TECHNICAL SPECIFICATION FOR ON TRACK BALLAST CLEANING MACHINE FOR BG (1676 MM GAUGE)

1.0 GENERAL :

1.1 The ballast in the track has an important role in providing the desired resilience and lateral resistance to track while at the same time ensuring good drainage. This is possible when the ballast is clean. These specifications have been framed for a machine which deployed for deep screening the entire cross section of Track Ballast on B.G.(1676 mm gauge) Track with concrete sleepers, on plain track and turnouts.

1.2 The Specifications have been drafted to reflect the performance and quality requirements of the machine in a neutral manner without bias to any specific manufacturer. Bidders are requested to carefully study the specification and assure that their machine fully complies with these specifications. Thereafter, if a bidder feels that his machine can substantially meet the performance and quality requirements of the machine but does not fully satisfy a particular system specification, he should immediately seek clarification from the purchaser prior to submission of the bids.

1.3 The bidder shall specify the model offered and furnish a detailed Technical Description of the same. System/sub-systems of the working mechanisms of the machine as per para '3' in particular and all the items of the specifications in general shall be described in detail in the "Technical Description", along with the sketches to show the manner in which the requirements of the specifications are accomplished by the machine (mode) offered.

1.4 Photographs of the type of machine offered in work mode shall be enclosed with the offer. This shall also show close-ups of various working assemblies/systems and the full machine. The tenderer shall furnish a video cassette showing the working of machine in real time under field conditions.

2.0 **Dimensional and Operating requirements:**

2.1 The diesel powered equipment shall be robust, reliable and suitable for working on Indian Railways. The design and dimensions of the machine/ components shall be to metric standards. Quality assurance during manufacturing of the machine shall be according to ISO - 9001.

2.2 The profile of the on-track equipment longitudinally and in cross section during transfer as self propelled vehicle or towed in train formation shall be within the Indian Railways Standard metric BG schedule of Dimensions - 1973 print. The minimum and maximum moving dimensions are enclosed in **Annexure - I.** The tenderer shall provide sketches of the machine in plan and shall give calculations to prove that the machine does not cause infringement while moving on a 10° curve at any cross section.

2.3 Adequate clearance shall be allowed so that no component infringes the minimum clearance of 102mm from rail level while traveling.

2.4 Wherever applicable, axle load shall not be more than 20t with minimum axle spacing of 1.80 m . Load per meter shall not exceed 7.67t.

2.5 It shall have a wheel diameter of 900mm. However, lesser diameter can also be considered.

2.6 It shall be capable of negotiating curves upto 10° curvature (176 m radius), super elevation upto 185mm and gradients upto 3% in travel mode. The supplier shall specify the minimum attainable speed under the above limiting conditions which in any case shall not be less than 40 kmph.

2.7 It shall be capable of continuous operation during the varying atmospheric and climatic conditions occurring throughout the year in India. The range of climatic conditions is as follows:-

Ambient temperature	:	0° - 55° C
Altitude	:	Sea level - 700m
Humidity	:	40% to 100%
Maximum rail temp.	:	70° C

2.8 During transfer from one station to another, it shall be capable of traveling on its own at a speed of 75 kmph and at a speed of 80 kmph when hauled in a train formation. Since the machines are likely to cover long distances on their own power, the travel drive system should be robust to sustain these requirements during the life of the machine without much break down/failure.

2.9 It shall be capable of working without requiring power block in electrified sections. 25 KVA current is used for traction through an overhead wire at 5.5 m above rail level. On bridges and tunnels, the height is restricted to 4.8 m.

2.10 While working on double line sections, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4.265 m.

3.0 **Working Mechanism**

3.1 The machine shall be capable of working on all types of track structures including long welded rails of 60 Kgs./52 Kgs./90 R on concrete/metal/wooden sleepers on plain track as well as turnouts (1 in 8 1/2 to 1 in 16) as per IRS layout (**Annexure- II/A**).

3.2 Since the machine is to work in dusty environments, all the components including gear boxes, bearings, drive motors, pumps, electric and electronic control shall be of robust design, shielded and sealed from the dust and spill over ballast pieces. Suitable protection cover must be provided so that these components do not fail prematurely. The various assemblies and the machines as a whole should provide adequate safety to the workmen working close by in connection with the machine operations. The necessary safety equipment shall form a part of the machine Tools and Plants. The tenderer should indicate these items in their offer.

3.3 The machine shall be capable of excavating ballast bed upto a depth of 900mm below the rail top and entire width of ballast section. The width of the ballast section from main line Track center may vary from 2700mm for plain track, to 4800 mm for turnouts.

working without air conditioning under the climatic conditions described in para 2.7 above.

3.21 The tenderer may be required to show the working of his machine under field conditions. The names of countries where such demonstrations will be feasible shall be indicated in the offer.

4.0 **Diesel Engine:**

4.1 The machine shall be powered by diesel engine preferably indigenous, with proven record of service in tropical countries. Robust construction and low maintenance cost are of particular importance. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions mentioned in this specification elsewhere.

4.2 High speed diesel oil to Indian Standard Specification shall be normally used. A minimum fuel capacity sufficient for continuous operation for 8 hrs. will be desirable.

4.3 Sight glass type fuel measuring gauge shall be provided on the fuel tank.

4.4 For starting the engine, storage batteries of well known make shall be provided. The engine shall normally be push button start type.

4.5 Since the engine is to work outdoor under extreme dusty conditions, the air intake system shall be designed suitably so as not to allow dust through air intake system.

4.6 There is a likelihood of dust deposition over the engine body and surrounding area over the lubricants spill over. These should be easy to access for daily cleaning and routine maintenance. In case, air cooled engines are proposed by the supplier, maintenance equipment for cleaning and maintenance of the air cooling fins shall be provided by the supplier along with.

4.7 The engine parameter monitoring gauges like temperature, rpm, lub. oil pressure shall be direct reading time mounted on the engine backed up by electrical/mechanical gauges in the operator's cabin showing the absolute readings along with safe limits suitably coloured. There shall be audio visual warning (safety mechanism) to the operators in case of any of these parameters exceeding the safe limit and engine shut down circuit in case of operator's failure to respond.

4.8 Suitable and rugged mechanism should be provided to start the prime mover at no load and gradual loading after the start of the prime mover. A fail safe clutch mechanism should be provided to meet this requirement.

5.0 **Cooling System**

The cooling system shall be efficient and designed for a maximum ambient temperature of 55°. Supplier may note that the machine shall be working under extreme dusty conditions and the cooling mechanism should be maintainable under these conditions.

6.0 **Brakes**

The machine shall be fitted with the airbrakes and provision shall be made to connect air brake system of the machine to that of muck wagon/Camping Coach of about 80 ton when it is being hauled by the machine. The brakes shall be protected from ingress of water, grease, oil or other substances which may have an adverse effect on them. The brake lining shall be suitable for high ambient temperature of 55° C. The force required for operating the brake shall not exceed 10 Kg. at the handle while applying by hand and 20 Kgs. on the pedal, when applied by foot. In addition, mechanical brakes shall also be provided for use in an eventuality of failure as well as for parking.

7.0 **Horn**

The equipment shall be provided with electric horns facing outwards at each end of the machine at suitable location. The horns shall be distinctly audible from a distance of atleast 400m from the machine. The horns shall be operated by means of push buttons provided in the cabs and also outside the machine body at appropriate locations on both sides.

8.0 **Hooks and Buffers**

The machine shall be fitted with hooks and buffers of IR design on both ends for coupling it with other vehicles for running in train formation.

9.0 **Electric equipment and lighting**

The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The machine shall be equipped with headlight at each end and with two front and rear parking lights, which can be switched to red or white according to the direction of the travel. Powerful swiveling flood lights shall also be provided to illuminate the working area sufficiently bright for efficient working during night.

10.0 **Chassis & Underframe**

The chassis shall be standard welded steel sections and of steel sheets so as to permit transportation of the machine in train formation without endangering safety of the train. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle.

11.0 **Cabins**

The machine shall be equipped with fully enclosed cabins with safely glass window. The working cabins shall be air conditioned as specified in 3.20 above. It shall be possible to have a clear view of the track ahead while driving the machine in either direction. Additional driver's cabin shall be provided, if the view while driving is not clear for safe travel in both directions.

11.1 The gauges, instruments and controls shall be suitably located in the operator's cab so that they can be observed without undue fatigue to the operator. One screen wiper preferably operated by compressed air shall be provided on the wind screen.

11.2 Fire extinguisher (dry chemical type) shall be provided in the cars.

3.4 While working it should be possible to increase the width of cut in steps so as not to infringe the schedule of dimensions at any location and at the same time, cover the entire cross section of turnout track at the longest sleeper in the crossing area.

The machine shall be able to deep screen both left hand/right hand turnouts when approached from either direction i.e., from the switch or the crossing side, depending upon the site conditions. No turning of the machine shall be required for this purpose.

3.5 The lifting and slewing devices of the machine shall be capable of handling long welded rails on PRC, steel trough, CST - 9 and wooden sleepers so that it may be possible to adjust the excavation depth and carry out slewing to avoid obstacles such as station platforms. While working on the plain track, it shall be capable of lifting the track ahead of excavating mechanism upto at least 100mm and slew the track by at least upto 200mm.

3.6 The excavation depth shall be adjustable to suit the requirements of sites. The ballast shall be excavated upto the desired depth in one working pass.

3.7 The machine while working shall, without slewing the track be able to by pass the foundations of the OHE masts. To achieve this, it should be possible to retract the cutting mechanism towards track center at OHE mast location and bring it back to cover the full ballast section after the OHE mast foundation is cleared. A typical ballast section and location of mast foundation is enclosed along with as **Annexure-II.** Suitable sketches of the relevant machine assemblies shall be furnished to clarify this aspect.

3.8 The machine shall be able to provide straight and continuous cross slope of 1 in 40 from one end to the other towards either side at the cutting level for drainage purposes.

To achieve this, it is desirable that the excavation unit excavates the ballast from the entire cross section in one continuous cross slope without any discontinuity.

3.9 The screening unit shall be capable of screening the excavated ballast through a series of screens. The return ballast sizes shall be 65mm maximum and 25mm minimum. The screening unit shall remain in horizontal position laterally, even when working in curves with super elevation upto 185 mm.

3.10 It shall be possible to dispose off the spoil directly beyond the cess at a distance of not less than 7m. from the center of track on either side of the machine. The conveyor system for spoil shall be such that no spoil falls on cleaned track. This feature is particularly important in the context of electrified sections where the spoil conveyor is required to swing back near every mast of overhead wire or signal post and such other features in the yard. For this reason muck shall be unloaded to the front on yet to be deep screened track.

3.11 Loading of spoil into a muck wagon attached to the machine shall also be possible. The height of the muck wagon attached to the machine shall be about 3500mm above the Rail level.

3.12 The tenderer shall provide an inbuilt suitable safety mechanism to ensure that the spoil conveyor does not hit the OHE mast or a signal post and cause damage to it or the machine even due to bad operation of the machine like non withdrawal of the muck conveyor in time to by pass the mast or signal post etc.

3.13 A combination of swiveling side conveyors, chutes and ballast plough shall be provided for distribution of cleaned ballast in the track on the shoulders/center of track/tamping zones or in any desired combination and closely behind the excavating mechanism. While deep screening turnouts, it shall be possible to distribute the clean ballast over the entire turnout width.

There shall be suitable mechanism to ensure that there is no heaping up of ballast or too short deposit of screened ballast at the beginning or at the end of the work or during any stoppage of the machine. It should be possible to control the ballast distribution across the whole cross section from the operator's cabin.

3.14 The machine after putting the cleaned ballast into the track shall profile the ballast and clear the ballast from the top of sleepers and fastenings by using suitable mechanism.

3.15 Various mechanisms of the machine shall be so designed that the ballast pieces do not scatter. The ballast conveyors at locations approachable by workmen close by shall be enclosed in safety trough/cages for the safety of the men.

3.16 After carrying out the work, the machine shall leave the track in a condition to permit the passage of the trains up to 40 kmph. Suitable mechanisms for grading of screened ballast bed before lowering of the track shall be provided for this purpose.

3.17 Time required for starting the excavation and screening of ballast after arrival of the machine at the site of work together with the time of winding up the machine and starting back from the site after the stoppage of the screening shall be less than 20 minutes. This does not include the time required for one time insertion of any cutting device in the track which is left behind after completion of days work. A lower setting up and winding up time shall be desirable. The purchaser attaches utmost importance to the effective utilization of the traffic block made available for screening work.

3.18 The machine shall be capable of cleaning grading and profiling a minimum 550 cubic meters of ballast on plain track in an hour of working including hard, encrusted and caked ballast. The machine shall be capable of deep screening a complete 1 in 12 T/out including setting up and winding up operations in not more than 90 minutes.

3.19 The efficiency of screening shall be judged by collecting four samples of the screened material as it falls from the machine. Not more than 4% of this material by volume shall pass through a 25mm sieve (ISI Standard).

3.20 The working cabins of machine shall be air conditioned for dust free atmosphere. The air conditioning provided shall be of robust industrial design capable of operating in highly dust laden environment. However, the electronic equipment shall be so designed that they shall be capable of

SECTION – III

TECHNICAL SPECIFICATIONS

11.3 The machine shall be provided with adequate space for keeping the tools and spares required for on site repair of the machine to attend the breakdowns and other working requirements.

12.0 **Tools and Instruction manuals**

Each machine shall be supplied with a complete kit of tools required by the operator in emergency and for normal working of the machine. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire machine including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application.

12.1 Detailed operating manual, maintenance and service manual shall be specifically prepared and three copies of these shall be supplied with each machine.

12.2 The manufacturer shall also supply circuit diagrams of electrical hydraulic, pneumatic and electronic circuits used on the machine. Trouble shooting diagram/table shall also be supplied. In additions, the supplier shall provide dimension drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. Main features of items like hydraulic pumps motors and such other bought out components/assemblies shall be furnished by the tenderer.

12.3 The supplier shall submit Tools, manuals, circuit diagrams and other technical literature/drawings along with each machine as above, for operation, servicing, maintenance and trouble shooting.

12.4 While offering the machine for first inspection, the supplier shall submit three copies of complete technical literature including operation, service and maintenance manuals, servicing and repair instructions of the sub-assemblies, complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/description and other relevant technical details so as to maintain master copies of these documents in Indian Railway Institutions and a reference documents for the inspecting officer.

13.0 Spare Parts

The expected life of the components shall be advised along with their condemning limits. The tenderer shall offer necessary spare parts for the operation and maintenance of the machine for a period of two years, i.e., working for about 1200 hrs. The spare parts required shall be detailed in a separate list indicating description, part no., quantity and whether imported or indigenous.

The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the life of the machine (15 years)
For indigenous parts and bought out components and assemblies, the source (original equipment manufacturer's reference and part number) and other relevant technical details shall be supplied while offering the first machine for inspection.

14.0 Maker's Test Certificate

Copies of the Maker's Certificate guaranteeing the performance of the machines shall be supplied in duplicate along with the delivery of each machine.

15.0 Operators

15.1 The number of operators and allied staff for working of the machines under normal condition shall be indicated, specifying their duties and minimum qualification.

16.0 Tenderer is expected to quote for optional equipments separately for each item giving the advantages/functions of such optional equipments. Tenderer shall be indicate whether such equipments are already in use on machines elsewhere indicating the user Railway system

17.0 **Inspection of the machine:**

While inspecting the machine before dispatch from the supplier's premises, the inspecting officer shall verify the conformity of the machine with respect to individual specification as above. The machine's conformity/non-conformity with respect to each item shall be jointly recorded before issue of the inspection certificate and approval for dispatch of the machine as per **Annexure - IV** enclosed.

18.0 Acceptance Test

In addition to verification of the various items of specifications covered earlier, the following tests shall be carried out in India at the purchaser's premises by the purchaser's nominee at the time of the commissioning of the machine.

18.1 Dimensional check of loading gauge, i.e., maximum moving dimensions, buffer heights, clearances, length of machines, bogie distance, clearances on curves etc.

18.2 Testing for negotiability of 10° Curve and 1 in 8 1/2 turnouts.

18.3 Running speed tests on the Indian Railway main line track on the first machine in accordance with the procedure outlined at **Annexure- III.**

18.4 Construction and engineering of the machine

18.5 Actual output and performance tests - Refer Clause 3.18 above:

This test shall be carried out on the first machine only.

The general conditions of the tests shall be as follows :-

a) The machine crew shall be either trained personnel of Indian Railways or the staff of supplier.

b) Dry weather, ambient temperature between +10° C to 40° C.

c) Straight track or curve of atleast 1000 meters radius.

d) Gradient upto 1/100

e) Rails fastened to all sleepers.

f) Concrete/wooden/steel sleepers

g) Cutting depth upto 300 mm below the bottom of sleepers.

h) No cutting into blanket or formation.

i) Generally, no ballast piece bigger than 150mm. Oversize between 75 mm and 150 mm not to exceed 1%.

j) No water pockets, no mud pumping, grass in limited quantity.

k) Normal moisture content of permanent way.

l) Spoil below 25mm upto maximum of 40% by volume. This shall be verified by taking samples from the Track to be screened.

m) The formula for calculating the output shall be as follows:

$$V = \frac{\text{Total Volume in } m^3 \text{ excavated for screening}}{\text{Time in hours.}}$$

V represents the volume of deep screening done per hour in plain track and shall not be lesser than 550 m^3.

Time shall be measured discounting the stoppages not attributable to the machine failures.

18.6 Samples of screened ballast shall be collected before it drops on the track and shall be screened separately to assess the quantity of the under size elements. The under size elements shall not exceed 4% by volume of the screened ballast. 4 samples shall be collected and an average shall be worked out.

18.7 The setting up time and winding up time of the machine as described in the specifications elsewhere shall be measured and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 20 minutes.

19.0 Should any modification be found necessary as a result of the tests, the same shall be carried out by the supplier at his own expenses.

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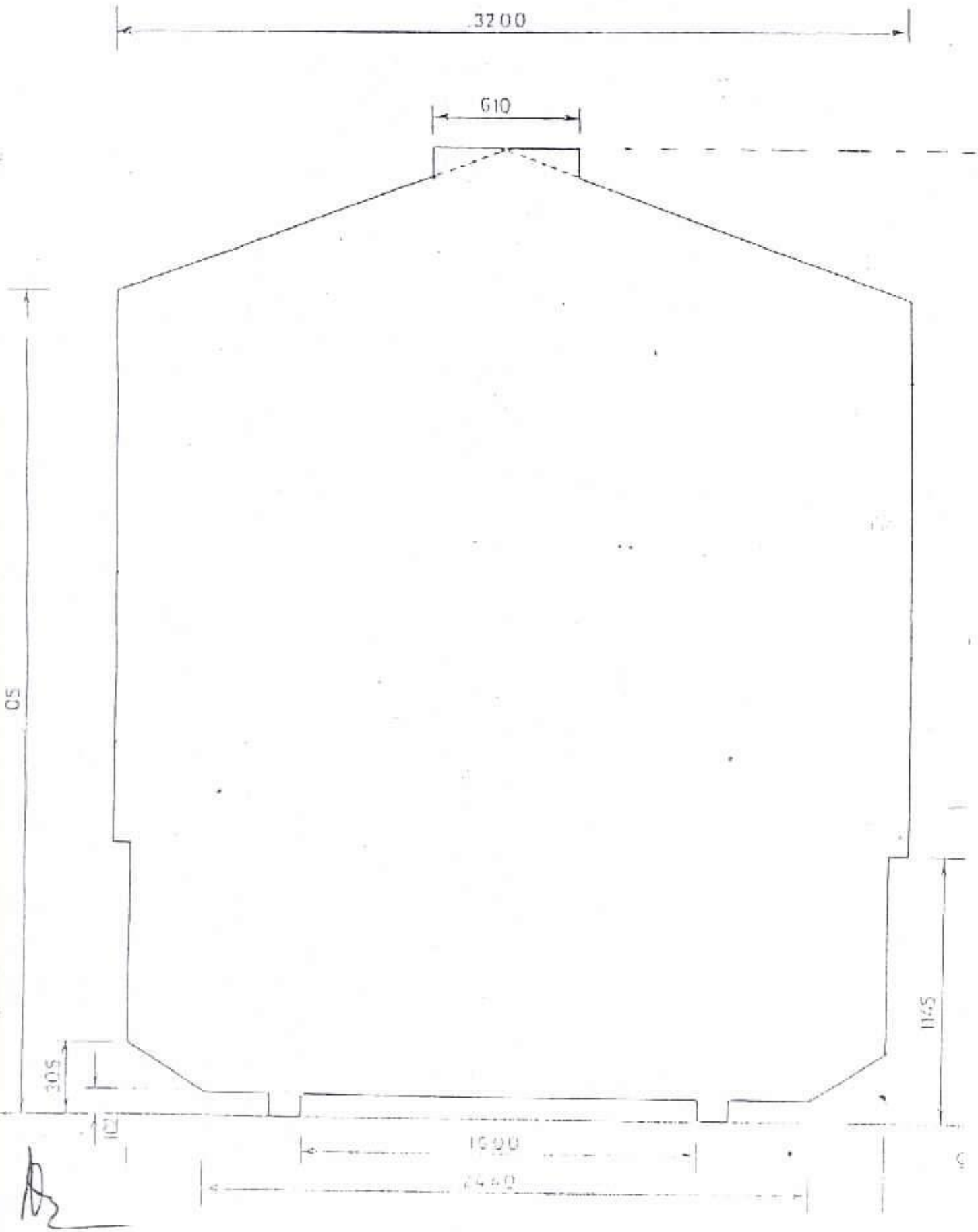
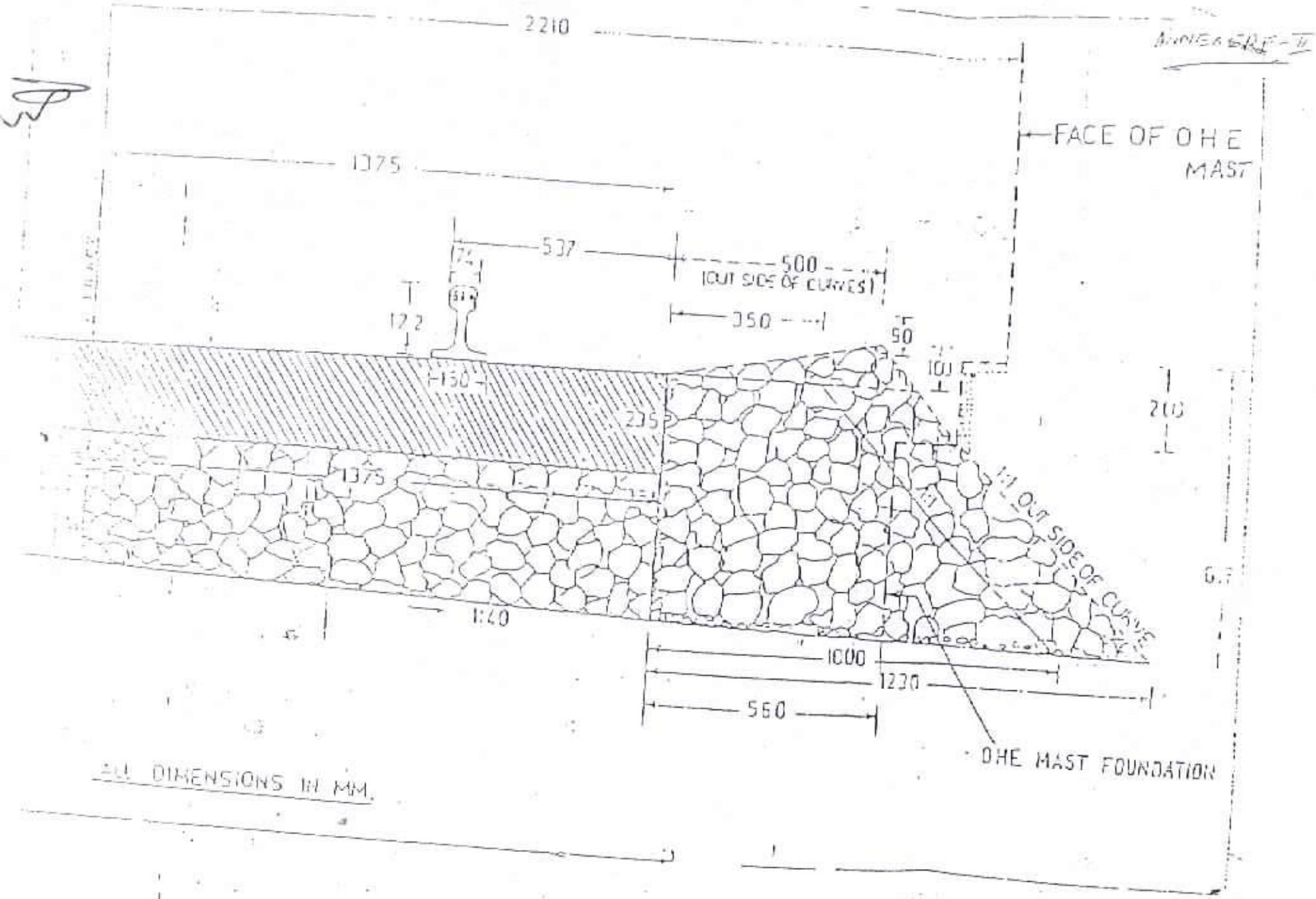
ANNEXURE-

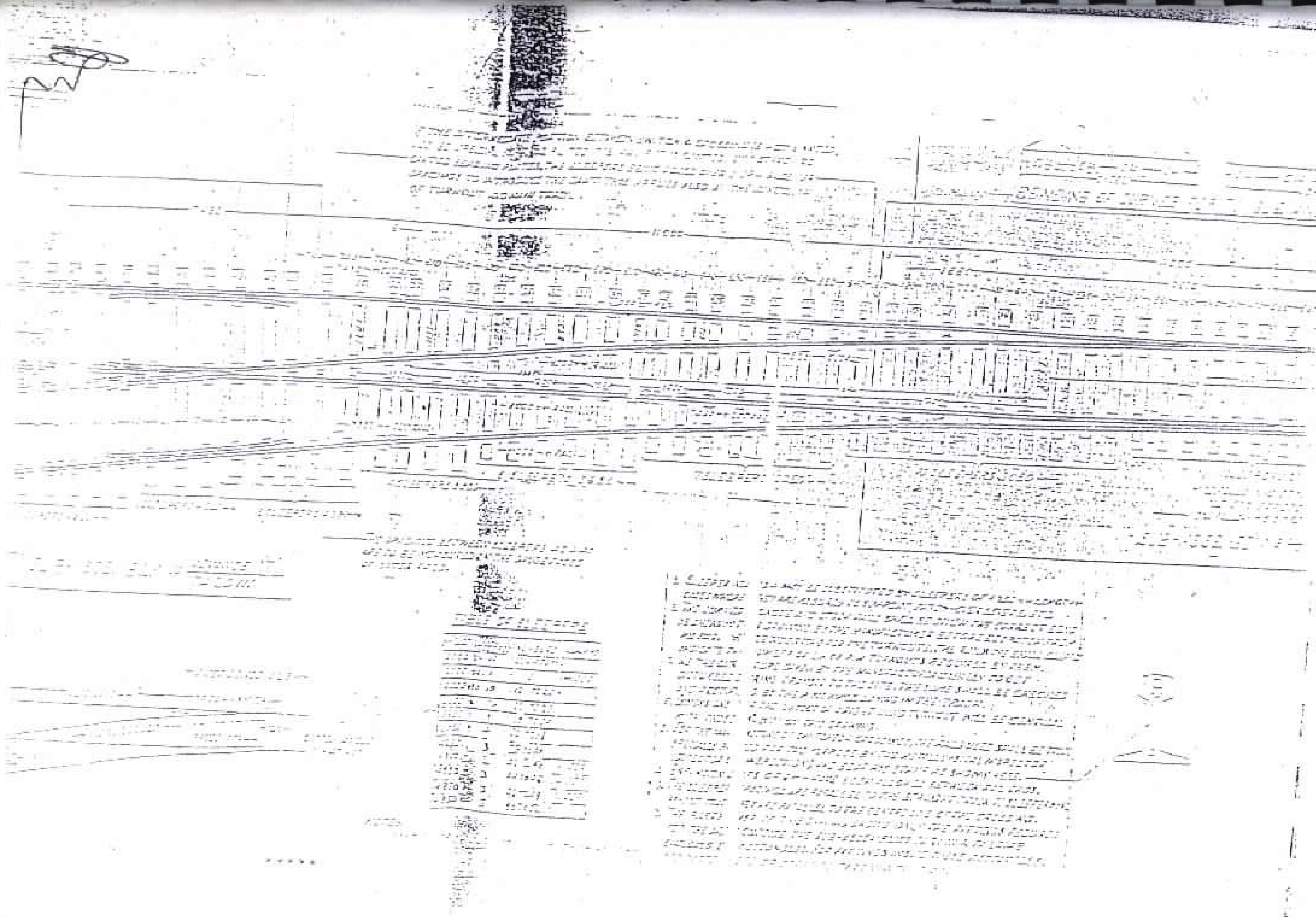
DIAGRAM SHOWING MAXIMUM MOVING DIAMENSIONS BROAD GAUGE



ANNEXURE-II



ALL DIMENSIONS IN MM.



ANNEXURE III

STANDARD CRITERIA FOR CLEARANCE OF ROLLING STOCK

The speed potential of the machine offered by the firm should be established based upon oscillation trials conducted in India. The tests will be conducted at speed usually 10% higher than the maximum speed potential indicated by the firm for the Machine under consideration and the following criteria satisfy for the same. For conducting the tests, a section of mainline track will be selected over which there is no temporary speed restrictions and which is considered by the Railway as being in a generally run down condition for mainline standards, but without speed restriction. The vehicle will be tested generally for new and worn clearance condition and where relevant for operation in the forward and backward directions. The vehicle selected for tests will be one in overage condition for normal maintenance.

2. The criteria applicable for establishing speed potential will be as follows:

i) A lateral force lasting more than 2 meters should not exceed the Prud Homme's limit of 0.85 (1 + P/3) where P is the axle load.

ii) Isolated peak values exceeding the above limit are permissible provided the record shows establishing characteristics of the vehicle subsequent to the disturbances.

iii) A derailment coefficient should be worked out in the form of ration between the lateral force (Hy) and the wheel load (Q) continuously over a period of 1/20th second, the value HY/Q shall not exceed 1.

iv) The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55 g both in vertical and lateral directions. The peak values upto 0.6 may be permitted if the records do not indicate a resonant tendency in the region of peak value.

v) In the case of such vehicles where measurement of forces is not possible, the evaluation shall be in terms of ride index based on the accelerations measured as detailed in para 2.4 above which shall not be greater than 4.5 but a limit of 4.25 is preferred.

vi) A general indication of stable running characteristics of the vehicle as evidenced by the movements of the bogie in straight and curved track and lateral force and derailment coefficient accelerations as the case may be.

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ANNEXURE-IV

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF TRACK MACHINE (_____) BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF MACHINES

(STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the machine (type)_____bearing Sl.No._____ from (date) _____to _____at (Place) _____ for its conformity/non-conformity with respect to the laid down Technical Specifications in contract Agreement No._____ dated_____between President of India through Director Track (Machines) and M/s. (Name of Supplier) _____

The detailed Inspection Note regarding its conformity/non-conformity to the laid specifications is enclosed along with as Annexure'A'. It is observed that (strike out whichever is not applicable):-

- The Machine conforms to all the laid down specifications.
- The machine conforms to all the laid down specifications except those at Sl.No._____
- The above deviations are minor/major affecting/not affecting the performance of the equipment in substantial way.

The following T and P/manuals/drawings are to be supplied alongwith the machine.

1. _____
2. _____
3. _____

Based on the above, the Machine is certified/not certified to be conforming to the specifications.

The machine is approved/not approved for despatch to _____ _____(Consignee) Indian Railway.

SIGNATURE AND DATE

For M/s._____

INSPECTING OFFICIAL
(NAME AND DESIGNATION)
for and on Behalf of President of India