	Vapour Pressure Average at 9 a.m.		Relative Humidity (per cent) at 9 a.m.			Rainfall					
	Inches	Milli- meters	Average	Highest	Lowest	Average Monthly Rainfall		Average Number of Days of Rain	Greatest Rainfall During One Day		
						Inches	Milli- meters		Inches	Milli- meters	
January	0.382	9.70	58	68	50	1.88	47.8	9	2.97	75.4	
February	0.417	10.59	62	77	48	2.00	50.8	8	3.44	87.4	
March	0.385	9.78	64	79	50	2.22	56.4	9	3.55	90.2	
April	0.351	8.92	72	82	66	2.30	58.4	13	3.15	80.0	
May	0.311	7.90	79	88	70	1.94	49.3	14	1.85	47.0	
June	0.276	7.01	83	92	75	2.06	52.3	16	1.74	44.2	
July	0.264	6.71	82	86	75	1.93	49.0	17	2.71	68.8	
August	0.271	6.89	76	82	65	2.02	51.3	17	1.94	49.3	
September	0.288	7.32	68	76	60	2.20	55.8	15	2.62	66.6	
October	0.307	7.80	62	71	52	2.63	66.8	14	3.00	76.2	
November	0.336	8.53	60	69	52	2.33	59.1	13	2.86	72.6	
December	0.373	9.47	59	69	48	2.38	60.4	11	3.92	99.7	
Year	(Totals Averages Extremes)	- 0.330 -	- 8.20 -	- 69 -	- 92 -	- 48 -	25.89 - -	657.6 - -	156 - -	- 3.92 -	- 99.7 -

APPENDIX A (11)

CITY OF MELBOURNE, VICTORIA, AUSTRALIA.

TEMPERATURE AND SUNSHINE DATA.

Month	Average Temperatures				Extreme Shade Temperatures				Extreme Temperature Range		Highest Temperature (in Sun)		Average Daily Hours of Sunshine
	Average Maximum		Average Minimum		Highest		Lowest						
	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	Degree F.	Degree C.	
January	77.7	25.4	56.9	13.8	114.1	45.6	42.0	5.6	72.1	40.0	178.5	81.4	7.8
February	78.6	25.9	58.0	14.4	109.5	43.1	40.2	4.6	69.3	38.5	167.5	75.3	7.4
March	74.9	23.8	55.2	12.9	107.0	41.7	37.1	2.8	69.9	38.9	164.5	73.6	6.5
April	67.9	19.9	50.8	10.4	94.8	34.9	34.8	1.6	60.0	33.3	152.0	66.7	5.0
May	62.0	16.6	46.9	8.3	83.7	28.7	29.9	-1.2	53.8	29.9	142.6	61.4	4.1
June	56.8	13.7	43.8	6.6	72.3	22.4	28.0	-2.2	44.3	24.6	129.0	53.9	3.4
July	56.2	13.4	42.6	5.9	69.3	20.7	27.0	-2.8	42.3	23.5	125.8	52.1	3.7
August	58.7	14.8	43.7	6.5	77.0	25.0	28.3	-2.1	48.7	27.1	137.4	58.6	4.6
September	63.3	17.4	46.0	7.8	88.6	31.4	31.0	-0.6	57.6	32.0	142.1	61.2	5.5
October	67.9	19.9	48.7	9.3	98.4	36.9	32.1	0.1	66.3	36.8	154.3	67.9	5.8
November	71.3	21.8	51.8	11.0	105.7	40.9	36.5	2.5	69.2	38.4	159.6	70.9	6.2
December	75.4	24.1	55.3	12.9	110.7	43.7	40.0	4.4	70.7	39.3	170.3	76.8	7.0
Averages Year	67.6	19.7	50.0	10.0	-	-	-	-	-	-	-	-	5.6
Extremes	-	-	-	-	114.1	45.6	27.0	-2.8	87.1	48.4	178.5	81.4	-

(F. - Fahrenheit: C. - Centigrade)

APPENDIX A (111)

SECTION III - SPECIFICATION.

3. DESIGN PARAMETERS.

3-1. GENERAL.

(a) Type of Tram.

The trams shall be of the all-electric type and of the most modern design and construction consistent with a requirement that all components shall have been proven in street traction service.

(b) Essential Features.

All designs offered will be subjected to critical examination to determine whether or not they incorporate the following features:

- (i) Quiet, smooth operation on rails set in concrete to street level as shown on Drawing T.2500-5.
- (ii) Effective and reliable braking - both service and emergency.
- (iii) Safe, economic operation.
- (iv) High schedule speed.
- (v) Low maintenance costs.
- (vi) The utmost in crew and passenger comfort and appeal.
- (vii) Low floor height and acceptable step arrangement.
- (viii) Ease of cleaning - internal and external.

(c) Method of Operation.

Trams shall be suitable for double ended operation with a seated conductor. Loading shall be through double folding doors at the front, and unloading shall be through double folding doors located forward of the rear truck.

(d) Interchangeability.

All parts of each tram shall be strictly interchangeable with any similar part on any other tram supplied under this Contract.

3-2. DIMENSIONS.

(a) Clearance Limits.

The maximum overall width of the tram shall not exceed 8 feet 9 inches (2,667 millimeters) at any point (with the exception of flashing turn indicators and retractable rear vision mirrors). It is, however, essential that the tram body be designed to provide the maximum possible floor area subject to the limitation of this overall width and the clearance limits governing length and end shape.

Drawing T.2500-6 shows the arrangement of tracks with the minimum radius of curve used in traffic operation. Any tram offered must be designed so that (with the exception of flashing turn indicators and retractable rear vision mirrors) no part of the body shall, whilst negotiating either curve, encroach on the clearance lines shown on this drawing.

The limits of the loading gauge are shown on Drawing T.2500-7. The cross section of the tram shall not extend beyond these limits.

(b) Typical Arrangement.

Drawing T.2500-8 shows one arrangement for a tram which conforms to the clearance requirements and provides the minimum acceptable seating capacity.

Tenderers are not bound to comply with this drawing in all respects but it indicates dimensions which are considered to be critical. If the body design offered departs substantially from these requirements, Tenderers shall submit detailed explanations of the reasons for the departures.

3-3. WEIGHT AND LOADING.

(a) Weight.

The tram shall be as light as is practicable without sacrifice of strength or rigidity.

(b) Passenger Loading.

When the total load on the vehicle is being considered, the allowance for each passenger shall be 140 pounds (63.5 kilograms). When individual items of equipment (such as seats, grab rails and the like) are designed, the allowance per passenger shall be 200 pounds (90.7 kilograms).

(c) Dynamic Loading.

Adequate allowances shall be made for increases in vertical loads caused by

suspension movement and for increases in horizontal loads caused by acceleration, deceleration, cornering and minor collisions.

(d) Standing Load.

The standing load capacity of the vehicle shall be calculated on the basis of one passenger for each 16 inches x 16 inches (406.4 millimeters x 406.4 millimeters) or acceptable equivalent rectangular area of floor available.

(e) Over Load.

Notwithstanding the above method of calculating the normal standing load, the tram must occasionally operate with as many passengers as can possibly board. The body and truck structures must be capable of withstanding this occasional load without failure and motors, control equipment and brakes must operate reliably though with reduced performance.

(f) Axle Load.

The maximum axle load under any operating conditions shall not exceed 8 tons (8,128) kilograms.

3-4. OPERATING PERFORMANCE.

(a) General.

The tram will be required to operate satisfactorily on all existing routes - where, apart from a small percentage of reserved track, it will be operating (at grade) with motor traffic and existing trams - and on future routes which are expected to include a higher percentage of reserved track and some underground operation.

The tram shall have acceleration and deceleration characteristics which will provide the best possible performance under the following conditions:

- (i) Suburban operation on tracks having separate right-of-way with 3 stops per mile (1.6 kilometers) and an average time of 10 seconds at each stop.
- (ii) Suburban operation on tracks at grade - while mixed with motor vehicles which have a nominal speed limit of 35 miles (56.3 kilometers) per hour - with up to 6 stops per mile (1.6 kilometers) and an average time of 10 seconds at each stop.
- (iii) City operation on tracks at grade with 8 stops per mile (1.6 kilometers) and up to 60 seconds at each stop.

Under existing conditions 10 per cent of normal operation occurs under condition (iii) and 75 to 90 per cent occurs under condition (ii). It is anticipated that operation under condition (i) - now zero to 15 per cent - could increase to 40 per cent in the future with consequent reduction in the operation under condition (ii).

When underground operation is introduced it will occur in the City section and it is probable that 8 stops per mile will be retained but that the time at each stop will be reduced.

(b) Maximum Speed.

The maximum speed of the tram with wheels of design diameter shall be 45 miles (72.4 kilometers) per hour plus or minus 5 per cent when operated with a full seated load on level straight track.

(c) Safe Motor Speed.

The maximum safe motor speed shall be not less than that corresponding to 55 miles (88.5 kilometers) per hour with the tram wheels at condemning diameter.

(d) Acceleration.

The tram shall be fitted with acceleration control equipment capable of providing a smooth increase of acceleration from zero to maximum acceleration in 1 to 1.5 seconds without undue discomfort to standing passengers.

(e) Acceleration Speed-Time Curve.

Tenderers shall submit a speed-time curve for acceleration to maximum speed from a stationary start under the conditions of full seated load on straight level track.

(f) Deceleration.

With full seated load on straight level track the maximum braking rate with normal service braking shall be 5.3 feet (1.6 meters) per second per second. The transition period from zero to maximum dynamic braking shall not exceed 1 second and the rate of change of deceleration should not exceed 7 feet (2.1 meters) per second per second.

The maximum emergency braking rate shall be not less than 12 feet (3.66 meters) per second per second.

(g) Deceleration Speed-Time Curves.

Tenderers shall supply speed-time curves for braking from initial speeds of

10, 20, 30 and 40 miles (16.1, 32.2, 48.3 and 64.4 kilometers) per hour and maximum speed with full seated load on level track under each of the following conditions:

- (i) Normal service braking.
- (ii) Full emergency braking.
- (iii) With one motor defective.
- (iv) With mechanical brake only.
- (v) With track brake only.

(h) Performance Data.

Tenderers shall submit lists showing the running time and energy consumption between each stop for a tram operating in both directions over both the sections of track shown on Drawings T.2500-2 and T.2500-3.

It shall be assumed that trams are required to remain at each stop for 10 seconds and carry a full seated load over the whole journey.

Tenderers shall guarantee the accuracy of these lists to within 5 per cent and the Board reserves the right to use them in an acceptance test of the tram.

3-5. STANDARDS.

(a) General.

All materials and equipment included in the tram offered shall comply with the appropriate Standard Specifications issued by an internationally recognised Standards Authority.

Tenderers shall clearly state the particular Standards which are applicable to the items included in their tender.

(b) Screw Threads.

Tenderers shall advise full details of the screw threads used in construction of the tram. If at all possible it is desirable that the one Standard should be used throughout the vehicle. If this can not be achieved, care shall be taken to ensure that on each unit requiring regular maintenance attention all bolts and studs shall have threads and spanner sizes to the same Standard.

3-6. NOISE LEVEL.

QUIET OPERATION OF THE TRAM IS ESSENTIAL. NOISE LEVEL TESTS WILL BE CONDUCTED ON ALL TRAMS IN ACCORDANCE WITH THE DETAILS SET OUT IN PART 10 OF THIS SPECIFICATION. TENDERERS SHALL GUARANTEE THAT EACH TRAM WILL COMPLY WITH THE NOISE LEVEL REQUIREMENTS AND SHALL BE PREPARED TO MODIFY ANY EQUIPMENT - AT NO COST TO THE BOARD - IF THE NOISE LEVELS ARE EXCEEDED.

4. BODY.

4-1. GENERAL.

The tram body shall be designed to comply with all of the requirements of Part 3 of this Schedule, and with the critical dimensions shown on Drawing T.2500-8.

It shall be of attractive, modern appearance with continuous glass lines and shall be of light weight consistent with a strength of construction which shall ensure at least 30 years of service without fatigue or other failure of body members.

Tenderers are reminded of the requirements for the lowest practicable floor height, low maintenance costs and attractive, comfortable interior.

The body structure shall be designed with adequate strength to meet all of the loading requirements imposed on it by street traction service.

Provision shall be made for lifting (also jacking) facilities at the following locations:

- (i) On each side of the tram - at or near each truck centre.
- (ii) At each end of the tram, preferably on the bumper bar.

For workshop maintenance purposes, the side lifting facilities will be used to lift the vehicle by means of cable suspended hooks and to transfer the body to temporary supports.

For emergency re-railing, the side lifting facilities will be used to raise the tram with jacks.

The end lifting facilities will be used for emergency recovery work when the side of the tram is not accessible.

The trucks shall be raised with the body unless intentionally detached.

The tram shall be provided with smooth exterior panels, free from ripple and wrinkle. The preferred design is one which permits the ready replacement of these

panels when damaged in minor collisions. Other designs will receive full consideration. Anti-drum treatment shall be provided wherever necessary to ensure quiet operation.

The roof shall be electrically insulated (over its entire area) to an approved standard. It shall be designed to support trolley poles and bases as described in Part 6 of this Schedule and to support, without damage, the weight of a man walking the entire length of the roof. During maintenance it is necessary to step from one tram to another.

The method of construction, insulation and sealing shall ensure permanent insulation and weather tightness under the above conditions and when subjected to all climatological variations described in Section II of this Schedule.

All equipment and enclosures beneath the body shall be located so that a clearance of 2 inches (51 millimeters) above rail is maintained under all conditions of loading when the wheels are at condemning diameter and the tram is operating on either a concave or convex vertical curve of 600 feet (183 meters) radius.

Tenderers shall provide full information relating to the design of the body structure including dimensioned drawings showing plan, elevations and cross-sections of the complete body. Details of construction such as the methods of joining all major sub-assemblies shall also be provided. Design calculations shall be submitted where applicable.

Tenderers shall also provide complete specifications of the materials used in the body structure and of the methods of assembly used. The method of insulation of the roof shall be described in detail and Tenderers shall provide information relating to the proof tests which may be applied to the insulated roof.

Details shall be given of tests to be applied to all relevant parts of the body structure - to prove design calculations - in the event of acceptance of any tender.

#### 4-2. FLOOR.

##### (a) General.

The floor height shall be as low as is practicable consistent with specified clearance requirements. A level floor throughout the passenger section is preferred. Tenderers may submit alternative proposals if changes in floor height can be provided at acceptable locations, thus making boarding and alighting safer and easier.

##### (b) Type of Construction.

Tenderers shall provide full details of the type of floor construction offered including details of the spacing of supports, thickness of material and the method of fixing the floor. If the type of construction proposed does not have inherent noise-damping properties, arrangements shall be made to provide this feature. The floor shall be treated to ensure that it is water proof and rot (or corrosion) resistant.

The floor shall have ample strength to meet the specified loading requirements. It shall be covered up to meet the walls or a suitable cove moulding shall be provided at all locations where vertical surfaces meet the floor.

##### (c) Floor Covering.

The floor shall be covered by means of an approved floor covering material which shall have the following properties:

- (i) Completely homogeneous in structure and having the same colour throughout the thickness of the material.
- (ii) High resistance to wear, decomposition and cracking.
- (iii) Good flexibility and resilience with a non-slip surface.
- (iv) Complete recovery after repeated indentations by a 5/16 inch (8 millimeters) diameter spike heel with a load of 140 pounds (64 kilograms).
- (v) Completely impervious to water.
- (vi) Unharmful and unchanged in appearance by a lighted cigarette dropped on it and allowed to smoulder.
- (vii) Easily cleaned.

The floor covering shall be supplied in sheet form (tiles are not acceptable) and shall be firmly attached to the floor by means of a fully water proof, permanent adhesive which will prevent lifting or bubbling of the covering even after repeated washings of the floor.

The floor covering may be provided in two thicknesses for use in areas of light and heavy traffic. The thick material may be ribbed, provided the ribs are not continued to walls or bulk heads.

Tenderers shall supply full details of the floor covering offered and shall submit samples of the material for inspection and test. The material used for floor covering shall be an item for approval by the Board after the Contract is signed.

##### (d) Floor Hatches.

Trap doors in the floor are not favoured and shall be limited to those



essential for maintenance purposes. Where trap doors are installed, flush fitting, non-jamming latch lifts shall be provided.

#### 4-3. INTERIOR LINING.

The interior of the tram shall be designed to have an attractive appearance. Painting shall be used only in those applications where no other surface treatment is practicable. All panelling, including the ceiling, shall have a melamine or other approved satin surface which is easy to clean and resists damage by scuffing, scratching, burning, denting and similar treatment. Joins in the panels shall be covered by adequate cover strips and the panel fixing shall be concealed although the panels shall be readily removable.

All equipment enclosures inside the tram shall be designed to match the interior finish and shall be covered with the selected panel material.

Non-flammable, thermal insulation shall be provided in the spaces between the roof and the ceiling and between the exterior panels and lining.

Samples shall be provided of the materials and cover strips which are offered together with details of the colour range available. The lining materials shall be items for approval by the Board after the Contract is signed.

#### 4-4. WINDOWS.

##### (a) General.

All glass used in the windows, doors and bulkheads shall be toughened safety glass of the correct weight for the application. The driver's windscreen shall be glazed with clear glass while all other glass in windows and doors shall be of a glare reducing and heat-ray-screening type which transmits 70 - 78 per cent of visible light and 44 - 53 per cent of total radiation.

##### (b) Windscreen.

The windscreen shall be sloped at an angle which will prevent night reflections from interfering with the driver's vision while still retaining upper and lower glass lines to provide adequate vision for the proper operation of the tram. All windscreen elements shall be plane sections and pillars and glazing bars shall be designed to reduce to a minimum the development of blind spots in the driver's field of vision.

##### (c) Side Windows.

The side windows shall be as large as is practicable consistent with the structural design of tram. Window pillars shall coincide with the centre of the back-to-back seats as shown on Drawing T.2500-8. All side windows shall be of the same size and continuous upper and lower glass lines shall be provided.

The lower section of each of the side windows shall be fixed and shall be glazed directly into the body side panels without the use of a frame. The corners of each window shall have a radius of not less than 4 inches (102 millimeters). The upper section of all side windows - approximately 10 inches (254 millimeters) deep - shall consist of two halves, each of which shall slide horizontally. Special attention shall be given to the sealing between the sliding sections so that the windows are draught proof and water tight when closed, regardless of the direction of travel. The sliding sections shall be free from rattles. Opening and closing shall be simple operations.

Tenderers may submit an alternative top opening provided it does not interfere with the operation of interior blinds, allows equivalent ventilation to the sliding window and does not protrude beyond the vehicle.

Tenderers shall supply full details of the proposed windows including the type and weight of glass to be used, the size and method of construction and the method of sealing the opening section of the windows. The windows shall be an item for approval by the Board after the Contract is signed.

#### 4-5. DOORS.

The doors shall be of the inward folding type arranged in pairs as shown on Drawing T.2500-8. The distance between door pillars at all doorways shall be identical. Each doorway shall be fitted with stanchions and dividing rails to provide two openings. The leading opening of each doorway shall be not less than 2 feet (610 millimeters). The remaining opening shall be 2 feet 3 inches (686 millimeters) wide. Sloping hand rails shall be fitted to the inside of the leading door at each doorway; but no hand rail is required on the trailing door. The hand rail shall provide firm support for passengers entering or leaving the vehicle.

The doors shall be constructed and installed so that they close positively and prevent draughts and rattling. Weather sealing shall be effective for both directions of tram operation. All wearing parts of the door shall be designed for ready replacement of worn sections. Lubrication points shall be readily accessible.

It will be an advantage if the front half of each entrance door can be opened independently of the rear half of that door; but this is not an essential requirement and a proven door mechanism should not be discarded by a Tenderer because this facility is not featured.

The required method of door control is set out in Part 6 of this Specification. The maximum time required for the doors to open or to close shall not exceed 2

seconds. Low voltage electric door motors are favoured. A clutch shall be provided in the door drive to -

- (i) ensure that the motor is not overloaded should the doors be prevented from operating, and
- (ii) permit the doors to be opened manually in the event of motor or supply failure.

The door drive mechanism shall be completely enclosed but shall be readily accessible for maintenance. The hinged access cover shall be provided with a device which positively locates it in the open and in the closed position. Means shall be provided for securing the cover in the closed position.

"Soft" edges shall be fitted to all doors to cause them to re-open if they strike an object while closing. The doors shall reclose after 2 seconds. When the door is closed, the soft edges shall be disconnected from the door-opening circuit.

If portion of the door is slotted to clear a step when the door is open, gravity operated flaps shall be used to form an effective weather proof seal when the door is closed.

Toughened safety glass shall be provided in the upper and lower sections of each door - as shown on Drawing T.2500-8.

Tenderers shall supply full details of the doors offered including illustrations, drawings and description of the methods of construction and of operation. Information shall also be provided of the number of doors of this type already in traction service. The doors shall be an item for approval by the Board after the Contract is signed and the Contractor shall be required to submit one set of doors for inspection and test before commencing quantity production.

#### 4-6. STEPS.

All steps shall be contained within the body of the tram. The step wells shall be constructed from an acceptable material which will provide a water tight, corrosion free structure. The steps shall be so arranged that they shed water off their surface and out of the tram. They shall be covered with a material similar to that used on the tram floors and shall be provided with light coloured non-metallic tread plates suitably located and dimensioned to facilitate cleaning.

Tenderers shall supply full details of the design of the steps including illustrations and dimensioned drawings. The materials used in construction of the step well, the steps, the floor covering and the tread plates shall be specified. The steps shall be an item for approval by the Board after the Contract is signed.

#### 4-7. PASSENGER SEATS.

##### (a) General.

The seating arrangement shall be as shown on Drawing T.2500-8. There shall be fixed seats for 36 passengers and folding seats for 12 passengers (6 at the front and 6 at the rear of the tram). Fixed seats shall be arranged in back-to-back units and shall be dimensioned as shown on the drawing.

##### (b) Seat Frames.

Seat frames shall be designed to carry the loads specified in Part 3 of this Schedule.

Seat bases for fixed seats shall be boxed in as shown and the seat shall be cantilevered from the base to provide a clear space under the front and end of the seat.

Folding seats shall be designed to automatically return to the folded position when they are not in use. The hinge arrangement shall be strong and effectively protected to prevent injury to passengers. When folded, seats shall present a smooth surface to the passenger area. The 6 folding seats at each end of the tram shall be so designed that all can be locked in the folded position by means of a control unit located in the conductor's enclosure at that end of the tram.

Supporting frames for upholstery materials shall be designed to meet the requirements of the upholstery materials to be used and shall be shaped where necessary to provide comfortable seating.

Seat cushions shall be securely fixed in position to prevent movement in service but shall be easily removed when necessary.

##### (c) Upholstery.

Seat cushions shall be upholstered with an approved foam material which shall have the following properties:

- (i) Graded resistance to load - that is, soft at first contact with increasing resistance as load increases, thus providing firm support without bottoming. Laminated construction is favoured.
- (ii) Adequate tensile and compressive strength to withstand heavy duty public transport service without crumbling or failure.

The upholstery material used for folding seats may be thinner than that

used for fixed seats if this will increase loading space (when the seats are folded) without seriously reducing passenger comfort.

Seat backs shall be upholstered with an approved foam material which shall be moulded to provide adequate and comfortable support for passengers' backs.

Seat cushions and backs shall be covered with an approved industrial quality material having a smooth, easily cleaned surface with minimum grain. The material shall also have -

- (i) resilience - to resist sagging and wrinkling;
- (ii) high flame resistance - it shall be difficult to ignite and shall be self-extinguishing upon removal of the flame;
- (iii) freedom from -
  - (a) cracking and peeling;
  - (b) softening (and stickiness) in hot weather;
  - (c) damage when scrubbed with warm water and detergent.

The covering material shall be stitched with an approved thread and shall be attached in an approved manner.

Tenderers shall supply full details of the seats offered including drawings and illustrations which show the method of construction. Samples of covering materials and information of the colour range available shall be submitted with the tender. Passenger seats shall be an item for approval by the Board after the Contract is signed. The Contractor will be required to submit a complete fixed seat and a complete folding seat for inspection and test before quantity production commences.

#### 4-8. DRIVER'S COMPARTMENT.

##### (a) General.

Each driver's compartment shall be identical in layout and in furnishing and shall house all equipment and controls specified. The floor of the compartment shall be raised approximately 12 inches (305 millimeters) above the floor of the passenger compartment.

A bulkhead (partition) shall be provided behind the driver's seat. This bulkhead may be used to house equipment but the depth of the bulkhead should not exceed 9 inches (228.6 millimeters). It would be an advantage if a coat locker could be provided in each driver's compartment. Part of the bulkhead may be used for this purpose.

If no equipment is to be housed therein, all or part of the bulkhead above seat back height shall be glazed with toughened safety glass of an approved colour and light transmission grade. Tenderers shall provide details of the glass proposed and alternatives available.

##### (b) Access.

Access to the compartment shall be provided from the passenger compartment by means of a movable section of the hand rail shown on Drawing T.2500-8. It shall be possible for a driver to abandon his position without difficulty if a collision is imminent.

##### (c) Protection.

Limitations on the direct fixing of equipment to the front panels are provided in Part 6 of this Schedule. It is, however, essential that the front of the vehicle be so constructed that protection is provided for the driver and all equipment in the event of a collision. A bar shall be provided in a convenient position in front of the driver as a hand support.

##### (d) Visibility.

Clear visibility for the driver both by day and by night is essential. Tenderers shall provide full details of all measures taken to eliminate windscreen reflections from the interior of the vehicle. Curtains should not be used.

##### (e) Interior Lining.

The interior lining of the driver's compartment shall be identical to that provided in the passenger section of the vehicle. All control enclosures shall be neatly finished and be free from sharp edges. All corners formed by the floor and vertical surfaces shall be coved to assist cleaning.

##### (f) Driver's Seat.

The driver's seat shall be designed to provide maximum comfort and ventilation. It shall be fully adjustable in all directions and shall swivel about the vertical axis.

Tenderers shall provide full details of the seat offered. Drivers' seats shall be an item for approval by the Board after the Contract is signed and the Contractor will be required to submit a complete seat for inspection and test before commencing quantity production.

##### (g) Ventilation.

In addition to the power ventilation system specified in Clause 4-11, the

driver's compartment shall be provided with an adjustable means of adequate direct ventilation from an air intake in the front of the tram.

(h) Windscreen Wipers.

Twin windscreen wipers shall be fitted to each windscreen, generally as shown on Drawing T.2500-8.

Wiper motors shall be of adequate capacity to operate continuously for extended periods without overheating or failure. Motors and operating mechanism shall be neatly housed but shall be accessible for maintenance. A clutch shall be provided in the drive to protect the motors (and the drive) should the blades stall (or be moved when the motors are not operating).

Wiper arms shall be of adequate strength to drive the blades but shall be of a section which does not seriously impede visibility. They shall be pivoted from the bottom of the windscreen and shall wipe the maximum area of windscreen with adequate overlap in the upper central section of the windscreen.

Blades shall be of a type and size readily available for replacement.

Full details shall be provided by the Tenderer.

(i) Windscreen Washers.

Power operated windscreen washers shall be provided at each end of the tram to deliver an effective stream of water in the path of the windscreen wipers.

Controls for the washers shall be included in (or be adjacent to) the windscreen wiper controls and be arranged so that water is delivered only while the control is held in the 'on' position.

A reservoir of approximately one-half gallon (2.3 litres) capacity shall be provided in a convenient location at each end of the tram. Provision shall be made for filling the reservoir from outside the tram.

(k) Demister.

A small heater and fan unit shall be provided in each driver's compartment and air from this unit shall be ducted on to the windscreen to provide effective demisting.

(l) Rear Vision Mirrors.

Rear vision mirrors shall be provided at each end of the tram to permit the driver to look along the left hand side of the tram and view the exit doorway. The mirrors shall be rectangular in shape, of the correct size and be edged with black rubber. Reflecting surfaces shall be sealed to ensure long service life.

The mirror shall be mounted on a retractable arm which shall automatically and positively locate itself in both the extended and the retracted positions. The mirror shall be capable of easy adjustment and positive locking at the end of the arm.

(m) Interior Mirrors.

Interior mirrors shall be provided to permit the driver to view the interior of the tram from the normal driving position.

(n) Sun Shield.

A sun shield of approved coloured toughened safety glass or plastic material shall be provided in each driver's compartment. It shall be of suitable size to assist the driver when he is driving towards the sun and shall fold away when not required. Suitable clamps shall be provided to lock the shield in the desired position.

4-9. CONDUCTOR'S ENCLOSURE.

(a) General.

Two enclosures (located generally as shown on Drawing T.2500-8) shall be provided for the seated conductor. Each enclosure shall consist of a hinged desk, an adjustable seat and a platform raised approximately 12 inches (305 millimeters) above the floor of the tram. A clear toughened safety glass screen shall be provided between each conductor's position and the adjacent transverse seat to protect the heads of seated passengers from the conductor's arm movements.

(b) Desk.

Each desk shall house a ticket printing and issuing machine, a cash tray and a change-issuing machine. A cover shall be provided and so arranged that the conductor can readily lock up all money and tickets without removing them from the operating position. It shall be possible for the conductor to work from either position without the need to transfer equipment or money. Locks shall be secure and effective and one key shall fit both desk covers. It shall be possible to remove the key only after the lock is operated.

Details of currency and fare scales in use in Melbourne are set out in Part 7 of this Specification. Tenderers are requested to design the desk to suit the tendered type of ticket and change-issuing equipment. This shall be shown in the tender as a separate cost item (not to be included in general tender price) as the Board may decide to purchase other types of change and ticket issuing equipment.

The desk shall incorporate a small, hand-luggage shelf for use by passengers when tendering fares.

(c) Seat.

The conductor's seat shall be designed to provide the maximum in comfort and ventilation. It shall be fully adjustable in all directions. The conductor's seat shall be an item for approval by the Board after the Contract is signed. The Contractor will be required to submit a complete seat for inspection and test before commencing quantity production.

(d) Locker.

A locker equipped with a key-operated lock shall be provided in each conductor's position to house spare tickets and personal effects.

(e) Controls.

The various controls and public address equipment operated by the conductor and specified elsewhere in this Schedule shall be capable of being locked when the conductor vacates his position.

4-10. STANCHIONS AND HAND RAILS.

There shall be no external stanchions. All internal stanchions, guard rails and strap hanger rails shall be manufactured from satin finish stainless steel tube, stainless clad tube or an acceptable alternative. The rails in the vicinity of the driver's compartments may be covered with shrink-on plastic tubing of an approved standard if this assists in reducing reflections.

Stanchions and rails shall be of adequate strength and rigidity and of a suitable diameter for their application. They shall be adequately supported.

Vertical stanchions shall be provided between the back of each transverse seat and the ceiling. They shall be set in 4 to 5 inches (102 to 127 millimeters) from the edge of the seat. Horizontal strap hanger rails shall be provided between these stanchions at a height of 6 feet 3 inches (1,905 millimeters) above the floor. These rails shall be located as shown on Drawing T.2500-8. Beyond the limits of the transverse seats, vertical stanchions and/or roof brackets shall be provided in suitable locations to support the strap hanger rail.

Strap hangers of approved design shall be provided and fixed at intervals along the rail. One strap hanger shall be provided approximately 16 inches (406 millimeters) from each vertical stanchion. Strap hangers shall also be provided in suitable locations beyond the limits of the transverse seats.

Strap hangers shall be provided with a smooth grip - which will comfortably fit a hand 4 inches (102 millimeters) wide - at a height of 5 feet 6 inches (1,676 millimeters) above the floor. Strap hangers shall have a breaking load in excess of 400 pounds (181 kilograms). It shall be possible to replace a defective strap hanger without dismantling the rail.

Provision shall be made for the support of the stop signal cord by means of suitably designed brackets attached to the window side of each strap hanger rail. The brackets shall be spaced to hold the cord clear of the rail at or about rail height.

4-11. VENTILATION AND HEATING.

(a) General.

Details of the power ventilation system and the required heating range are provided in Clause 6-8 of this Schedule.

(b) Ducts.

Ducts shall, wherever possible, be designed as an integral part of the body structure. All interior vents and openings shall have an attractive appearance. External openings shall be located and designed to prevent entry of moisture, dust and other foreign matter. If air is drawn in below floor level, filters shall be provided. These filters shall be designed for ready removal and simple cleaning or cheap replacement.

All ducts shall be designed and constructed to inhibit the transmission of noise to the interior of the tram. They shall be insulated or protected to prevent objectionable local heat transfer or the burning of a passenger by contact with the duct or duct opening.

All removable covers shall be provided with flexible, oil-resistant seals capable of withstanding the temperatures likely to be encountered. Hinges and latches shall be of sturdy construction and be securely attached.

The ventilation system may incorporate outward-opening roof vents. If this type is tendered, open vents shall not foul a lowered trolley pole and shall be completely weather sealed when closed. They shall have a firm, lever-controlled action and be spring loaded in both the open and closed positions. Control levers shall be located to permit ready operation. Vents shall be capable of opening in any direction to suit double ended tram operation.

4-12. DESTINATION AND ROUTE NUMBER SIGNS.

Requirements for destination and route number signs are detailed in Clause 6-9 of this Schedule. Each end of the tram shall be shaped to accommodate the signs and associated equipment. Care shall be taken to ensure that projections and/or angles do not interfere with the free movement of the trolley rope.

The signs at each side of the tram shall be designed to fit (with minimum projection into the passenger space) into the pillar near the entrance door as shown on Drawing T.2500-8.

All signs shall be sealed to prevent the ingress of water and dust. Ready access shall be provided for sign maintenance and lamp replacement.

4-13. MISCELLANEOUS BODY ITEMS.(a) Bulkheads.

(i) Bulkheads - glazed above seat back height with clear toughened safety glass - shall be provided on each side of each exit doorway.

(ii) Bulkheads - to sill height - shall be provided in front of the first transverse seat (opposite the seated conductor's enclosure) at each end of the tram. These shall be of an approved type.

(b) Roof Drains.

Roof water shall be collected in continuous guttering around the perimeter and shall be discharged through four concealed downpipes of adequate cross-sectional area. The guttering shall be at least 1½ inches (32 millimeters) wide and 1¼ inches (32 millimeters) deep.

Guttering and downpipes shall be manufactured from corrosion resistant material, care being taken to ensure that junctions between guttering and downpipes are effectively sealed.

Tenderers shall provide full details of the drainage installation proposed as this will be an item for approval by the Board after the Contract is signed.

(c) Access to Roof.

Folding steps of the hand grab type shall be provided on each side of the tram - at or near the location shown on Drawing T.2500-8 - to provide access to the roof. The steps shall be arranged to project at least 2 inches (51 millimeters) from the side of the tram when in the lowered position and be flush with the side of the tram body when not in use. Step housings shall be adequately drained.

Two suitably located steel hand grips shall be provided on the roof of the tram above each set of steps to assist a man to climb on to the roof. These grips shall be electrically insulated from the frame of the tram.

Tenderers shall submit full details of the steps and grips offered. These items and their location shall be an item for approval by the Board after the Contract is signed.

(d) Sand Boxes.

Sand boxes of adequate capacity shall be provided in suitable locations on the tram. They shall deliver sand in front of the leading wheels for each direction of travel. It is desired that the boxes be arranged for filling through hatches located on the outside of the tram. Visual indication (at the filling point) of the height of the sand in the boxes would be an advantage.

Sand boxes shall be manufactured from non-corrodible material and shall be designed to ensure ready release of sand when required.

As detailed in Part 6 of this Schedule, sand shall be delivered automatically when the emergency brake is applied but on all other occasions sand shall be delivered only when the driver pushes a button on the control panel.

Tenderers shall provide full details of the sand boxes offered and the method of release of sand.

(e) Bumper Bar.

A bumper bar of the anti-climber type shall be provided at each end of the tram. It shall be rigidly constructed to absorb impact and attached to the tram in an approved manner. It shall be capable of use as a jacking point (as detailed in Clause 4-1) unless an acceptable alternative arrangement is provided.

The top of the bumper bar shall be 2 feet 6 inches (762 millimeters) above rail level and shall be capable of accepting the Board's standard towing attachment which is 4 inches (102 millimeters) wide and 10 inches (254 millimeters) long. The towing attachments will be made available to the Contractor at the Board's Preston Store and mounting details will be discussed with the Contractor.

(f) Skirt Height.

The use of a straight skirt - generally as shown on Drawing T.2500-8 - is favoured but the final choice of skirt arrangement (and height) will be governed by several factors including floor and step heights and required access for maintenance and emergency work.



Tenderers shall submit a body design incorporating a skirt arrangement which they consider to be the most satisfactory for the tram offered and shall state the reasons for their choice. The Board may require the Contractor to modify the skirt line after the Contract is signed.

(g) Blinds.

A sun blind shall be fitted to each of the side windows. The blind shall be mounted on a spring roller housed in a neatly covered recess above the window. The lower end of the blind shall be attached to a bar, the ends of which slide in channels fitted to each window pillar.

The blinds shall be manufactured from material with the following properties:

- (i) An open weave which permits the passage of air but absorbs between 50 and 70 per cent of sunlight.
- (ii) Colour fast and unaffected by exposure to sunlight.
- (iii) Strong and resilient - free from sag and wrinkling.

Details of the blinds offered shall be submitted together with samples of the material and details of the colour range. The blinds shall be an item for approval by the Board after the Contract is signed.

(h) Luggage Racks.

Luggage racks - for small cases and parcels - shall be centrally located above each of the side windows (in the section of the tram with transverse seats). The racks shall be approximately 2 feet 6 inches (762 millimeters) long and 12 inches (305 millimeters) wide. The front edge of the racks shall be approximately 6 feet 3 inches (1,905 millimeters) above the floor of the tram. They shall be properly designed and fixed to securely hold parcels under all conditions of tram operation.

Details of the rack offered, including illustrations and/or drawings shall be submitted. The luggage racks shall be an item for approval by the Board after the Contract is signed.

(i) Litter Baskets.

Stainless steel litter baskets shall be provided at each exit doorway. These baskets shall be flush mounted in the bulkheads at the side of the doorways and shall be designed for the ready emptying of their contents.

Tenderers shall supply full details of the litter baskets offered and these baskets shall be an item for approval by the Board after the Contract is signed.

(k) Bumper Access Steps.

A recessed step shall be provided (in front of each entrance doorway as shown on Drawing T.2500-8) to provide access to the bumper bar. Suitably located hand grips and grab rails shall be provided to assist a man to climb on to the bumper bar and support himself while carrying out maintenance or cleaning operations.

4-14. PAINTING.

(a) Corrosion Prevention.

The possibility of corrosion shall receive close attention at all stages of design. Corrosion resistant materials shall be used where practicable. Recesses which could collect water shall be avoided.

In addition, all metal surfaces shall be cleaned by approved methods to remove rust, scale, dirt and other foreign matter. The cleaning process shall be immediately followed by the application of approved protective coatings.

The protective coatings applied to interior surfaces which will not be painted (such as the inside surface of the external panels) shall provide permanent protection from corrosion.

The protective coatings applied to surfaces which will be painted shall be compatible with the paint system to be applied.

(b) Timber Treatment.

Any timber which is exposed to the weather shall be vacuum impregnated with an approved preservative and shall be sealed with an approved paint film.

(c) Exterior Painting.

The colour scheme used on existing trams is green and cream; but the Board may adopt a different colour scheme for the trams purchased under this Contract. Tenderers are invited to design a colour scheme and submit a coloured illustration showing a perspective view of the tram.

The exterior paint system shall have the following properties:

- (i) 10 years' life in street traction service.
- (ii) A tough, scratch-resistant surface.
- (iii) High gloss finish.