भारत सरकार
भारतीय रेलवे
Government of India
Indian Railways

FUNCTIONAL REQUIREMENTS SPECIFICATION

For

SELF PROPELLED RAIL CUM ROAD INSPECTION VEHICLE (RCRIV) FOR BROAD GAUGE (1676 mm)

Issued By:

Track Machine & Monitoring Directorate
Research Designs and Standards Organization
Manak Nagar, Lucknow-226011

FUNCTIONAL REQUIREMENTS SPECIFICATION
For
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(RCRIV) FOR BROAD GAUGE (1676 mm)

1.0 GENERAL

1.1. This specification is for a "Self Propelled Rail cum Road Inspection Vehicle to carry officials for inspection on B.G. (1676 mm) Routes of Indian Railways". The vehicle is self-propelled both on rail and on road for maximum flexibility. It shall be capable of facilitating travelling safely on electrified/non-electrified section during day or night under the conditions prevailing on IR. This specification has been framed to reflect the technical performance and quality requirements of such vehicle, hereinafter called Rail cum Road Inspection Vehicle (RCRIV).

1.2. The technical specification has been drafted to reflect the performance and quality requirements of the RCRIV in a neutral manner without bias to any specific manufacturer. Bidders are requested to carefully study the specification and assure themselves that their machine fully complies with this specification. Thereafter, if a bidder feels that his machine can substantially meet the performance and quality requirements of the vehicle but does not fully satisfy a particular specification, he shall mention the deviations if any, in the statement of deviation from the specification, giving the details how the functional requirements are going to be met with.

1.3. The bidder shall specify the make/model offered and furnish a detailed technical description of the same. System/sub-systems of the vehicle along with the sketches to show the manner in which the requirements of the specification are accomplished by the RCRIV (model) offered.

1.4. Photographs and videos of the type of the RCRIV/other similar type of vehicle manufactured and technical literature shall be enclosed with the offer.

1.5. The bidder shall be entirely responsible for the execution of the contract strictly in accordance with the terms and conditions of the specification not withstanding any approval, which RDSO or the Inspecting Officer may have given:

- Of the detailed drawings prepared by the bidder.
- Of his sub-bidders for materials, components & sub-assemblies.
- Of other parts of the work involved in the contract.
- Of the tests carried out by the bidder/Sub-bidder or RDSO or the Inspecting Officer.

2.0 SCOPE OF SUPPLY

2.1. Self-propelled Rail cum Road Inspection vehicle. It should be possible to drive the vehicle in both the directions (forward & reverse direction).

2.2. There will be arrangement of four seats in vehicle with rear side open platform for loading of P-way material/equipment. Visibility diagram should be submitted along with the design details.

2.3. The tenderer shall develop its own design and submit along with his tender document, provided it meets with overall requirement of space on the vehicle, speed/running characteristics of the vehicle and the desired amenities asked for in the subsequent paragraphs of this specification.

3.0 SYSTEM's REQUIREMENTS:

3.1. The profile of the RCRIV (including its units) longitudinally and in cross section during transfer as self-propelled vehicle shall be within the maximum moving dimension shown in the Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments. The maximum moving dimensions are shown in Annexure-I. The tenderer shall provide sketches of the RCRIV, both in plan and elevation and shall give calculations along with Vogel's diagram to prove that the RCRIV does not cause any infringement while moving on a 10° curve at any cross-section.

3.2. Adequate clearance shall be allowed so that no component/part infringes the minimum vertical clearance of 91 mm from rail level while travelling on track up to condemnation limit of wheel.

3.3. It shall be capable of negotiating curves up to 10º curvature (175 m radius), super elevation up-to 185 mm, maximum cant deficiency 100 mm and gradients up-to 1 in 33 in travel mode. The supplier shall specify the minimum attainable speed by the machine under the above limiting conditions.

3.4. Axle load of RCRIV shall be less than 20.32 t.

3.5. 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	:	-5º C to 55º C
Altitude	:	up-to 1800 m above mean sea level
Humidity	:	up-to 100%
Maximum rail Temperature	:	70º C
Rain fall	:	Fairly heavy
Atmospheric condition	:	Very dusty, heavy fog

All the system components on the vehicle, which are vulnerable to moisture ingress and adversely affected during rains, shall be covered by roof or suitable arrangement so that the vehicle is able to work continuously even during rains.

3.6. It shall be capable of working and travelling without requiring power block in electrified sections. On Indian Railways, 25 KV or 2x25 KV AC power supply is used for traction through an overhead wire at approximately 5500 mm above rail level. On bridges and tunnels, the height is restricted to 4800 mm.

3.7. While working on double/multiple 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 4265 mm centre to centre. The RCRIV or its any part shall not infringe adjoining track as per Indian Railways Schedule of Dimensions-1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments, during travelling or its operation.

4.0 FUNCTIONAL REQUIREMENTS:

4.1. Speed:

On-tyres	:	As per specifications of road vehicle.
On-rail drive on plain track without check/guard rail –forward direction	:	50kmph
On-rail drive on plain track with check/guard rail and turnout–forward direction	:	15kmph
On-rail drive on plain track without check/guard rail –reverse direction	:	15 kmph
On-rail drive on plain track with check/guard rail and turnout–reverse direction	:	05 kmph
On-rail creep working speed on track	:	05 kmph

4.2. Rail wheel Arrangement

- 4 wheels on 2 rail axles-retractable or any other suitable arrangement for on-and off-tracking the vehicle and for driving on track or guiding road wheels on track.

4.3. Road Wheel Arrangement

- 4 wheels especially dimensioned for on-and off-tracking.
- 1 front articulated steering axle
- 4 wheel drive
- Parking brake
- The provision of Motor Vehicle Act 1988 as applicable shall be complied with.
- All hydraulic, electrical, electronic and mechanical controls shall be located in the driving cabin within easy accessibility of the driver.

4.4. Open Platform

Minimum dimension..... 1.5 m x 1.5 m

Minimum height of the platform of guard rail..... 350 mm

Minimum pay load ..... 1000 kg

4.5. OFF/ON Tracking

It should be possible to mount the vehicle on rail at level surface where minimum width of level surface at right angle to the centre line of the road will be 5000 mm.

4.6. Safety features:

Suitable safety features, as applicable, like horn, flasher units, marker light, headlights, emergency stop switches etc. to be provided in RCRIV.

4.7. Track circuits and axle counters:

Indian Railways is using track circuits and axle counters as per Indian Railways Signal Engineering manual Volume II Chapter XVII. The vehicle should be infallibly detectable to both-track circuits and axle counters.

4.8. **Steering System:**

- The vehicle shall have a properly designed steering system for quick & easy maneuverability of vehicle while running on road.
- The steering system control shall remain in lock position while running on rail. For this a properly designed steering system shall be provided by the manufacturer.

5.0 DIESEL ENGINE:

5.1. The RCRIV shall be powered by diesel engine preferably indigenous with proven record of service in tropical countries with wide service network in India. The minimum engine power of 125 kw should be ensured. Robust construction and low maintenance cost are of particular importance.

5.2. The tenderer shall indicate the continuous horse power at rated output of offered engine under site condition. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions.

5.3. The tenderer shall furnish a copy of type test report of the engine by a Statutory Body in support of their claim regarding performance, reliability and specific fuel consumption.

5.4. The supplier shall furnish the information regarding make and model of the engine proposed to be used and details of agency which will provide after sales service support and availability of spares in India.

5.5. The diesel engine for RCRIV shall work satisfactorily with High speed diesel oil.

5.6. For starting the engine, storage batteries of well-known indigenous make with wide service network in India shall be provided. The engine shall normally be push/pull button start type or key type. A battery management system to be provided. It should report too low battery voltage to the vehicle driver and protects the battery from deep discharges.

5.7. In order to adhere to pollution control norms, the diesel engine should have electronic emission control with minimum compliance of BS-VI standards.

5.8. The tenderer shall furnish the information regarding make and model of the engine proposed to be used and details of agency which will provide after sales service support and availability of spares in India. If the vehicle 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.

6.0 BRAKES

6.1. The RCRIV shall be provided with parking brakes. The parking brake power shall be adequate to hold the vehicle on 1 in 33 down gradient on rail and 1 in 20 down gradient on road.

6.2. The functioning of brake system on rail/road shall be explained.

6.3. The RCRIV shall be fitted with system which shall apply brake equally on all wheels which can be applied from driving cabins. 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 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 55º C.

6.4. The supplier shall submit details of brake system covering brake schematic diagram, working principle, brake power diagram, number, dimension & type of brake block and literature on brake equipment proposed along with offer.

6.5. In case of driving through rail wheels, there shall be provision of mechanically operated emergency brake application (operated by a hand lever or any other suitable arrangement) in driver cab using the compressed air/oil in the vehicle, travelling in addition to the normal braking system of the vehicle. The emergency braking distance (EBD) of the vehicle on the Indian Railways track at the maximum designed speed to zero on a level track shall not be more than 600 m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the vehicle on level track & at falling grade of 1 in 33 shall be provided by the supplier. Brake design details of the RCRIV for calculation of EBD are to be submitted as per Annexure-II.

6.6. Clearly visible brake lights shall be provided at rear end of the vehicle, which will be automatically operated when brake is applied and switched off when brake is released.

7.0 HORN:

7.1. The RCRIV shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the RCRIV at suitable locations for use during travelling 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(A) at a distance of 5 m from horn (source of sound). The higher tone horn shall have fundamental frequency of 370 ±15 hertz. These horns shall be operated by means of push buttons provided in the cabins.

8.0 CABINS:

8.1. The RCRIV shall be equipped with fully enclosed cabins with safety glass window. In view of the high ambient temperature prevailing in India, special attention should be paid to free circulation of air and ventilation in the cabin. It shall be possible to have a clear view of the track ahead while driving the RCRIV in either direction.

8.2. Good sound insulation inside the RCRIV shall be provided. It will largely dampen the penetration of air-borne and structure-borne sound (vibrations) and thus keeps the noise level low.

9.0 TOOLS AND INSTRUCTIONS MANUALS:

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

9.2. The tenderer shall along with his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings in English language to be supplied along with each RCRIV as above, for operation, servicing, maintenance, assembly overhauling, periodic overhauling and troubleshooting guides/manuals. The list can be modified to suit the purchaser's requirement, while examining the offer.

9.3. Detailed operating manual, maintenance & service manuals and user manual indicating capabilities of RCRIV shall be specifically prepared in English language with colour and four hard as well as soft copies of these shall be supplied with each RCRIV.

9.4. As a part of service manual, the manufacturer shall also supply circuit diagram in hard and soft copies of electrical, hydraulic, pneumatic and electronic circuits used on the RCRIV. Trouble shooting diagram/table shall also be supplied. In additions, the manufacturer shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. and main features such as type; 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 hard as well as soft copies of these shall be supplied with each RCRIV.

9.5. One set of all the manuals and diagrams in hard as well as in soft copy (one set for a group of similar machines) shall be sent to the Principal/IRTMTC, Allahabad, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, PO. Dhoomanganj, Prayagraj -211011, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, South Central Railway, Rayanapadu, Vijaywada, Dist.-Krishna, Andhra Pradesh-521241, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, Eastern Railway, Bhutbagan Railway Colony, Kanchrapara, P.S: Bizpur, P.O.: Kanchrapara, West Bengal-743145, one set for Chief Engineer. C.P.O.H, Western Railway, Divisional Office, Near Chamunda Mata Mandir, Naroda Road, P.O. – SaijpurBodha, Ahmedabad-382345,one set to be sent to ED/TMM, RDSO, Lucknow, one set to ED/TK (MC)/Railway Board and one set to Director General/IRICEN/Pune along with supply of first RCRIV of similar group. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents should also be sent to above mentioned authorities.

10.0 SPARE PARTS:

10.1. The tenderer shall quote, apart from main equipment, separately for the mandatory spares as well as for recommended spares required for two years along with

description, part number, quantity, cost, whether imported or indigenous. The expected life of components/spare parts shall be advised along with their condemning limits.

10.2. The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service the life of the RCRIV (15 years). It is preferred that the spares shall be stored in India and will be available at short notice say maximum within a month.

10.3. For indigenous parts and bought out components and assemblies, the source (original equipment manufacturer's reference and part no.) and other relevant technical details shall be supplied while offering the first RCRIV for inspection.

11.0 OPTIONAL EQUIPMENT:

11.1. Tenderer is expected to quote for optional equipment if any separately for each item giving the advantages/functions of such optional equipment. Tenderer shall also indicate whether such equipments are already in use on RCRIV elsewhere indicating the user railway system.

12.0 MAKER'S TEST CERTIFICATE:

12.1. Copies of the Maker's certificate guaranteeing the performance of the RCRIV shall be supplied in duplicate along with the delivery of each RCRIV.

13.0 INSPECTION OF THE MACHINE:

13.1. While inspecting the RCRIV before dispatch from the supplier's premises, the inspecting officer to be nominated by the purchaser shall verify the conformity of the RCRIV with respect to individual specification as above. The conformity/non-conformity with respect to each item shall be jointly recorded before issue of the Inspection certificate and approval for dispatch of the RCRIV as per Annexure–III enclosed.

13.2. Following arrangements shall be made by the supplier/manufacturer at the inspection premises for carrying out inspection of the RCRIV by inspecting official:

- RCRIV to be stabled on straight & level BG track. The length of the track shall be at least 10 m more than end to end length of RCRIV.

- 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 RCRIV holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.

13.3. The following documents shall be provided to the Inspecting Officer at least 30 days in advance of the date of inspection.

i) One copy of complete technical literature, in English language, including operation, service and field maintenance manuals/instructions, user manual and complete electrical, hydraulic and pneumatic circuit diagrams, troubleshooting charts, component drawings/description and other relevant

technical details as a reference documents in soft & hard copies.

ii) Cross section of the RCRIV super imposed on Indian Railways maximum moving dimensions envelope.

iii) Clause by clause comments of the manufacturer for review. Comments should state manufacturer's conformity of compliance of each of the requirement stated in each clause of the specification, elaborating where necessary the details/manner in which the requirement has been complied. The pro-forma for the clause-wise comments is given below:

Clause no.	Clause	Comments of Supplier/manufacturer	Comments of Inspecting Officer

iv) Manufacturer's internal quality inspection report of the RCRIV.

v) Manufacturer's quality certificate and/or test reports for bought out assemblies/sub- assemblies with serial number wherever applicable.

vi) Draft inspection report shall be prepared by the manufacturer, containing all annexure mentioned at para 13.4.

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 comments, if any.

13.4. List of documents to be annexed in the draft Inspection report shall include:

i) Maker's Test Certificate.
ii) Manufacturer's Internal Quality Inspection Report.
iii) Quality Certificates of bought out assemblies/sub-assemblies.
iv) Cross section of the RCRIV super imposed on the Indian Railways maximum moving dimensions (IR MMD).
v) Vogel's diagram.
vi) List of spare parts to be dispatched along with the RCRIV.
vii) List of tools to be dispatched along with the RCRIV.
viii) List of manuals, drawings, spare parts catalogues, etc. to be dispatched along with the RCRIV, duly indicating the number of sets of each.

These above documents in soft & hard copies shall be part of final inspection report.

14.0 TRAINING & SERVICE ENGINEERS:

14.1. The supplier shall provide at his own expense the service of competent engineers during the warrantee period for warranty related issues. The service engineers shall be available for the commissioning of the RCRIV for regular service. E-Learning courses shall be arranged for imparting training to Railways operators. In addition the service engineer shall provide hands on training to Railways staff in calibration, operation, repairing and maintenance of the RCRIV in field to make them fully

conversant with the RCRIV. The engineers shall also advise the Railways on appropriate maintenance, testing, operating, repair and staff training facilities that are necessary for the efficient performance of the RCRIV.

15.0 SPEED CERTIFICATE:

15.1. PROVISIONAL SPEED CERTIFICATE:

Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by Research, Design and Standards Organization (RDSO) of Indian Railways at Lucknow, based on certain design parameters of the RCRIV. Final speed certificate of the RCRIV shall be after conducting detailed oscillation trial of the RCRIV, which shall be a time taking process. Therefore, issue of provisional speed certificate for the RCRIV becomes a necessity and based on the same, the approval of running of the RCRIV on Indian Railways track is taken from commissioner of Railways 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 Railways, 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-frame i.e. suspension system/arrangement, wheel & axle assembly, braking arrangement, loading pattern of the RCRIV etc. and the distribution of axle loads, lateral forces, un-sprung mass, tractive effort and braking force coming on railsand they remain the same. If, there is any difference of the above parameters 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 RCRIV as per specification, the technical details as per Annexure-(VI & VII) which in no case should be more than six months from signing of contract, shall be supplied to Track Machine and Monitoring Directorate of RDSO of Indian Railways at Lucknow, for processing of provisional speed certificate for the RCRIV so that it can be permitted to move on track. On case-to-case basis, more technical details (other than mentioned in Annexure-VI& VII) can also be asked for issue of provisional speed certificate for the vehicle. The firm will also submit the technical details as per pro-forma placed at Annexure-V. The supplier shall submit the dynamic simulation report of the RCRIV on professional track vehicle simulation software. The RCRIV shall have to fulfill the acceptance criteria specified at Annexure-V.

c. New suppliers, whose models are new:

The technical details shall be supplied as detailed in para (b) above.

15.2. FINAL SPEED CERTIFICATE:

Final speed certificate of the RCRIV shall be given after conducting detailed oscillation trials of the RCRIV. For this purpose Railways shall conduct running speed tests on the Indian Railways main line track on one of the RCRIV supplied to

them preferably with in warranty, in accordance with procedure outlined in Annexure- IV with the RCRIV running up to speed 10% higher than the maximum speed mentioned in clause 4.1 above.

16.0 ACCEPTANCE TEST:

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

16.1.1. Dimensional check of loading gauge, i.e. maximum moving dimensions, clearances, length of RCRIV etc.

16.1.2. Testing for negotiability on 10^0 curves and 1 in 8½ turnouts.

16.1.3. Construction and engineering of the RCRIV and its ability to perform all the functions as laid down in the specification.

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

18.0 WARRANTY:

18.1. The RCRIV shall be warranted for 24 months from the date of commissioning and proving test of machine or 36 months from date of delivery at ultimate destination in India whichever shall be earlier.

19.0 MARKING OF RCRIV:

19.1. Following should be written on the RCRIV at appropriate location in Hindi & English as per direction of Indian Railways official:-

i) Indian Railways logo of height between 150 mm to 300 mm as suitable on all four faces of the RCRIV.
ii) On both side faces and below the Indian Railways logo, the text "INDIAN RAILWAYS" to 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 125 mm.
iii) Below the text "INDIAN RAILWAYS" mentioned above, RCRIV model and manufacturing year should be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 100 mm in any case.
iv) If required, the manufacturers name may be written in size not more than 75 mm and should not be at more than four locations. Also the manufacturer's logo may be provided at no more than two locations and should be of size less than 100 mm.
v) Suitable signage to warn the driver and RCRIV working staff against the 25 KV OHE shall be stenciled on the RCRIV.

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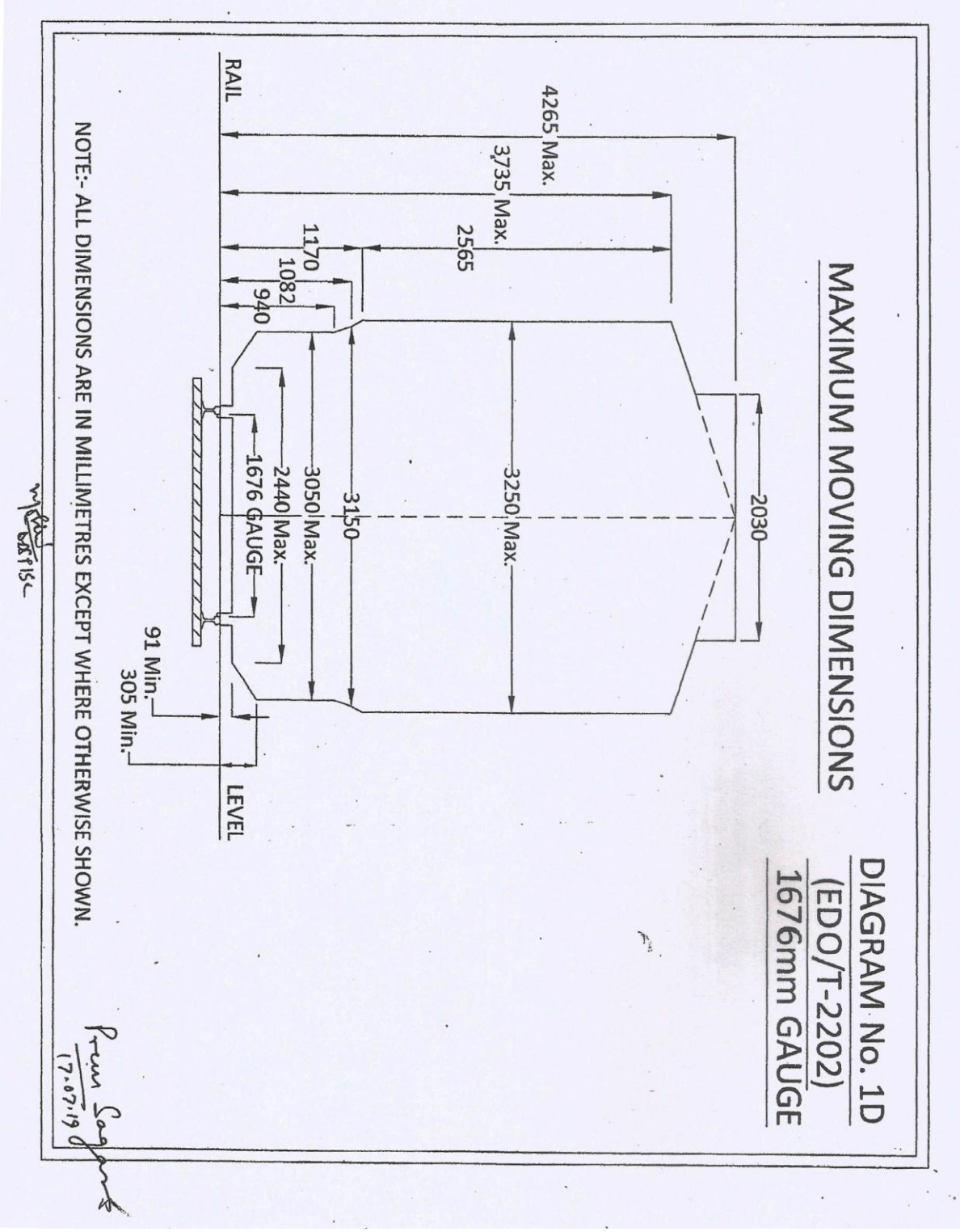
MAXIMUM MOVING DIMENSIONS
DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE
RAIL
4265 Max.
3,735 Max.
2565
1170
1082
940
2030
3250 Max.
3150
3050 Max.
2440 Max.
1676 GAUGE
91 Min.
305 Min.
LEVEL
NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

Annexure-II

BRAKE DESIGN DETAILS OF THE RCRIV FOR CALCULATION OF EMERGENCY BRAKING DISTANCE

1.	Tare & gross weight of the machine in Kilograms	
2.	Brake power in Kilograms	
3.	Type of Brake blocks	
4.	Brake block area in Square Centimeters	
5.	Brake Rigging Diagram	
6.	Type of Brake system	

Annexure-III

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF RCRIV (MODEL No.....)
BY INSPECTING OFFICIAL AND APPROVAL FOR DISPATCH OF RCRIV. (STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the RCRIV_____bearing Sr.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 (MC) /Railway Board and M/s. (Name of Supplier) _____ _____.

The detailed inspection note regarding its conformity/non-conformity to the laid specifications is enclosed along with this certificate. It is observed that (strike out whichever is not applicable):-

- The RCRIV conforms to all the laid down specifications.
- The RCRIV 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 along with the machine:

1. _____
2. _____
3. _____

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

The RCRIV is approved/not approved for dispatch to_____(Consignee) Indian Railways.

For M/s._____
_____

Signature and Date
Inspecting Official
(Name and Designation)
For and on behalf of President of India

Annexure-IV

ACCEPTANCE CRITERIA DURING OSCILLATION TRIALS

1. The speed potential of the RCRIV offered by the supplier 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 supplier for the RCRIV under consideration and the following criteria satisfy for the same. For conducting the tests, a section of main line track will be selected as per Third Report of the Standing Criteria Committee, Revision-1: Criteria for assessment of stability/riding of rolling stock, (Document No. TG-CR-4.2.3-2, March 2013) with latest amendment over which there are no temporary speed restrictions and which is considered by the Railway as being in a generally run-down condition for main line 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 as per Third Report of the Standing Criteria Committee as applicable on date (21.04.2022) is given below for general information purpose which may be amended from time to time:

i) A lateral force lasting over a length of more than 2 m should not exceed the Prud-Homme's limit of k (1+P/3) tones. Where P is the axle load in tones, k=0.85 for wooden sleepers and k=1 for concrete sleepers.

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

iii) A derailment co-efficient should be worked out in the form of ratio between the lateral force (Hy) and the wheel load (Q) continuously over a period of $1/20^{th}$ second; the value HY/Q shall not exceed 1.

iv) The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55 g both in vertical and lateral directions. The peak values 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 movement of the bogie in straight and curved track with cant deficiency as prescribed in IRPWM-June, 2020 with latest amendment and lateral force and derailment coefficient of accelerations as the case may be.

3. SELECTION OF TEST TRACK (Third report of the standing criteria committee, revision-1: Criteria for assessment of stability/riding of rolling stock, (Document No. TG-CR-4.2.3-2 March-2013) with latest amendment**:**

3.1. Oscillation trials shall be conducted over a section containing the following:

(i) A Tangent (straight) track - of about 1 km length. Efforts shall be made to conduct trials over two such stretches.

(ii) A Station Yard having facing/trailing points, and

(iii) A curved track having about 2º curves of length about 700-800 m. normally, above criteria shall be applicable. However, in case of non-availability of 2º curves fit for requisite speed, following shall be applicable:

- For C&M I Vol I Standard Track: A curved track having 1.75º to 2.2º curve of about 700-800 m and a curved track having 0.5º to 1º curve of length about 700-800 m.

- For other than C&M I Vol I Standard Track: A curved track having 1.75° to 2.2° curve of about 700-800 m and a curve track having 1° to 1.5° curve of length about 700-800 m.

3.2. Indian Railways track is classified in two categories:

- Main line track - fit for operation less than 110 Kmph,
- High Speed (C&M I Volume I) track, permitting operation upto 160 kmph.

3.3. Since main line standard track permits speeds less than 110 kmph, in case the test vehicle is designed to run at speeds 110 kmph and beyond, its Oscillation trials become necessary on High-Speed track also.

3.4. A vehicle suspension should be so designed that it should be able to run freely on all Indian Railways tracks (in certain cases, it may become necessary to place a restriction in running of vehicle on some track structures due to various reasons). Since Oscillation trials cannot be conducted all over the Railway system, the section chosen for detailed Oscillation trials should be a representative 'run down' section. The section should generally be such that 90% of Indian Railways track should be better than this section - the philosophy being that if a vehicle manages to run satisfactorily on this track stretch, it will be able to run satisfactorily anywhere else on Indian Railways.

3.5. At present, the track geometry parameters are 'peak based' and not Standard Deviation based. Subject to fulfillment of stipulations of 2.4 above, the parameters of the selected track should be as per the following:

Parameters	**Main line Standard (Speeds below 110 kmph)**
Unevenness	B or C
Twist	B or C or D
Gauge	B or C
Alignment	B or C

Parameters	**Category**	**Extent of irregularities**
Broad Gauge		
(1) Unevenness (3.6 M chord).	A B C D	0-6 mm. (inclusive) 6 mm. (exclusive) to 10 mm. (inclusive) 10 mm. (exclusive) to 15 mm. (inclusive) Above 15 mm
(2) Twist (3.6 M base)	A B	0-5.0 mm. on chart (up-to and inclusive of 1.39 mm./M) 5-7.5 mm. on chart (1.39 mm./M to 2.08

Note- 1 mm./M = 3.6 mm. on chart	C	mm./M inclusive)
	D	7.5-10.0 mm. on chart (2.08 mm./M to 2.78 mm./M inclusive) Above 10.00 mm. on chart (above 2.78 mm./M.)
(3) Gauge	A B C	Up-to and ±3 mm. (inclusive) ±3 mm to & ±6 mm. (inclusive) Above ±6 mm
(4) Alignment (7.2 M. chord)	A B C	Up-to 3mm. versine (inclusive) More than 3 mm. and less than 5 mm. versine. 5 mm. versine and above.

For certain trials only limited sections can be available due to constraints of axle load, speeds, bridges, signaling, structures etc. For such limited sections, if test stretches are not available as per above criteria, stretches should generally be selected such that 90% of the track of these limited sections should be better than the stretch chosen for conduct of trials for issue of speed certificate. However, the limitation of trial shall be clearly indicated in speed certificate issued subsequent to such trials.

3.6. After detailed oscillation trials have been completed and the safe speed thereby determined, a 'Long Confirmatory Run' should be conducted in each of the configurations as per requirement. The basic idea of the 'long run' is to confirm that the values of parameters are in general conformity with the values found in the detailed trial section.

(a) Cover a long distance (say, 10-50 kms) at the maximum speed determined by oscillation trials of the configuration.
(b) Cover a few 'hard spots' like level crossings, culverts and bridges as far as possible. Riding of the vehicle over such points (resonance or amplitude build up) will be specially mentioned in the trial report.

Annexure-V

RCRIV data to be submitted along with dynamic simulation report of the vehicle

S. No.	Component's Name	Parameters required						
		C.G. of component in x, y, z direction from rail level in mm (reference point 1st axle)			Mass in kg and mass moment of inertias in kg. m^2 of component in three dimension space about their C.G.			
		X	Y	Z	Mass	Ixx	Iyy	Izz
1.	Super structure with vehicle frame (Machine structure kept on secondary suspension of front and rear bogie)							
2.	Front Bogie frame including brake rigging							
3.	Rear Bogie frame including brake rigging							
4.	Transmission system device (hydraulic. Mechanical or electrical traction motors							
5.	Wheel axle set including axle boxes which constitute the unsprung mass							
6.	Mass of Items included in unsprung mass partially or fully along with their name per axle	1	2	3		4		Total unsprung mass in tonnes
7.	Total weight of components in tonnes	Front bogie full assembly		Rear bogie full assembly		Machine frame full structure	Full weight of vehicle (All bogies + vehicle car body or super structure)	
8.	Suspension stiffness details in kg/mm	Primary suspension element stiffness per axle box between bogie and axle box			Secondary suspension element stiffness per side between bogie and machine frame			
		Vertical stiff	Lateral stiff	Longitudinal stiff	Vertical stiff	Lateral stiff	Longitudinal stiff	

9.	Damping force details (If hydraulic damper used give there rating force per meter/second)						
10.	Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper)	Vertical direction	Lateral direction	Longitudinal direction	Rotation about vertical axis	Rotation about Lateral axis	Rotation about Longitudinal axis
11.	Detail of location of suspension elements	Detail of location of suspension springs and dampers and shock absorbers with support drawing			Detail of location of suspension springs and dampers and shock absorbers with support drawing		
12.	Details of centre pivot arrangement working and location	Provide detail arrangement drawing and description					
13.	Set of drawings and design description	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 machine bogie.					

Annexure-VI

Particulars Required in Respect of the Rolling Stock under Consideration

1. A diagram showing elevation with salient dimensions :

   a) Wheel spacing, Wheel diameter and axle load.

   I. Overall length of the vehicle :
   II. Length over head stock :

   b) I. Wheel base :
   II. Axle load (max) :
   III. Weight of each axle :
   IV. Weight of each bolster :

2. Wheel dimension :
   I. New :
   II. Worn out :

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

6. Un-sprung weight per axle in tonnes
   I. Driving axle :
   II. Running axle :

7. Sprung weight per axle in tonnes
   I. Driving axle :
   II. Running axle :

8. Sprung mass on primary suspension :

9. Stiffness of suspension coil spring :

10. Rate of deflection of primary spring :

11. Number of springs per nest :

12. Expected lateral force in tonnes per axle at maximum design speed. :

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

14. Maximum tractive effort at start and at the speed of operation -
   I. At drive at start :
   at creep speed :

15. Maximum braking force coming on to the rails per wheel
At driving speed
at transfer axle :

16. Drawing indicating suspension arrangement details of axle. :

17. Height of centre of gravity from rail level. :

18. Height of floor from rail level. :

19. Engine Make, Model, Power Rating etc.

20. Any infringement to the moving dimensions :
(Sketch provided in the Indian Railways Standard Schedule of Dimensions – Chapter IV (A)).

Annexure-VII

Following information as detailed below is required for processing the case for issue of provisional speed certificate for new vehicle

Name of the RCRIV _____ Model_____

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