

**Technical Specification of Work**

Clause No.	Technical Specification	Comments of Manufacturer	Comments of Inspection Officer
	<b>DIMENSIONAL AND OPERATING REQUIREMENTS</b>		
<b>1.0</b>	1.1 The upgraded machine shall be diesel powered vehicle which shall be of robust, design similar to DTE machines being supplied to Indian Railways <b>(56 series)</b> by OEM M/s. Plasser India. It should be suitable for working on plain track, transition and curved track (up to 10°) on the broad Gauge (1676 mm) of Indian Railways. The design and dimensions of the machine and components shall be to metric standards and shall comply with provision of Indian Railways Schedule of Dimension-1676 mm gauge (BG), revised, 2004 Quality assurance during upgradation shall be as per ISO- 9001. The welding standard followed for manufacturing of machine shall conform to ISO 3834 EN: ISO 15085. Or any other equivalent standard for welding railway vehicle and components. The manufacturer shall specify the standard followed and certify that it meet the welding standard mentioned above.		
	1.2 The profile of the upgraded machine longitudinally and in cross section shall be within the Indian Railways schedule of Dimensions 1676 mm Gauge (BG), revised 2004 with the latest corrigendum and up to date correction slips issued during transfer as self-propelled vehicle or towed in train formation as last vehicle. Wherever required, the tenderer shall submit the sketches of purposed upgraded machine in plan and shall give calculations for moving dimensions on 10° curves to show the extent of lateral shift at the ends, center and any other relevant cross sections. It shall be ensured that the machine does not cause infringement while moving on a 10° curve.		
	1.3 In the past Indian Railways has condoned certain infringements to the Indian Railways Schedule of Dimensions -1676 mm gauge (BG), revised, 2004 of such dimensions as rigid wheel base, length of stocks, distance apart of bogie Centre's and maximum height of floor above rail level in certain track machines after due consideration of their design features vis-à-vis safety and operation requirements of Indian Railways. However, condonation of an infringement in another track machine in the past does not by itself entitle the manufacturer to assume acceptance of the same in other track machines by Indian Railways. Where an infringement to Indian Railways Standard BG schedule of Dimensions (metric)-2004 is considered necessary by the manufacturer as intrinsic to the design of the machine for meeting the work performance requirements laid down in this specification while meeting the safety and operational requirements of Indian Railways, the condonation of the same may be permitted by Indian Railways.		

	However, only those infringements which are acceptable shall be permitted.		
1.4	Adequate clearance shall be allowed so that no component infringes the minimum clearance of 102 mm from rail level while travelling up to condemnation limit of wheel.		
1.5	Wherever applicable, axle load of the machine shall be lesser than 20.32 t with minimum axle spacing of 1.83 m. Load per meter shall not exceed 7.67 t. Axle loads up to 22.82t and lower axle spacing may be permitted, provided the load combinations do not cause excessive stresses in the track and bridges of Indian Railways. Stresses in the track and bridges shall be calculated by IR/RDSO, based on design data submitted by the firm as per Annexure VII and decision of IR/RDSO shall be final in this regard.		
1.6	Wheel dia for stabilizer unit shall be compatible with wheel dia of exiting machine Permitted worn out wheel diameter shall be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn-out wheel diameter. The new wheel profile in the machine shall be as per Indian Railway standard drawing.		
1.7	Wheels shall be conforming to Indian Railway Standard R-19/93 or European Standard EN13262 or any other equivalent standard (for product requirement) and design shall duly conform to European Standard EN 13979 or other equivalent standard. The supplier shall submit detailed design calculation along with material parameters at the time of supply of the machine.		
1.8	The non-powered axles shall be conforming to Indian Railways Standard R 16/95 or European Standard EN 13261(EA1N) or any other equivalent standard. The supplier shall submit detailed design calculation, if new non- powered axles provided along with material parameters at the time of supply of the machine.		
1.9	The powered axles shall be conforming to Indian Railways Standard R-43/92 or European Standard EN 13261 (EA4T) or any other equivalent standard (for product requirement). The design shall conform to EN: 13104 or any other equivalent standard. The supplier shall submit detailed design calculation, if new powered axles provided along with material parameters at the time of supply of the machine.		
1.10	Upgraded machine shall be capable of negotiating curves up to 10°curvature (175 m radius), super elevation up to 185 mm and gradients up to 3% in travel mode. The supplier shall specify the minimum attainable speed under the above gradient 'conditions; which in any case shall not be less than 40 kmph. The machine shall be able to work on single/multiple lines as		

	well as between platforms without infringing the traffic movement on the adjoining track.		
	1.11 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: -5° to 55° C, Altitude: Sea level to 1750m above mean sea level, Relative Humidity: Up to 100%, Maximum rail temperature: 70° C. All the system components on the machine shall be covered by roof or other suitable sturdy covering so that the system & components vulnerable to moisture ingress are not adversely affected during rains and the machine is able to work continuously even during rains.		
	1.12 During transfer from one station to another, it shall be capable of travelling on its own at a speed of 80 kmph and at a speed of 100 kmph when hauled in a train formation as last vehicle. Since the machine is likely to cover long distances on its own power, the travel drive system shall be robust to sustain these requirements during the life of the machine. It shall be possible to drive the machine in both directions at the same speed. Driving cabin shall be at both end of the machine for this purpose. The machine shall be capable of hauling an 8-wheeler camping coach at a maximum speed of not less than 50 kmph.		
	1.13 It shall be capable of working without requiring power block in electrified sections. 25 KV or 2x25 KV AC power supply is used for traction through an overhead wire at 5500 mm above rail level. The height of overhead wire is restricted to 4800 mm on bridges and in tunnels.		
	1.14 The machine or its any part shall not infringe the adjoining track as per “Indian Railways Schedule of Dimensions 1676 mm gauge (BG), Revised 2004 with the latest corrigendum and up to date correction slips issued”, while opening and closing the work. During working, also 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 4265 mm center to center.		
2.0	<b>WORKING MECHANISM</b>		
	2.1 The upgraded machine shall consist of a tamping unit and stabilization unit. The stabilizing unit will be in the form of trailer linked with the tamping portion of machine by suitable coupling. The stabilizing unit shall be operated by same operator who is operating the tamping unit. The machine shall be capable of tamping up to three sleepers at a time along with lining/lifting/levelling. No separate operator for stabilizing unit shall be required. Stabilizing unit shall be so synchronized with the tamping unit that stabilization can be made to start automatically from the first sleeper tamped and stop at the last sleeper tamped. The machine shall be capable of performing both function of tamping and stabilizing		

	<p>independently also. The machine shall be capable of carrying out automatic lifting, levelling, tamping, lining along with simultaneous stabilization of the tamped track, at the peak rate of 3500 sleepers or more per hour over a period of not less than 10 minutes and an average of not less than 2700 sleepers in an effective hour of working on all type of track structures in Indian Railways with uniform sleeper density as per clause 2.11 at the specified parameters of clause 2.6 for achieving durable compaction. The time shall be counted from start to finish of tamping work at work place. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding up time 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 10 minutes. The setting up time shall be counted from the time machine arrives at site to the time work is started. The winding up time will be counted from the time the work is stopped to the time machines starts moving away from the work site. The tenderer shall furnish the full details of the working cycle of the machine, its timings and other operational details.</p>		
2.2	<p>The machine shall be provided with new automatic tamping units. Separate tamping units have to be provided for each rail. Each unit comprising of tamping tools, shall be operated hydraulically. <b>The supply of new Tamping Tines is not included in this offer, however, railway may provide a new set of Tamping Tines during the work which would be installed by the firm during the work.</b></p>		
2.3	<p>The necessary work units shall be positioned on an under frame separate from the main frame capable of cyclic movement from sleeper to sleeper, independent of the main frame, to facilitate continuous working for high output so that the operator does not get undue fatigue due to acceleration pull, braking jolt in each tamping cycle.</p>		
2.4	<p>The tamping below the sleepers, after the track geometry correction, shall be based on vibratory squeeze principle to achieve a durable compaction. The amplitude and vibration frequency squeezing pressure and squeezing time to achieve a durable compaction on different track structures shall be specified.</p>		
2.5	<p>The ballast depth up to 350 mm shall be effectively compacted having zone of influence of tamping of approx. 150 mm layer below the bottom of sleepers. The maximum depth of concrete sleeper is equal to 235 mm. Rail top to sleeper bottom depth may vary from 365 mm to 420 mm. There shall be provision for step-less adjustment of the depth of tamping tools to suit different types of sleepers. The machine shall be provided with a penetration assistance system to achieve full penetration even in caked ballast bed. The Tamping units shall be equipped with a vibration control</p>		

	system. The system shall increase the mechanical induced vibration for easy penetration while lowering the tamping units.		
2.6	<p>Amplitude of vibration, vibration pressure, vibration frequency, squeezing pressure, squeezing time and tamping depth of the tamping tools in tamping unit shall be such that durable compaction under the sleeper is achieved. The vibration frequency and vertical load of stabilizing unit should be such that controlled settlement, lasting consolidation and substantial increase in post tamping lateral ballast resistance of sleeper is achieved. Details of all the above parameters will be submitted in the offer. The machine shall be capable of giving the output as stipulated in Clause 2.1 with the following tamping parameters:</p> <ul style="list-style-type: none"> <li><b>a.</b> minimum Squeezing time of 0.8 sec or more (as per IRTMMCS 0.8-1.2sec)</li> <li><b>b.</b> minimum Squeezing pressure of 110 kg/cm<sup>2</sup> or more (as per DTE manual)</li> <li><b>c.</b> minimum Tamping depth upper edge of tool blade should be 15—20 mm below the bottom of the sleeper.</li> </ul>		
2.7	The tamping tools shall come to rest automatically after they encounter the resistance from the ballast to pre-selected squeezing pressure and hold the squeezing pressure for pre-set time. It shall be possible to vary the squeezing pressure, squeezing time, to suit varying track structure and ballast conditions.		
2.8	The lifting system shall be such that the track can be lifted without bearing on the ballast. The machine frame and the lifting system shall be strong enough to bear the track lifting forces for all types of track structures for 150 mm lift in one go. The free length between the two bogies of the main machine shall be long enough to permit the track lifting up to 150 mm in one go, having 60 Kg rails on concrete sleepers without excessive stresses in the rail or on the lifting mechanism. The lifting system should hold the rail continuously rather than releasing and re-lifting the rail at every tamping cycle. However, the lifting/lining system and actual tamping should be so synchronized that the track is stiffly held in position and there is no movement in the track when the tamping tool is inserted for tamping. This is required to ensure that the lift and slew are not altered during the process while track is being tamped. The machine shall also have arrangement to lift properly the insulated glued joint, switch expansion joint and special one-meter fishplates joint during tamping.		
2.9	The machine shall be fitted with automatic lining equipment		

	capable of carrying out lining simultaneously with levelling. The machine shall also have the ability to slew all type of track structures including rails and concrete sleepers up to 150 mm in one go. The lining & levelling unit shall have two sets of track lifting and lining rollers clamps for each rail.		
	2.10 The machine shall be capable of tamping, lifting, lining and stabilization of track laid on pre stressed concrete sleepers with long welded rails, short welded rails and fish-plated rail. The normal sleeper spacing center to center in different track structures on Indian Railways is 550 mm to 650 mm and the clear spacing between sleepers will be minimum 260 mm and maximum 405 mm.		
	2.11 The three cabins of the machine shall be air-conditioned. The air conditioning provided shall be of robust industrial design capable of operating in highly dust laden environment. However, the electronic equipment should be so designed that the machine shall be able to work without air-conditioning under the climatic conditions described in clause no. 1.11.		
	2.12 It shall be possible to control the target track geometry parameters, in infinitely variable steps from operators/front cabin. To suit this, suitable proportional/servo control systems shall be provided.		
	2.13 The machine shall be provided with a computerized unit for the overall control of its working system for all possible track geometry. The system shall be so designed that for working on tracks with pre decided target geometry, the standard track geometry data as well as correction values can be entered prior to work either directly on system or via USB, CD or DVD. For working on tracks with unknown target geometry, it shall be possible to determine the correction values by making a measuring run and subsequent geometry compensation of the recorded data considering obligatory point and constraints of lifting and lining etc. Interactive processing of the target profile by the operator shall be possible. Important tamping Parameters like datum rail, general lift, single insertion or double insertion, design or smoothening. mode, time of start and finish of work, squeezing pressure, squeezing time, vibration pressure and tamping depth etc shall be displayed in graphic as well as text form on a colour monitor. It shall be possible to guide the working system of the machine continuously and automatically by this unit. The software shall be Windows based. The hardware shall be sturdy for operations under conditions of shock, vibrations, dust, electromagnetic influences from outside and interruption of power supply. The unit shall have memory storage not less than 500 GB to keep records of minimum 100 km of work performed, New track geometry obtained and enables transfer of the data via USB· port on a memory stick as required. Any software required to		

	read this retrieved data should be supplied with the machine as an integral part of the machine offered.		
2.14	In addition to the computer system provided on the machine for its own controls, the machine shall be provided with laptop (14-inch screen, intel i7 processor with turbo boost technology, 16GB RAM, 512GB SSD, 12th generation or higher, q series chip set, windows 11 pro) for keeping record of overall aspects of working, spares management and reporting. The detailed specifications of Laptop will be same as that being provided by OEM with new DTE machines.		
2.15	<p>The machine shall be equipped with an electronic device for measuring and recording the following track parameters in real time:</p> <ul style="list-style-type: none"> <li>• Alignment and longitudinal level on minimum 7.2m chord length Cross level difference and twist at every 0.6 m or less interval.</li> <li>• Super elevation</li> <li>• Lifting value</li> </ul> <p>The system therefore shall be able to record the final corrected track parameters during tamping itself and as achieved after tamping and there should be no need for separate run to record these parameters. The hardware shall consist of a touch panel computer with flash disc and a laser jet printer. There should be provision to fix threshold value of above parameters and it shall be possible to draw reports to allow evaluations when threshold values are overstepped. Standard deviations shall also be calculated in 200 m sections for the track parameters i.e alignment of the reference rail, longitudinal level and twist. It shall have an inbuilt storage to store the above parameters of minimum 100 km of tamping work. The storage however shall not be less than 500 GB for this purpose.</p>		
2.16	A programmable logic control system shall be provided in the machine so that the works like lifting, lining, tamping and work drive of machine will commence only when all conditions for their working/movement are fulfilled.		
2.17	In case of failure of the up and down cylinders of tamping unit, there shall be an arrangement for lifting the tamping units mechanically by lifting equipment like trifor/chain pulley etc. Any other alternative arrangement shall also be provided for mechanically lifting tamping unit in such failures.		
2.18	The machine shall be equipped with a centralised computer and monitoring system which shall monitor the health of machine working system such as engine (lubricant oil pressure, temperature, rpm etc.), hydraulics (hydraulic pressure in different units, temperature, oil level in tank etc), pneumatic (pressure of different units), electrical (charging/discharging rate, voltage etc.). All these data should		

	be displayed on a monitor installed in working cabin.		
	2.19 The stabilizing unit shall be an integral part of the machine. It shall achieve effective and continuous stabilization of the track and shall be able to match the working speed of the tamping portion without loss in stabilizing quality. It should be able to increase the lateral ballast resistance of individual concrete sleepers on an average by minimum 25% of lateral resistance left immediately after tamping (with general lift of 20-30 mm) on concrete sleeper track with at least 150 mm clean ballast cushion.		
	2.20 During the operation, the stabilizer unit shall be capable of lowering the track in a controlled manner, while maintaining the pre stabilized geometry. Proper longitudinal and cross-level control mechanisms shall be provided to achieve this. The manufacturer shall clearly explain the mechanism in its offer.		
	2.21 The stabilizing unit shall be capable of continuous stabilization of track including typical Indian Railways heavy concrete sleeper track. To achieve a controlled settlement and a lasting consolidation of such heavy track, it shall be equipped with minimum two independent stabilizing units, applying equally or variable maximum vertical load of 12t or as designed to get the required consolidation.		
	2.22 The stabilizing unit shall be capable of pre loading the track. The driving wheels shall provide adequate adhesion to avoid wheel slippage/loss of traction and risk of derailment while pre loading the track by stabilizing unit.		
	2.23 The horizontal and vertical force and frequency of vibration shall be adjustable so as to carry out effective stabilization on various types of track structures.		
	2.24 The machine shall be equipped with suitable mechanism to control the degree of settlement of the track which shall copy the pre stabilizing geometry by automatically increasing/relieving the vertical load on the stabilizing units. For optimum results, mechanism shall work independently for the left and right hand rail. 2.25 It shall be possible to steplessly pre select the frequency of stabilizer vibrations which shall be between 0-45 Hz for optimum adjustment to suite the various kinds of track structure. During work near fixed structures like bridges, it shall be possible to pre-select a frequency within that range which is beyond the natural frequency of the structure. In this context, it is also essential that the vibrations be automatically cut off, when the machine working speed reduces below cut off speed. This is to be prescribed by the manufacturer in the offer.		
	2.26 The stabilizing unit shall be equipped with a frequency modulation measuring unit for optimum regulation of frequency. The machine shall be equipped with display units		



	for monitoring vibration frequency, and degree of settlement on both rails.		
	2.27 Only lateral vibrations shall be permitted to avoid damages on the rail surface by excess friction and force by the rollers and to achieve a force free resettlement of the ballast grains and these lateral vibrations by stabilizing unit shall be created without any vertical impact.		
	2.28 The tamping tool holding arrangement in tamping arm of tamping bank should be cylindrical compressible type with bolting and dowel arrangement such that no hammering is normally required for fixing and removing the tamping tools.		
	2.29 The ALC/AGC (automatic guiding control) system/software shall be capable of recording pre and post tamping track parameters i.e. unevenness, cross level, alignment in analogue format at every 1 m interval. Also the ALC/AGC (automatic guiding control) system/software shall be capable to work out the “standard deviation” (SD) of the track parameters before and after tamping to assess the correct picture of the quality of work done by the machine.		
	2.30 The machine shall be capable to work in manual mode also in case of failure of computer/software/display units along with provision of manual feeding of required data. Necessary calculation chart shall be provided with each machine.		
	2.31 The machine shall be capable to rectify the track parameters by compensation mode/smoothing mode and Geometry mode/Design mode.		
	2.32 All inputs values like general lift, Super elevation etc. shall be also displayed on the panel board in addition to display unit of ALC/AGC (automatic guiding control).		
3.0	<b>DIESEL ENGINE:</b>		
	3.1 The machine shall be powered by one diesel engine preferably indigenous with proven record of service in tropical countries with wide service network in India. 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 the specification elsewhere. High speed diesel oil to Indian standard specification shall normally be used. A minimum fuel tank capacity sufficient for continuous operation for 8 hrs but not less than 1400 liters shall be provided. Sight glass type fuel measuring gauge preferably of full height shall be provided on the fuel tank. Storage batteries of well-known indigenous make with wide service network in India shall be provided for starting the engine. The engine shall normally be push/pull button start type or key type. (Necessary modifications will be carried out in machine frame as per new engine requirement.)		
	3.2 Since the engine has 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.		
	3.3 The engine parameter monitoring gauges like temperature, rpm, and lubricant 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 will shut down automatically.		
	3.4 The engine power take off shall be coupled to the main gearbox through a flexible coupling/cardon shaft (propeller shaft). A fail-safe clutch mechanism, if required, may be provided to meet this requirement. The engine shall be mounted on suitable Anti-Vibration Mountings.		
	3.5 The engine shall have Electronic Control Module (ECM) or similar arrangement for taking out operating parameters on real time basis such as RPM, load, fuel consumption, temperature, pressure and diagnostic data as well as trip and historical data. These data shall be displayed and stored on a centralized computer and monitoring. It shall also be possible to transfer these data on USB device through the centralised computer-based control.		
	3.6 In order to adhere to pollution control norms, the diesel engine should be electronically controlled emmissionized engine with minimum compliance of EU stage IIIA Equivalent emission standards.		
	<b>DRIVE MECHANISM</b>		
	4.1 The machine shall be upgraded with an efficient traction drive system for traction during the operation. It shall be equipped/upgraded with separate power train circuits for high-speed travelling in travelling mode and slow cyclic movement in working mode.		
<b>4.0</b>	4.2 The machine's driving system shall be through hydro dynamically coupled power with shift arrangement capable of achieving full speed in travel mode in both the directions and hydrostatic drive for working mode. However, the system should be so designed/upgraded that all the driving wheels work in synchronization and there is no slippage/skidding of the wheels during the work drive. The driving mechanism for travel drive shall be rugged to perform satisfactorily during the life cycle of the machine.		
	4.3 The driving mechanism, in working mode, shall be adequately designed/upgraded to handle the acceleration and braking forces at each tamping cycle. A suitable synchronization circuit to control the synchronization of lifting/lining/tamping process with the machine drive/braking system in working mode shall be provided/upgraded to prevent any damage to the machine systems on account of non synchronisation.		
	4.4 Suitable differential systems may be provided between		

	coupled wheels on the same bogie.		
	4.5 Suitable flow divider/throttling arrangement may be provided to equalize the tractive effort amongst different bogies.		
	4.6 The tenderer shall provide the necessary technical details including circuit diagrams and detailed specifications of all electronic/electrical parts to confirm the above requirements.		
	4.7 Adequate gauges shall be provided in working and driving cabins near operator's seat and solenoid valves shall be provided near linkage assembly for indication, flow control and carrying out necessary adjustment in the field.		
	4.8 To the extent possible hydraulic and pneumatic component/assembly shall 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-to-day maintenance schedules.		
	4.9 The pneumatic circuit shall be provided with air dryer for the smooth working of pneumatic components.		
	4.10 The machine shall be equipped with adequate safety circuit such that if any unit/part which may endanger the safety is unlocked, the machine shall not move during run drive. The indication of locking and unlocking of all units should be displayed in the working cabin.		
	4.11 On-board system for online filtration and monitoring the quality of hydraulic oil in hydraulic circuit should be provided. The gauge shall clearly indicate if the hydraulic oil is contaminated beyond the permissible limits and requires immediate replacement.		
	<b>COOLING SYSTEM</b>		
<b>5.0</b>	5.1 The cooling system shall be efficient and designed for a maximum ambient temperature of 55°C. Supplier shall note that the machine shall be working under extreme dusty conditions and the cooling mechanism shall be maintainable under these conditions.		
	5.2 Adequate heat transfer arrangement for the hydraulic system shall be designed and provided so that under extreme heat conditions as mentioned in clause 2.12 above, the system oil temperature does not go beyond the range specified by the supplier.		
	<b>BRAKES</b>		
<b>6.0</b>	6.1 The machine shall be fitted with compressed airbrake system which shall apply brakes equally on all wheels and provision shall be made to connect air brake system of the machine to that of camping coach when the machine is hauling it. Fail safe braking mechanism system shall be provided so that in case of any failure of brake, there shall be arrangement of automatic application of brake. The pneumatic parking brake shall also be spring loaded so that in case of drop in pneumatic pressure below certain value the brake will be		

	applied automatically. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake shoe 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.		
	6.2 Machine shall be equipped with suitable arrangement of braking so that while attached in train formation as last vehicle, machine can be braked by traction vehicle having compressed air braking system. In addition, the machine shall be equipped with suitable air brake system in the driving cabins so that the attached coach while being hauled by machine can be braked.		
	6.3 There shall be provision of emergency brake application using the compressed air in the machine either travelling alone or coupled with the camping coach, in addition to the normal braking system of the machine. The emergency braking distance (EBD) of the machine on the Indian railway track at the maximum designed speed on a level track shall not be more than 600 m. Design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at falling grade of 1 in 33 should be provided by the supplier. Brake design details are to be submitted by the firm.		
	6.4 Mechanical brakes shall also be provided in addition for use as parking.		
	6.5 Clearly visible brake lights shall be provided at both the ends of the machine, which will be automatically operated when brake is applied and switched off when brake is released. This will be required to alert the operator of machine following this machine when the machines are working in groups.		
	<b>HORN, HOOTER AND SAFETY SWITCHES:</b>		
7.0	7.1 The machine shall be provided with dual tone (low & high tone) electric/pneumatic horns conforming to RDSO specification no. RDSO/2010/SPEC/0105 May, 2010 (pneumatic) with the amendments facing outwards at each end of the machine at suitable locations for use during travelling and to warn the workmen of any impending danger. Control shall be provided in close proximity to the driver permitting the driver to operate either horn individually or both horns simultaneously. The horns shall be distinctly audible from a distance of at-least 400 m from the machine and shall produce sound of 120-125 dB at a distance of 5 m from horn (source of sound). The higher tone horn shall have fundamental frequency of $370 \pm 15$ hertz. These horns shall be operated by means of push buttons provided in the cabins.		
	7.2 Adequate numbers of safety stop switches shall be provided		

	all around so that in case of any danger to worker as well as hitting of any obstructions by working unit like signalling cable, joggle fish plate etc, during working, the operator can be warned or the machine can be stopped immediately.		
	7.3 Safety equipment like jacks, hydraulic pin pullers (complete) for tamping unit, terfor, chain pulley block with capacity 3 tonne and other such equipment specific to the machine for restoring failed units of the machine during working shall be provided on the machine.		
	7.4 The machine shall be provided with emergency backup system to wind up the machine quickly in the event of failure of prime mover or power transmission system of the machine. The emergency backup system shall be able to be operated manually also.		
	7.5 Pneumatically/electrically operated Hooters conforming to RDSO specification no. TM/SM/318 dated 21.05.2008 shall be provided facing outwards at each end of the machine at suitable locations, operated by means of push buttons provided in the cabins to warn the staff working on/around the machine about approaching train on adjoining track. Pneumatically/electrically operated hooters capable of producing intensity of sound between 105-110 dB at a distance of 5 m (when measured in still air in a closed room) and variation in intensity of sound shall not be more than 5 dB. Additionally switches for such hooter shall be provided outside on the machine frame and near the both side exit gates so that it can be operated by staff present at worksite near the machine. The hooter shall also be operated by remote switch at a distance of at least 300 m from the hooter.		
	7.6 In addition, separate electric horns with push button type switches shall be provided at suitable locations in all cabin(s) and on machine body for communication between the machine staffs about infringement/malfunctioning or any other trouble.		
	<b>HEAD LIGHT, FLASHER LIGHT AND OTHER IGHTING ARRANGEMENTS:</b>		
<b>8.0</b>	8.1 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 latest twin beam headlight assembly conforming to Latest RDSO standards RDSO/2017/EUSPEC/0134 (Rev-3) LED headlight with the amendments ensuring a light intensity of 4.8 lux at ground level at track center at a distance of 305 m 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 flood light shall also be provided to illuminate the working area sufficiently bright for efficient working during night. In addition, minimum eight power point locations (24-volt		

	DC/15-amp socket) shall be provided on outside frame of the machine two in front, two in rear and two on both sides for providing lighting arrangements during night working.		
	8.2 The amber colour LED based flasher lights producing not less than 500 lux at 1 m and 55 lux at 3 m in line measurement in axial direction from flasher light shall be provided on the both ends of the machine to give indication to the train arriving on other line about any impending danger.		
	8.3 The machine shall be provided with marker light on suitable location to RDSO specification no. ELRS/SPEC/PR/0022, (Rev-1) October' 2004 or latest.		
	8.4 Provision of cameras with protection at lifting unit, front and rear of the machine and display units in working cabin.		
9.0	<b>ELECTRICAL:</b>		
	9.1 Complete re wiring of the machine internal and external & converting panels as per upgraded requirement. For stabilization unit complete wiring should be undertaken and integrated with the machine.		
	9.2 Provision of cameras with protection at lifting unit, front and rear of the machine and display units in working cabin.		
	9.3 Complete re wiring of the machine internal and external panel & converting panels as per upgraded requirement.		
	9.4 All panels overhauling to be performed if old panels are used.		
	9.5 All switches, transducers, pendulums, modules, programmer need to be replaced/upgraded as per the required for technical upgradation.		
	9.6 All PCBs shall be replaced with microcontroller-based PCBs instead of analogue.		
10.0	<b>PNEUMATICS:</b>		
	10.1 All pneumatic valves and pneumatic cylinders need to be replaced / upgraded.		
	10.2 Independent regulators to be provided to adjust pneumatic pressure as per required on all trolleys for datum pressure, chord tensioning, lining chord tensioning and vertical load.		
	10.3 All trolleys should be locked and unlocked with pn cylinders and all trolleys should be gradually placed on the track before starting of the working and it should be moved up with the help of pn cylinders.		
	10.4 Proper air dryer system to be provided to eliminate moisture content entering into the working system.		
	10.5 Air oiler and water separator arrangement to be provided so as to lubricate valves and cylinders.		
	10.6 ZF parking braking system needs to be provided.		
	10.7 All Pneumatic hoses needs to be replaced.		
11.0	<b>CHASSIS AND UNDER-FRAME:</b>		

	11.1 The chassis shall be modified 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 under frame shall be modified with rolled steel section and/or plates and shall be designed to withstand a horizontal squeeze load of 102t at each side of buffers without any permanent distortion. The modified under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle.		
	11.2 There shall be provision of properly exhibited/conspicuous jacking and lifting points on the machine underframe for helping in quick handling of the crane in case of derailment/accident as well as during maintenance at workshop. The jacking and lifting points shall be obstruction free and easily accessible, so that jacks can be fitted/placed conveniently. There should be no any rigid unit along the rail up-to 350 mm from wheel tread and 525 mm above rail level.		
	11.3 Existing 09-3X Tamping Express comprising of older diesel engines and without stabilization unit Accordingly, for technical upgradation of the existing machine to advanced 09-3X Dynamic will single high powered CAT diesel engine and stabilization unit, modification to the chassis has to be undertaken for integration of the new systems. The existing chassis should be modified, and manufacturing of new modified chassis shall be integrated with the same, along with new bogie system and additional items.		
12.0	<b>CABINS:</b>		
	12.1 Cabin will be equipped with fully enclosed air conditioner, sound and heat insulation. cabins with safety glass windows at both ends and working cabin shall be air conditioned. In view of the high ambient temperature prevailing in India, special attention should be paid to free circulation of air and ventilation in the driver's cabin. 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, the operating staffs have full view on both the sides before leaving the machine, to avoid any danger to them from trains on the adjacent tracks. Additional driver's cabin shall be provided, if the view, while driving is not clear for safe travel in both directions. The design of cabin shall be as per UIC-651.		
	12.2 The gauges and control panels shall be suitably located in the operator's cabin so that they can be observed by the operator without undue fatigue. Screen wipers preferably operated by compressed air or electrically operated shall be provided on the wind screen.		

	12.3 The operator's cabin shall be ergonomically designed to have easy access to all the controls. The operator shall have a full view of the working area from the operating seat to have full control over the work. The stabilizing unit shall also be controlled/operated from the working cabin.		
	12.4 Necessary inter-communication system shall be provided inter connecting all the cabins and shall be so oriented that the operator, seating on the seat of either cabin/working cabin, can easily operate/hear distinctly the conversation.		
	12.5 The machine shall be equipped with speed indicator and recording equipment of range between 0-120 kmph for recording the speed of the machine in real time basis. The recorded data shall be retrievable on computer through memory card/pen drive. It shall be provided in the driving cabin at suitable place and recording system shall have sufficient memory to keep the speed record of minimum 15 days which should always be stored for retrieving as per requirement.		
	12.6 Manufacturing of complete stabilizer trailer Including new Cabin, Driver panel, Bogle, Stabilizer units, second Measuring system: The stabilization unit should be completely manufactured along with cabin, panel, bogie, sub-systems etc, and integrated with the existing machine. The stabilization unit should be manufactured as per the latest technical specifications of 09-3X Dynamic machine and integrated with the machine.		
13.0	<b>PUMP GEAR BOX:</b> Pump Gearbox should be completely replaced along with supply and integration of new pumps as required for the 09-3X Dynamic machine. The existing system shall be integrated with the replaced pump gearbox and new sub-systems. The newly supplied sub-system should be technically integrated with the existing machine chassis for technical upgradation of the machine.		
14.0	<b>Hydraulic:</b> With the incorporation of stabilization unit and changes to the system, additional hydraulic components, motors, pumps, all Servo valves, all proportional valves, all pressure setting valve must be indicated and hydraulic hoses shall be supplied and integrated with the existing machine. In addition, major hydraulic components including motors, pumps, hoses etc. for sub systems like vibration units, axles, brakes etc. shall be replaced with new hoses including fittings. The hydraulic system should be completely upgraded to suit the requirements of the technically upgraded machine. For the additional items, all new pumps and motors including hydraulic hoses should be supplied and integrated with the machine.		
15.0	<b>Satellite Frame:</b> The satellite frame of the existing machine shall		



	be disassembled and inspected. Overhauling and strengthening of the satellite frame to be attended.		
16.0	<b>Replacement / upgradation of major systems including Control System with latest ALC, DRP, CWS, CMS and DRP system:</b> With continuous technological advancement in the field of electronics and control system, there has been drastic upgradation in the control system of the machines for better operation ease and optimized solutions. Technical Upgradation of supply/upgradation and Integration with latest ALC, CWS, CMS and DRP systems similar to existing DTE machine. The existing control system should be completely replaced/upgraded with new panels and shall be integrated with the existing and additional sub-systems for complete operational requirement.		
17.0	<b>Tamping UNIT:</b> Tamping Unit should be inspected, and detailed Inspection report should be prepared and submitted. The existing two Tamping Unit should be replaced completely with new tamping units along with auto greasing system.		
18.0	<b>Cleaning and washing of the machine</b>		
19.0	<b>SUSPENSION SYSTEM:</b> 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 measures shall be adopted to minimize the weight transfer while starting, stopping and during runs.		
20.0	<b>MARKING &amp; COLOUR OF MACHINE:</b>		
	20.1 The machine body shall be painted in golden yellow colour of Indian Standard Colour code of 356 conforming to IS: 5. the exterior painting shall be polyurethane binder-based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for Epoxy cum Polyurethane Painting System - Two packs for the Exterior Painting of Railway Coaches, Diesel and Electric Locomotives and other Industrial Applications) or conforming to ISO 12944.		
	20.2 Following should be written in black on the machine at appropriate location in English & Hindi as per direction of Indian Railway official. i. Indian Railways logo of height between 300 mm to 600 mm as suitable on all four faces of the machine. ii. The text "INDIAN RAILWAYS" shall be written in Bold and in Black colour of size equal to or slightly smaller than the size of logo but of size not less than 250 mm on both side faces and		

	<p>iii. Machine model and manufacturing year shall be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 200 mm in any case below the text "INDIAN RAILWAYS" mentioned above</p> <p>iv. If required, the manufacturer's name may be written in size not more than 150 mm and shall not be at more than four locations. Also the manufacturer's logo may be provided at not more than two locations and shall be of size less than 200 mm.</p>		
	<b>TOOLS AND INSTRUCTION MANUALS:</b>		
	21.1 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 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. The tenderer shall along with his offer submit the list of tools to be supplied along with each machine. The list can be modified to suit the purchaser's requirement, while examining the offer.		
	21.2 Detailed operating manual, maintenance and service manual, user manual indicating capabilities of machine, shall be specifically prepared in English language and four hard copies & soft copies of these shall be supplied with each machine.		
21.0	21.3 The supplier shall also supply circuit diagrams in hard and soft copies of electrical, hydraulic, pneumatic and electronic circuits used on the machine. Trouble shooting diagram/table shall also be supplied. In addition, the supplier shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. Main features such as type, rpm & discharge etc. of items like hydraulic pumps, motors and such other bought out components assemblies shall be furnished by the tenderer. These shall be specially prepared in English language and four copies of these shall be supplied with each machine.		
	21.4 While offering the machine for first inspection, the supplier shall submit one copy of complete technical literature in English language including operation, service and tiled maintenance manual/instructions and complete electrical, electronic, hydraulic & pneumatic circuit diagrams, troubleshooting charts, component drawings/description and other relevant technical details as a reference document for the inspecting officer.		

	21.5 One portable diesel operated D.C. welding generator (with the provision of auxiliary Output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably made In India) with a minimum 5 KVA capacity of welding up to 5 mm electrode at 60% duty cycle along with sufficient length of cable or lead shall be provided with the machine for day to day repairing of machine and its wearing parts. The diesel tank capacity shall be not less than 15 liters.		
	21.6 The firm shall provide detailed technical drawings and specifications of new wheels and axles, if provided in the machine. The above details shall be provided during final inspection of machine at OEM firm premises.		
	<b>SPARE PARTS:</b>		
22.0	22.1 The supplier shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the balance life of the machine (14 years). It is preferred that the spares shall be stored in India and will be available at short notice say maximum within a month.		
	22.2 For indigenous parts and brought out components and assemblies, the relevant technical details shall be supplied while offering the first machine for inspection.		
23.0	<b>MAKER'S TEST CERTIFICATE:</b> Copies of maker's certificate guaranteeing the performance of the machines shall be supplied in duplicate along with the delivery of each machine.		
24.0	<b>OPERATORS:</b> The required number of operators and allied staffs shall not exceed as prescribed for Plasser make DTE.		
	<b>INSPECTION OF THE MACHINE:</b>		
25.0	25.1 The machine shall be stabled on straight & level BG track. The length of the track shall be at least 10 m more than buffer to buffer length of machine. In order to check maximum moving dimensions in cross section, a sturdy frame of Indian Railways maximum moving dimensions shall be provided by the manufacturer and passed over the machine holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.		
	25.2 The following documents shall be provided to the Inspecting Officer (IO) at least 30 days before the proposed date of inspection: i. One copy of complete technical literature mentioned in clause 14, in English and service field maintenance language, including operation, manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, troubleshooting charts, component drawings/description and other relevant technical details as reference documents in soft and hard copies of the inspecting officer.		

	<p>ii. Cross section of the machine super imposed on Indian Railways maximum moving dimensions envelope shall be provided to Inspecting Officer (IO) in advance.</p> <p>iii. Clause by clause comments of the manufacturer shall be sent to Inspecting Officer (IO) in advance for his review. Comments shall state manufacturer's conformity of compliance of each of the requirement stated in each clause, elaborating where necessary the details/manner in which the requirement has been complied. The pro forma for the clause-wise comments is given below:</p> <table border="1"> <tr> <th>Clause No</th><th>Clause.</th><th>Comments of Supplier/ manufacturer</th><th>Comments of Inspecting officer</th></tr> <tr> <td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td></tr> </table> <p>iv. Manufacturer's Internal Quality Inspection Report of the machine.</p> <p>v. Manufacturer's quality certificate and/or test reports for bought out assemblies/subassemblies shall be provided to Inspecting Officer (IO), containing serial number wherever applicable.</p> <p>vi. Draft Inspection Report shall be prepared by the manufacturer, containing all annexure mentioned at clause 20.4.</p> <p>vii. Details of arrangements made for checking maximum moving dimensions for his approval Supplier will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officer (IO) keeping in view the Inspecting Officer's.</p>	Clause No	Clause.	Comments of Supplier/ manufacturer	Comments of Inspecting officer										
Clause No	Clause.	Comments of Supplier/ manufacturer	Comments of Inspecting officer												
	<p>25.3 List of documents to be annexed in the draft Inspection Report should include:</p> <p>i. Maker's Test Certificate.</p> <p>ii. Manufacturer's Internal Quality Inspection Report</p> <p>iii. Quality Certificates of Bought out assemblies/sub-assemblies.</p> <p>iv. Cross section of the machine super imposed on the IR MMD</p> <p>v. Vogel's diagram.</p> <p>vi. List of Manuals, Drawings, Spare Parts Catalogues, etc. to be dispatched along with the machine, duly indicating the number of sets of each.</p> <p>vii. Manufacturer's certificate on standard followed for design of wheels and axles against clause 1.7 to 1.9.</p> <p>These above documents in soft &amp; hard copies shall be part of final inspection report.</p>														
	<b>ACCEPTANCE TEST:</b>														
26.0	<p>26.1 In addition to verification of the various items of specification, the purchaser's nominee shall carry out the following tests in India at the purchaser's premises at the time of commissioning of the machine. The pre-commissioning tests shall be completed and the machine shall be commissioned within 90</p>														

	days of its arrival at the premises of the final consignee.		
26.2	The dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances, length of machine bogie distance etc.		
26.3	Testing for negotiability of 10° curve and 1 in 8.5 turnouts.		
26.4	Construction and engineering of the machine and its ability to perform all the functions as laid down in the specifications above.		
	<p>a) 26.5 Actual output and performance test: These tests shall be conducted under field conditions on Indian Railway. An electrified section shall be chosen for this test.</p> <p>b) The general conditions of tests shall be as follows:</p> <p>c) Machine crew shall be either trained personnel of Indian Railways or the staff of the supplier.</p> <p>d) Dry weather, ambient temperature between -5°C to 55°C.</p> <p>e) Plain Track on curve with radius not less than 175 m.</p> <p>f) Straight track with gradients up to 5 per thousand.</p> <p>g) Rails and sleepers in good conditions and properly fastened.</p> <p>h) Concrete sleepers.</p> <p>i) clean ballast cushion of minimum 150 mm in sufficient quantities below the bottom of the sleepers and generally not cemented.</p> <p>j) LWR track with ballast as per standard profile (Given in IRPWM).</p> <p>k) Regular sleeper spacing of 60/65 cm with a tolerance of ±2 cm on straight track.</p> <p>l) J) Formation good</p> <p>m) Amount of lowering up to 20 mm by stabilizing unit maintaining track parameters within permissible range.</p> <p>n) General lift during working up to 30 mm.</p> <p>o) Lifting of track in non- working mode of 150 mm in one go to be conducted at manufacturer's premise/siding.</p> <p>p) Maximum slew during working up to 10 mm</p> <p>q) Slewing of track in non-working mode of 150 mm in one go to be conducted at manufacturer's premise/siding.</p> <p><b>Actual Test to be conducted.</b></p> <p>a) Track lowering by Stabilizing Unit: The amount of lowering of track as measured shall be limited to maximum 20 mm and track parameters left by tamper should be simultaneously retained in general within acceptable limit.</p> <p>b) Tamping Output: At the parameters specified against clause 3.6 for achieving durable compaction by tamping unit and controlled settlement, lasting consolidation and desired increase in lateral ballast resistance of sleeper by stabilizing unit, the machine shall be able to tamp and stabilize 2700 sleepers in One effective hour of working. The time shall be counted from start to finish of tamping</p>		

	<p>work at work place. The machine shall also be able to achieve a peak tamping and stabilizing rate of 3500 sleepers or more per hour over a 10 minutes period at the above prescribed parameters. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding up time 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 10 minutes. The setting up time shall be counted from the time machine arrives at site to the time work is started. The winding up time will be counted from the time the work is stopped to the time machines starts moving away from the work site.</p> <p>c) Lifting Capability: Lifting of track in non- working mode of 150 mm in one go.</p> <p>d) d) Slewing Capability: Slewing of track in non-working mode of 150 mm in one go.</p>		
<b>27.0</b>	Should any modification be found necessary as a result of the tests, these shall be carried out by the supplier at his own expenses.		
<b>28.0</b>	<p>Supply of all major parts, spares, sub systems including hoses, fittings, cables, pipes, thimbles etc as per below:</p> <p>Hydraulic hose: Aeroquip, parker, Plasser</p> <p>Electric Spares: Plasser, Schneider</p> <p>Electrical cables: Plasser, LAPP.</p>		
<b>29.0</b>	Assembly with new/ reconditioned components/spares and consumables. Commissioning of complete technically upgraded machine. Equipment testing of sub systems and complete machine working.		
<b>30.0</b>	All sub-systems shall be overhauled/ reconditioned or replaced with new spares/ components as prescribed by the RDSO maintenance manual.		