

For: " AH" & " Artic 2001"
Tram Sand Tests
May 84

4-14 CONDUCTOR'S ENCLOSURE.

* (a) General.

The Board will design, manufacture, supply and install two conductor's enclosures in each tram, each complete with a conductor's seat and pedestal.

(b) Location.

* The proposed locations are as shown in Drg. T.3000-8. The floor of the enclosure will be positioned approximately 300 mm. above the tram floor. The space between these surfaces will be available for the Contractor for installation of heating-comfort equipment or ducts if he so requires.

(c) Construction.

The construction will be F. R. P. sections assembled over a welded frame of 19 mm. square steel tubing with plywood floor covered in the same material as the tram floor.

(d) Attachment.

* The enclosures will be fastened to the floor in the same manner as the seats.
The method of attachment to the wall will be discussed with the Contractor.

(e) Bulkhead.

The Contractor shall provide a 6 mm. tempered glass bulkhead and upper rails and fittings for installation by the Board. The exact shape and size will be determined in consultation with the Contractor.

(f) Power supply.

The Contractor shall provide the necessary wiring to the enclosures to supply the requirements of

- (i) 24V motorized ticket machine base
- (ii) 24V seat locks
- (iii) 24V driver's signal
- (iv) microphone leads.

(g) Mass.

The mass of the conductor's enclosure, and the seat and pedestal are given in Schedule "H".

4-15 SANDING EQUIPMENT.

(a) General.

To improve adhesion under conditions of greasy track surfaces, it is imperative that a rapid flow of dry clean sand is available ahead of the wheels of the leading truck.

* Four F. R. P. sand boxes shall be provided on each tram with sanding valves, piping and nozzles arranged to deposit sand ahead of the leading wheels for each direction of travel.

(b) Capacity of boxes.

Each box shall have a capacity of not less than 50 Kg of useable dry sand.

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(c) Shape and design of boxes.

Tenderers are advised that tests have shown that even under dynamic conditions including vibration, acceleration, braking and hill climbing, no significant flow of the sand used by the Board occurs below an angle of repose of 22° . Consequently, angles less than this in the sand box floor will result in deadweight, unuseable sand and shall not be used.

The design shall be such that foreign matter cannot enter the box under normal operation.

(d) Location of boxes.

* It will probably be necessary to locate the sand boxes behind the folding passenger seats. The shape of the sand boxes shall be such that no interference occurs with the operation or placement of the folding seat or its squab.

(e) Venting.

The sand boxes shall be vented in an approved manner to allow water vapour but not sand to escape.

(f) Rain proof external hatches.

The sand boxes shall be arranged for filling through F. R. P. hatches located on the outside of the body. Each hatch shall have a common keyed lock and shall be absolutely waterproof against any form of rainstorm, hosing during cleaning operations or machine washing. No water shall enter the sand storage section or enter the body side through hinges.

Every mating surface of the hatch to body, sand box to body, sand box to floor, floor to valve and valve to pipe shall be provided with appropriate sealants or gaskets to ensure no water enters. The sand hatch aperture shall measure 120 mm. x 75 mm.

Location of these hatches shall be as low as practicable to facilitate sand filling, yet consistent with the other requirements of the sanding equipment.

The hatch contour shall have smooth easily cleaned surfaces which shall not project beyond the external wall surface of the tram.

(g) Sand valves.

The sanding valves shall be operated pneumatically or electrically with reservoir traps, piping and nozzles for each sander location. The sanding valve shall be readily accessible and shall be provided with gasketed inspection plates which will enable maintenance or inspection of the sand feeding and controlling mechanism without emptying the sand box contents.

The sand valve shall be so designed that it can break up weakly agglomerated particles of sand and shall not be held open by any sand particle up to 3 mm. diameter.

The sand valve shall deliver clean, dry, sieved sand at a rate of 35 to 45 grams per second to the each wheel.

(h) Sand specification.

The sand used in the Board's trams complies with the following specification.

(i) Moisture content shall be not greater than 5 percent by mass.

(ii) Sand shall be clean and sharp and free from loam, salt or other deleterious material.

- (iii) Grading of the sand shall be as follows:

B.S. sieve (Metric)	Percentage passing (by mass)
3.00 mm	100
2.36 "	95-100
1.18 "	70- 95
600 micron	40- 70
300 "	10- 40
150 "	0- 5

- (iv) When tested for clay, silt and dust in accordance with Method B of B.S. 812-1967, the percentage of material passing a 75 micron sieve shall not exceed one percent.

- (i) Anti-clogging design.

The entire system shall be designed so that no external water or condensation from compressed air lines can clog lines and prevent proper flow.

- (j) Piping.

The outlet of each sand valve shall be connected by a non-collapsing rubber sleeve, secured by stainless steel worm drive clips to a rigid thick walled P.V.C. tube, angled as steeply and uniformly as possible, to discharge the sand rapidly on to the rail head as close as possible ahead of the front wheel of the truck when the tram is on a straight track.

The pipe shall be securely supported by the underframe so that the pipe and its brackets clear the truck for the full possible range of truck movements.

The sand pipe placement and its exit design shall be such that water caused by wheel splash has a minimal effect on the correct flow of sand.

- (k) Sander control.

Sanding control shall be from the low voltage power supply. A uniform rate of flow shall be provided when the sander is activated.

The sanders shall be operated –

- (i) automatically from an emergency stop command and by slip or spin detection during braking or acceleration. To prevent excessive loss of sand, the sander shall cease delivery when the tram has stopped.
- (ii) from a separate, manually controlled electric push button on the driver's console available for use by the driver at any time regardless of the braking or accelerating mode then in effect. By this means the driver shall be able to apply sand to the rail at any tram speed and when the tram is stationary. Sanding shall cease when the button is released.

- (l) Approval.

Tenderers shall provide full details of equipment offered including drawings, photographs and test data.

The Contractor shall provide a valve and set it up with a complete sand box and piping in the correct configuration and shall demonstrate its compliance with the specification by an operating test before approval is granted.