1.0 GENERAL

1.1 These specifications are framed for a Shoulder Ballast Cleaning Machine (hereinafter called the machine), which should be capable of removing the ballast from the shoulder portion of the track, screen it, put back the screened ballast and profile it. The machine shall be robust, sturdy and capable of operating under the conditions prevailing on Indian Railways.

1.2 Technical 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 equipment fully comply with these specifications. Thereafter, if a bidder feels that his equipment can substantially meet the performance and quality requirements of the machine but does not fully satisfy a particular system specification, he should mention the same in the statement of deviation from the technical specifications, giving the details how the functional requirements are going to be met with. The tenderer may seek clarifications, if any, from the purchaser prior to submission of the bids.

1.3 The bidder shall specify the model offered and furnish detailed Technical Description of the same. System/sub-systems of the working mechanisms of the machine 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 (model) offered.

1.4 Photographs of the type of machine in working mode shall be enclosed with the offer. The photographs shall also show close-ups of various working assemblies/systems and the full machine. The tenderer shall furnish a video CD showing the working of machine 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. The machine shall be suitable for working on straight, transition and curved tracks (upto 10 degree) on broad gauge (1676 mm) of Indian Railways.

2.2 The machine shall be a self propelled bogie type vehicle with minimum 4 axles (2 bogies).

2.3 The profile of the machine longitudinally and in cross section during movement as self-propelled vehicle or towed in train formation shall be within the minimum and maximum moving dimensions shown in the Indian Railways Standard BG schedule of Dimensions(metric)-Rev-2004. These dimensions are shown at Annexure-1/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.

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

2.5 Axle load shall be lesser than 20.32t with minimum axle spacing of 1.83 m. Load per metre shall not exceed 7.67 t. Axle loads upto 22.82 tonnes and lower axle spacing may be permitted, provided the load combinations do not cause excessive stresses in the tracks & bridges of IR. Stresses in the tracks & bridges shall be calculated by IR/RDSO based on design data submitted by the firm as per (annexure-IV), and decision of IR/RDSO shall be final in this regard.
2.6 It shall have a desirable wheel diameter of 915 mm. However, lesser diameter can also be considered, provided it meets the speed and riding quality criteria as laid down. Forged wheels to Indian Railway Profile shall be provided on the machine. It shall have a minimum wheel diameter of 915 mm (new wheel profile). However, lesser diameter upto 730 mm (new wheel profile) can also be considered provided it meets the riding quality and speed criteria laid down in Clause 2.10 & 19.3 and rail wheel contact stresses for 72 UTS rails are within permissible limits. Forged wheels to Indian Railways profile shall be provided on the machine. The worn out wheel diameter based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

<table>
<thead>
<tr>
<th>Maximum axle load tonne)</th>
<th>Minimum worn out wheel diameter (mm)</th>
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<tbody>
<tr>
<td>20.32</td>
<td>816</td>
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<tr>
<td>20.0</td>
<td>805</td>
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<td>19.5</td>
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<td>17.0</td>
<td>700</td>
</tr>
<tr>
<td>16.5</td>
<td>680</td>
</tr>
</tbody>
</table>

It should be able to meet the speed and riding quality criteria as given in clause 2.10 and 19.3.

2.7 The wheel profile shall be as per Indian Railway standard wheel profile provided in annexure VII.

2.8 It shall be capable of negotiating curves upto 10° curvature (176 m radius), super elevation upto 185 mm 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.

2.9 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 to 1700m
- Humidity:      : 40% to 100%
- Maximum rail temp. : 70°C

2.10 During transfer from one station to another, it shall be capable of travelling on its own and haul a camping coach (maximum trailing load of 70 tonnes on four axles & air brakes) at a speed of 75 kmph and at a speed of 80 kmph when hauled in a train formation. Since the machine is likely to cover long distances on its own power, the travel drive system should be robust to sustain these requirements during the life of the machine without significant break down/failure.

2.11 It shall be capable of working without requiring power block in electrified sections. On Indian Railways, 25 KV 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.

2.12 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 centre to centre. The machine or its any part shall not infringe the adjoining track while opening and closing of work as per Indian railways Schedule of Dimensions 1676mm gauge (BG), revised-2004 with the latest corrigendum and up to date correction slips issued, while opening and closing of work.

2.13 The machine shall be equipped with pneumatically operated block brakes acting on all wheels. The
2.14 It shall be possible to drive the machine in both directions at the same speed.

3.0 WORKING MECHANISM

3.1 The machine shall be capable of working on all types of track structures including long welded rails of 60Kg./52Kg./90-R sections laid on concrete/steel-trough/CST-9/wooden sleepers.

3.2 Since the machine is required to work in dusty environment, 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 protections covers must be provided so that these components do not fail prematurely.

3.3 The various assemblies and the machine as a whole should provide adequate safety to the workmen working close by in connection with the machine operations. Various mechanisms shall be so designed that the ballast pieces do not fall on persons standing nearby. The necessary safety equipments shall form a part of the machine’s Tools & Plants. The tenderer shall supply these items as a part of the offer.

3.4 It shall be capable of excavating ballast on the sleeper shoulders upto distance of 2600 mm from the track centre and a depth of 900, below the rail top. The excavation depth shall be adjustable to suit the requirement at site.

3.5 The ballast shall be excavated upto the desired depth and width in one working pass.

3.6 It shall be possible to screen the ballast from either or both shoulders in one pass.

3.7 The machine shall be able to excavate ballast from the end of the sleepers to the toe of the ballast section (ref. Sketch at Annexure-I/II). The width of excavation, measured from the end of the sleeper, shall be adjustable from 500 mm to 1300 mm depending upon the site conditions.

3.8 The undercutting on shoulders shall be done at a cross slope of 1 to 30 towards outside of the track for good drainage (Ref. Annexure-I/II) on double line track the slope shall be in the same direction on both shoulders.

3.9 The excavating mechanism of the machine shall be retractable towards the track centre so as to avoid hitting of OHE mast foundations and at the same time, excavating the shoulder ballast from the area. The details of the OHE mast foundations are shown in the sketch enclosed along with as Annexure- I/II.

3.10 The machine shall have mechanism to excavate ballast from under the sleeper bottom upto 100 mm distance from the sleeper ends towards the track centre, to break the mud pockets. It shall be possible to use this mechanism only when considered necessary.

3.11 The excavation units shall be laterally adjustable for compensation of various sleeper lengths or for meeting certain other site conditions. The shift of the inner cutting face of the excavating mechanism shall vary from 1300mm to 1500mm, from the track centre, on either side of the track.

3.12 The machine shall be able to adjust the continuously variable speed from 0 to 1.5 kmph while in the work mode.
3.13 The screening unit shall be capable of screening the excavated ballast through a series of screens. The maximum and minimum sizes of the ballast retained shall be 65 mm and 25 mm respectively. The screening unit shall automatically remain in horizontal position laterally, even when working on curves up to a super elevation of 185 mm.

3.14 It shall be possible to dispose of the spoil (oversize as well as the under sized ballast and muck) on the cess at a distance of not less than 5 metres from the centre of the track, on either side of the machine. The spoil conveyor system shall be such that the spoil does not fall on the cleaned track. This feature is particularly relevant in the context of electrified sections where the spoil conveyor is required to clear the mast of overhead wire which are placed at a close distance to the track (ref. Annexure- I/II). For this reason muck shall be unloaded to the front on yet to be screened track.

3.15 The tenderer shall also provide a suitable safety mechanism to ensure that the spoil conveyor does not hit the mast and cause damage even due to error of the operator like non-withdrawal of the spoil conveyor in time to by-pass the mast.

3.16 Loading of spoil into a muck wagon attached to the machine shall also be possible, when required, while working in yards, built up area or cuttings etc. Machine during its working mode shall be capable of hauling/pushing muck wagons attached with the machine. The maximum trailing load of muck wagons is 800 Tonnes approximately. The muck carrying wagons shall be air braked vehicles.

3.17 The machine shall deposit cleaned ballast on either or both shoulders as required. There shall be not too short deposit of the cleaned ballast or heaping up of the ballast at the beginning/end of the work or during any stoppage of the work.

3.18 The machine after putting the cleaned ballast into the track shall make the desired ballast profile on either or both the shoulders. The side ploughs shall be suitably designed for necessary adjustment to achieve the required width and slope of ballast on the shoulders. It shall be possible to suitably retract the side of ploughs near the mast or signal posts etc.

3.19 Top of the sleeper ends, fastening area and rails shall be cleaned of ballast pieces, using end ploughs and brooms.

3.20 After carrying out the work, the machine shall leave the track in a condition so as to permit trains at maximum sectional speed without tamping, while the temperature is in the working range.

3.21 The machine shall have suitable mechanism to retract the excavating, regulating and other mechanisms from their working position on the approaches of level crossings, bridges, turnouts, etc. It shall be possible to retract and lower these assemblies within about 1 metre of the level crossing, bridge, etc. so that there may be minimum loss of shoulder ballast cleaning operation.

3.22 Time required for starting the ballast excavation and screening after arrival at the site of work together with the time required between stopping of the screening work and the starting of the machine for return journey shall be less than 15 minutes. A lower setting up and winding up time shall be desirable. The purchaser attaches utmost importance to the effective utilisation of the traffic block made available for working of the machine.

3.23 The output of the machine in one hour of effective working shall not be less than screening of 500 m$^3$ (five hundred cubic metre) of ballast. The test conditions for this purpose have been spelt out in detail in clause 19 of these specifications.

3.24 The excavating and pick up mechanism shall be so designed that nearly all the excavated material is picked up for screening. Not more than 2% of the total material excavated, by volume shall be left behind by the picking up mechanism.
3.25 The efficiency of screening shall be judged by collecting 5 samples of the screened material as it falls from the machine before its deposition in the track. Not more than 4% of this material by volume shall pass through a 25 mm sieve (ISI standard).

3.26 In addition to the computer system provided on the machine for its own controls, the machine shall be provided with one additional industrial quality shockproof & waterproof heavy duty Portable computer (laptop-toughbook) for keeping record of overall aspects of working, spares management and reporting. The software shall be window based. The hardware shall be sturdy for operation under conditions of shock, vibration, dust, electromagnetic influences from outside and interruption of power supply. The detailed specifications of the laptop are enclosed as annexure-IX.

4.0 DIESEL ENGINE AND DRIVE MECHANISM

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. The manufacturer of the Engine shall have acquired quality assurance certification of ISO: 9001. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions mentioned in this specification elsewhere.

4.2 The supplier shall furnish the details of diesel engine and its controls to assess its conformity with the engines already operating on track machines on IR. If the machine-design incorporates an engine not already operating with the purchaser, the model of the engine is liable for change as per the technical requirements and the maintenance logistics with the purchaser after technical negotiations with the supplier. Nothing extra shall be payable on this account.

4.3 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.

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

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

4.6 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 the system.

4.7 There is a likelihood of dust deposition over the engine body and surrounding area where 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 the machine.

4.8 The engine parameter monitoring gauges like temperature, rpm, lub.oil pressure shall be direct reading type 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.

4.9 Suitable and rugged mechanism should be provided to start the prime mover at no load and gradual loading after the start of the prime move.

4.10 The engine power take off shall be coupled to the main gear box through a flexible coupling. The engine shall be mounted on suitable Anti Vibration Mountings.
4.11 The machine should be provided with an efficient traction drive system for traction during the operation. The machine’s driving system shall be through hydro dynamically/hydrostatic capable of achieving full speeds in travel mode in both the directions. The system should be so designed that all the driving wheels work in synchronization and there is no slippage / skidding of the wheels during the work drive.

4.12 The driving mechanism, in working mode, shall be adequately designed to handle the acceleration and braking forces.

4.13 Suitable differential systems may be provided between coupled wheels on the same bogie.

4.14 Suitable flow divider/throttling arrangement may be provided to equalize the tractive effort amongst different bogies. Adequate gauges shall be provided to indicate the power sharing among different driving bogies to prevent overstretching of any traction bogie or its components.

4.15 The supplier shall provide the necessary technical details including circuit diagrams and detailed technical specifications of all electrical/electronic parts to confirm the above requirements.

4.16 Adequate gauges (flow meter) and solenoid valves shall be provided near linkage assembly, for indication, flow control and carrying out necessary adjustment in the field. To the extent possible hydraulic and pneumatic component/assembly should be fixed at suitable location preferably on the side frame of the machine so as to avoid the need of going on top of the machine for day-today maintenance schedules.

5.0 COOLING SYSTEM

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

5.2 Adequate heat transfer arrangement shall be designed and provided so that under extreme heat conditions as mentioned in 2.9 above, the system oil temperature does not go beyond 85 degree centigrade.

6.0 BRAKES

6.1 The machine shall be fitted with the compressed air-brakes. Provision shall be made to brake the camping coach from the machine air-brake system, when these are 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 kg 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.

6.2 Machine shall be equipped with suitable air brake valves so that while working in train formation, machine can be braked by traction vehicle. In addition, the machine shall be equipped with suitable air brake system in the driving cabins so that the attached wagon or camping coach while being hauled by the machine, can be braked. The speed of machine while hauling a 8 wheeler coach should not be less than 50 kmph.

6.3 There should be provision of emergency brake application in the machine either travelling alone or coupled with the camp coach, in addition to the normal braking system of the machine, using the compressed air. The emergency braking distance (EBD) of the machine coupled with a camping coach on the Indian railway track at the maximum designed speed on a level track shall not be more
than 600m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the machine coupled with coach on level track & at falling grade of 1 in 33 should be provided by the supplier. Brake design details are to be submitted as per annexure VIII.

7.0 HORN AND SAFETY SWITCHES

7.1 The machine shall be provided with electric/pneumatic horns/hooters at suitable location facing outwards to warn the workman of any impending danger at the work spot or from on-coming train. The horns shall be distinctly audible from a distance of at least 400 m from the machine. The horns/hooters shall be operated by means of push buttons provided in the cabs. Adequate no. of safety stop switches should be provided all around so that in case of any danger to worker during working, the working shall be stopped immediately.

7.2 Safety equipments like jacks, pullers, tirfor and other such equipment specific to the machine for restoring failed units of the machine during working, shall be provided on the machine.

7.3 Machine shall be provided with emergency back up system to wind up the machine in the event of failure of prime mover or power transmission system of the machine.

8.0 HOOKS AND BUFFERS

8.1 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 and for attachment with the camp coach/ muck wagons. IR currently uses Transition Centre Buffer Coupling for such applications.

9.0 SUSPENSION SYSTEM:
The suspension system shall be preferably of two-stage type with suitable spring and damping arrangement. Spring for primary and secondary suspension shall be designed to cater for actual service conditions. Effective measure shall be adopted minimize the weight transfer while starting, stopping and during runs.

10.0 ELECTRIC EQUIPMENT AND LIGHTING

10.1 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 Twin beam headlight assembly conforming to RDSO’s specification No.ELRS/SPEC/PR/0024 Rev-1, Sept 2004 with latest amendments ensuring a light intensity of 3.2 lux at ground level at track centre at a distance of 305 mts. away on a clear dark night, 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 floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. The flasher lights at both ends shall be provided on the machine to give indication for the train arriving on other line.

11.0 CHASSIS & UNDER FRAME

11.1 The chassis shall be fabricated from 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 underframe shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle.
12.0 CABINS

12.1 The machine shall be equipped with fully enclosed cabins with safety glass window at both the ends. It shall be possible to have a clear view of the track ahead while driving the machine in both the directions from the cabins at either end. The cabin layout shall be such that, before leaving the machine, the operating staff has full view on both the sides, to avoid any danger to them from trains on the adjacent tracks.

12.2 The working cabins of machine shall be air conditioned to provide dust free atmosphere inside the cabins. 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 working without air conditioning under the climatic conditions described in para 2.6 2.9 above.

12.3 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.

12.4 The operator’s cabin shall be ergonomically designed so that the operator has easy access to all the controls. The operator shall have a full view of the working area from the operating seat to have a full control over the work.

12.5 One screen wiper shall be provided on each of the wind screens.

12.6 Fire extinguisher (dry chemical type) shall be provided in the cabins.

12.7 The machine shall be provided with adequate space for keeping the tools and spares required for on-site repair of the machine and other working requirements.

13.0TOOLS AND INSTRUCTIONS MANUALS

13.1 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 specialised equipment. All special tools shall be listed and catalogued illustrating the method of application.

13.2 Detailed operating manual, maintenance, service and assembly overhauling manuals shall be specifically prepared and four copies of these shall be supplied with each machine. These shall be specifically prepared in English language and four copies of these shall be supplied with each machine. One set of all the manuals and diagrams (one set for a group of similar machines) should be sent to the Principal/IRTMMC, Allahabad, ED/TMM directorate, RDSO, Lucknow and DTK(MC)/Railway Board.

13.3 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 dimensioned 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 items shall be furnished by the supplier. These shall be specifically prepared in English language and four copies of these shall be supplied with each machine.

13.4 The tenderer shall, alongwith his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings to be supplied alongwith each machine as above, for operation, servicing, maintenance, assembly overhauling, Periodical Overhauling of the machine and trouble shooting guides. The list can be modified to suit the purchaser’s requirement, while examining the offer.
13.5 While offering the machine for first inspection, the supplier shall submit three copies of complete technical literature including operation, service and field maintenance instructions and workshop manuals for overhauling of the assemblies and the machine, 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 document for the inspecting officer.

13.6 One portable welding plant of reputed make with a minimum 11 KW/16 H.P capacity along with sufficient cable or lead shall be provided with the machine for day to day repairing of machine and its wearing parts.

13.7 The firm shall provide detailed technical drawings and specifications of wheels and axles used in the machine along with detailed code of procedure for ultrasonic testing of wheels and axles of all types. The above details shall be provided in four sets.

14.0 SPARE PARTS

14.1 The expected life of the components shall be advised along with their condemning limits. The machines shall be supplied with necessary spare parts for the operation and maintenance of the machine for a period of two years i.e working for about 2000 hrs.

14.2 The tenderer, alongwith the offer, shall furnish the required spare parts details in a separate list indicating description, part number, quantity, price, cost, whether imported or indigenous and their source of supply (OEM details).

14.3 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).

14.4 For indigenous parts and bought out components and assemblies, the source and other relevant technical details shall be supplied while offering the first machine for inspection.

15.0 MAKER'S TEST CERTIFICATE

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

16.0 OPERATORS

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

17.0 OPTIONAL EQUIPMENTS

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

18.0 INSPECTION OF THE MACHINE

18.1 While inspecting the machine before despatch from the supplier's premises, the inspecting officer to be nominated by the purchaser 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 the issue of the “Inspection certificate and approval for despatch of the
19.0 ACCEPTANCE TEST

19.1 In addition to verification of the various items of specifications covered earlier, the purchaser's nominee shall carry out the following tests in India at the purchaser's premises at the time of the commissioning of the machine. The pre-commissioning tests shall be completed and the machine shall be commissioned within 90 days of its arrival at the premises of the final consignee.

Dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances etc.

19.2 Testing for negotiability of 10° curve and 1 in 8\(\frac{1}{2}\) turnouts on the first machine.

19.3 Running speed tests on the Indian Railway mainline track on the first machine in accordance with the para 2 of Annexure-II.

19.4 Construction and engineering of the machine and its ability to perform all the functions as laid down in the specifications above.

19.5 Actual output and performance tests: These tests shall be conducted under field conditions on I.R. An electrified section shall be chosen for this test. The procedure shall be as follows:

a) The machine crew shall be either trained personnel of Indian Railways or the staff of the contractor.
b) Dry weather, ambient temperature between \(+10^\circ\) C to \(40^\circ\) C.
c) Straight track or curve with radius minimum up to 1000 m.
d) Gradient up to 1 in 200
e) Rails fastened to all sleepers.
f) Concrete/wooden/metal sleepers.
g) Same type of sleepers, excepting case of fishplated track where joint sleepers could be of different type.
h) Variation in sleeper length \(+ 50\) mm from standard length.
i) No cutting into blanket or formation.
j) Screening of both shoulders simultaneously.
k) Cutting depth shall be at least 200 mm below the bottom of the sleeper on both shoulders.
l) Generally, no ballast piece bigger than 150 mm. Over-size between 75 mm and 150 mm not exceed 1%. Size of ballast to be recovered between 25 mm and 75 mm. The ballast not generally cemented.
m) No water pockets, no mud pumping, grass in limited quantity.
n) Normal moisture content of permanent way.
o) Spoil below 25 mm size up to a maximum of 30% by volume for this purpose 4 representative samples shall be collected from the test length and screened at site for calculation of the spoil content. An average value shall be worked out which shall not exceed 30% by weight. While collecting the samples it shall be ensured that the entire section to be excavated and screened is picked up.
p) The formula for calculation of the output shall be as follows:

\[ V (Output) = \frac{\text{Total volume in } \text{m}^3 \text{ excavated for screening}}{\text{Time in hours}} \]

V represents the volume of the excavated ballast which shall not be less than 500 m\(^3\)/hr. Time shall be measured in hours discounting the stoppages not attributable to machine failures.

19.6 Samples of the screened ballast shall be collected before it drops on the shoulder and shall be screened separately to assess the quantity of under size elements. Under size material up to 25 mm shall not exceed 4% by volume to the screened ballast. 5 Samples shall be collected and an average volume shall be worked out for the purpose of this test.
19.7 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 shall not exceed 15 minutes.

20.0 ISSUE OF PROVISIONAL SPEED CERTIFICATE

Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by RDSO based on certain design parameters of the vehicle. Final speed clearance of the vehicle is given after conducting detailed oscillation trial of the vehicle, which is a time taking process. Therefore, issue of provisional speed certificate for the vehicle becomes a necessity and based on the same, the approval of running of the vehicle on Indian Railway track is taken from commissioner of Railway Safety. For issue of provisional speed certificate, the following actions are required to be taken by the suppliers:

a) Current suppliers, whose models are approved:
The supplier shall give details of the model, year of introduction in Indian Railway, details of speed certificate issued etc. The supplier shall certify that no change has taken place in the model being offered with respect to design of under carriage i.e. suspension system/arrangement, wheel & axle assembly, bogie, braking arrangement, loading pattern of the vehicle etc. and the distribution of axle loads, lateral forces, un-sprung mass and braking force coming on rails is the same. If, there is any change in above respect, the action shall be taken as detailed in para (b) below:

b) Current suppliers, whose models are not approved/ or new:
As soon as the supplier completes the design of the machine as per specifications, the technical details as per Annexure (IV, V & VI) shall be supplied for processing of provisional speed certificate for the machine so that it can be permitted to move on track. On case-to-case basis, more technical details (other than mentioned in Annexure IV, V & VI) can also be asked for issue of provisional speed certificate for the machine.

c) New suppliers, whose models are new:
The technical details shall be supplied as detailed in para (b) above.

21.0 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.
NOTE:
ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

RAIL

3735 MAX

1082

2653

3135 MAX

2440 MAX

3250 MAX

1827

LEVEL

MAXIMUM MOVING DIMENSIONS

102 MIN

305 MIN

1170 MIN

4265 MAX

DIAGRAM NO. 1D (EDD/T-2202)

1676mm GAUGE
1 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 restrictions. The vehicle will be tested generally for new and worn clearance conditions and where relevant for operation in the forward and backward directions. The vehicle selected for tests will be one in average condition for normal maintenance.

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

i) A lateral force lasting more than 2 metres should not exceed the Prud-Homme’s limit of 0.85 \( (1 + \frac{P}{3}) \) 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 ratio between the lateral force \( (h_y) \) and the wheel load \( (Q) \) continuously over a period of \( 1/20^{th} \) second, the value \( h_y/Q \) 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 kg both in vertical and lateral directions. The peak values up to 0.6 g 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 (iv) 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 of accelerations as the case may be.
ANNEXURE-III

INSPECTION CERTIFICATE

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

(STRIKE OUT WHICHERVER 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 ‘--’. 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:

______________________________________________________________
______________________________________________________________
______________________________________________________________

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
Particulars Required in Respect of the Rolling Stock Under Consideration

A diagram showing elevation salient dimensions:

Wheel spacing, Wheel diameter, bogie centres, and axle load.

i) Over all length of the vehicle:
ii) Length over head stock:
iii) Length over buffers:
iv) Distance apart for Centre of buffers:
v) Max./Min. height of centers of buffers above rail level:
b) i) Wheel base:
ii) Axle load (max):
iii) Bogie Centres:

2. Wheel dimension:
   i) New:
   ii) Worn out:

3. Tread and flange profile of the wheel:
    indicating clearly whether it is Indian Railway standard profile or differs from standard flange profile.

Wheel gauge dimension – (back to back of tyre flange).

4. Whether the stock is designed to be used as a general purpose or in a closed circuit in specified sections under defined conditions.

5. Maximum design speed
   i) Own Power:
   ii) In train formation:

6. Unsprung weight per axle in tonnes
   i) Driving axle:
   ii) Running axle:

7. Expected lateral force in tonnes per axle:
   At maximum design speed.

8. Increase in the impact load during motion (Dynamic Augment)

9. Method of operation -
   Whether single only or coupling together is possible. If coupling is possible, the number which can be coupled and what is trailing load.

10. Maximum tractive effort at start and at the speed of operation
    i) at working drive at start:
        at operation speed:
    ii) at transfer drive at start:
        at maximum speed:

11. Maximum braking force coming on to the rails per wheel
at working axle:  
at transfer axle:  

Drawing indicating suspension arrangement details:  
of bogie and axle.

13. Height of centre of gravity from rail level:  
14. Height of floor from rail level:  
15. Type of coupler provided - Indian Railways Standard  
   - Coupling:  
   - Buffer:  
16. Any infringement to the moving dimensions:  
Sketch provided in the Indian Railways Standard Schedule of Dimensions – Chapter IV (A).
Annexure : V

Following information as detailed below is also required along with the information required for processing the case for issue of provisional speed certificate for new vehicles:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. a)</td>
<td>Brake System details</td>
</tr>
<tr>
<td>b)</td>
<td>Gross Braking Ratio</td>
</tr>
<tr>
<td>2.</td>
<td>Brake rigging arrangement drawing and calculation of braking force</td>
</tr>
<tr>
<td>3.</td>
<td>Maximum Braking Effort at start and at the speed of operation -</td>
</tr>
<tr>
<td></td>
<td>a) at working drive at start : at operation speed :</td>
</tr>
<tr>
<td></td>
<td>b) at transfer drive at start at maximum speed :</td>
</tr>
<tr>
<td>4.</td>
<td>Characteristics of springs used in suspension indicating free height,</td>
</tr>
<tr>
<td></td>
<td>working height, dynamic range, stiffness and locations etc.</td>
</tr>
<tr>
<td>5.</td>
<td>Characteristics of the dampers if used, and over all damping factors</td>
</tr>
<tr>
<td></td>
<td>Calculation of the following frequency of the vehicle to be attached</td>
</tr>
<tr>
<td></td>
<td>Bouncing ii) Pitching iii) Rolling</td>
</tr>
<tr>
<td></td>
<td>Wave length of free axle and bogie</td>
</tr>
<tr>
<td>6.</td>
<td>Write up and salient design calculation on suspension system, type</td>
</tr>
<tr>
<td></td>
<td>whether it is of coil suspension with or without dampers and laminated</td>
</tr>
<tr>
<td></td>
<td>bearing springs and double link suspension.</td>
</tr>
<tr>
<td>7.</td>
<td>What are lateral clearance of axle box / horn, wheel flange/rail and</td>
</tr>
<tr>
<td></td>
<td>other locations for the negotiability of the vehicle on curve and</td>
</tr>
<tr>
<td></td>
<td>turn out (enclose Vogels Diagram for negotiability on maximum degree</td>
</tr>
<tr>
<td></td>
<td>of curve and turn out permitted on Indian Railways) of new and worn</td>
</tr>
<tr>
<td></td>
<td>out wheel.</td>
</tr>
<tr>
<td>8.</td>
<td>Wheel and axle assembly drawings</td>
</tr>
<tr>
<td>9.</td>
<td>Calculation for flange force</td>
</tr>
<tr>
<td>11.</td>
<td>Calculation of natural frequency</td>
</tr>
<tr>
<td>12.</td>
<td>Calculation of spring characteristics and critical speed of the</td>
</tr>
<tr>
<td></td>
<td>vehicle.</td>
</tr>
<tr>
<td>13.</td>
<td>Simulation result showing ride index, lateral force and acceleration</td>
</tr>
<tr>
<td></td>
<td>results.</td>
</tr>
<tr>
<td>14.</td>
<td>A certificate regarding the speed of the vehicle for which it has</td>
</tr>
<tr>
<td></td>
<td>been designed.</td>
</tr>
</tbody>
</table>
Annexure VI

Machine details required for simulation of machine on NUCARS or similar Track-vehicle simulation software

<table>
<thead>
<tr>
<th>SL.</th>
<th>Component’s Name</th>
<th>Parameters required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C.G. of component in x, y, z direction from rail level in mm (Referenced point 1st axle)</td>
</tr>
<tr>
<td>1.</td>
<td>Super structure with vehicle frame (machine structure kept on secondary suspension of front and rear bogie)</td>
<td>X</td>
</tr>
<tr>
<td>2.</td>
<td>Front Bogie frame including brake rigging</td>
<td>X</td>
</tr>
<tr>
<td>3.</td>
<td>Rear Bogie frame including brake rigging</td>
<td>X</td>
</tr>
<tr>
<td>4.</td>
<td>Transmission system device (hydraulic, Mechanical or electrical traction motors)</td>
<td>X</td>
</tr>
<tr>
<td>5.</td>
<td>Wheel axle set including axle boxes which constitute the</td>
<td>X</td>
</tr>
</tbody>
</table>
### Unsprung Mass

<table>
<thead>
<tr>
<th>6.</th>
<th>Mass of Items included in unsprung mass partially or fully along with their name per axle</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total unsprung mass in tonnes</th>
</tr>
</thead>
</table>

### Total Weight of Components in Tonnes

<table>
<thead>
<tr>
<th>7.</th>
<th>Total weight of components in tonnes</th>
<th>Front bogie full assembly</th>
<th>Rear bogie full assembly</th>
<th>Machine frame full structure</th>
<th>Full weight of vehicle (front bogie + rear bogie + vehicle car body or super structure)</th>
</tr>
</thead>
</table>

### Suspension Stiffness Details

<table>
<thead>
<tr>
<th>8.</th>
<th>Suspension stiffness details in Kg/mm</th>
<th>Primary suspension element stiffness per axle box between bogie and axle box</th>
<th>Secondary suspension element stiffness per side between bogie and machine frame</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vertical stiff</td>
<td>Lateral stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vertical stiff</td>
<td>Lateral stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>9.</td>
<td>Damping force details (If hydraulic damper used give there rating force per meter/second)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper)</td>
<td>Vertical direction</td>
<td>Lateral direction</td>
</tr>
</tbody>
</table>

Vertical direction | Lateral direction | Longitudinal direction | Rotation about vertical axis | Rotation about lateral axis | Rotation about longitudinal axis |
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>Dimension of location of suspension elements</td>
<td>Detail of location of suspension springs and dampers and shock absorbers with support drawing</td>
</tr>
<tr>
<td>12.</td>
<td>Details of centre pivot arrangement working and location</td>
<td>Provide detail arrangement drawing and description</td>
</tr>
<tr>
<td>13.</td>
<td>Set of drawings and design description</td>
<td>Concerning with general arrangement of vehicle, bogie general arrangement, suspension arrangement details, suspension clearances drawing, detail written description of configuration and loading pattern accompanies design particular of vehicle bogie.</td>
</tr>
</tbody>
</table>
Annexure-VII

PROCEDURE OF DRAWING -

1. DRAW A HORIZONTAL LINE "X-X" TO THE VERTICAL LINE "Y-Y".""
### Annexure-VIII

**BRAKE DESIGN DETAILS OF THE MACHINE** for calculation of Emergency Braking Distance

<table>
<thead>
<tr>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tare &amp; gross weight of the machine in Kilograms</td>
</tr>
<tr>
<td>Brake power in Kilograms</td>
</tr>
<tr>
<td>Type of Brake blocks</td>
</tr>
<tr>
<td>Brake block area in Square Centimeters</td>
</tr>
<tr>
<td>Brake Rigging Diagram</td>
</tr>
<tr>
<td>Type of Brake system</td>
</tr>
</tbody>
</table>

### Annexure- IX

**Specifications of Heavy duty Industrial Quality Water proof & shock proof laptop (Toughbook)**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel Core i-5 540 M at clock speed of 2.53 GHz or higher version</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows 7 professional or higher version</td>
</tr>
<tr>
<td>RAM</td>
<td>2 GB (DDR 3 1066 MHz) or more</td>
</tr>
<tr>
<td>Storage</td>
<td>Shock mounted flex connect hard drive with quick release 250 GB -540 M or More</td>
</tr>
<tr>
<td>Display</td>
<td>13.1” XGA touchscreen- LED backlit with Intel Graphics</td>
</tr>
<tr>
<td>Keyboard</td>
<td>Backlit 61 key QWERTY keyboard</td>
</tr>
<tr>
<td>Wireless</td>
<td>Integrated Gobi TM 2000 mobile broadband, Bluetooth</td>
</tr>
<tr>
<td>Durability features</td>
<td>MIL-STD-810G &amp; IP65 certified (6’ drop)</td>
</tr>
<tr>
<td></td>
<td>MIL-STD-461F certified</td>
</tr>
<tr>
<td></td>
<td>UL1604 certified model</td>
</tr>
<tr>
<td></td>
<td>HDD heater</td>
</tr>
<tr>
<td></td>
<td>Magnesium alloy w/handle</td>
</tr>
<tr>
<td></td>
<td>Shock-mounted flex-connect HDD with quick-release</td>
</tr>
<tr>
<td></td>
<td>Reinforced flex-connect HDD with quick-release</td>
</tr>
<tr>
<td></td>
<td>Reinforced locking port covers</td>
</tr>
<tr>
<td>Additional features</td>
<td>WebCam</td>
</tr>
<tr>
<td>Pre Loaded Softwares</td>
<td>Antivirus software for 18 months validity</td>
</tr>
<tr>
<td></td>
<td>Microsoft office 2007 complete bundle</td>
</tr>
</tbody>
</table>