



**RESEARCH DESIGNS AND STANDARDS ORGANISATION**  
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**Functional Requirement Specification for Light Weight Track Measuring  
Trolley (LWTMT)**

**FRS No. - TM/SM/FRS/013**

## 1.0 Scope:

This specification covers the functional and technical requirements with testing details of Light Weight Track Measuring Trolley, able to measure track geometry parameters. It should be able to measure and record the Track Parameters of all track structures (BG) with 52 Kg / 60 Kg rails under floating conditions on Indian Railways like (a) Gauge (b) Cross Level (c) Twist (d) Track Distance/Chainage.

## 2.0 References:

Following codes/specifications have been referred to in this specification. Updated copy of latest version with correction slip/amendments of these codes/specifications shall be followed and available at the Works of the firm.

1.	IS: 9000 (Part II/ sec 1 to 4) – 1977(Re-affirmed 2004)	Basic Environmental testing Procedures for Electronic and Electrical Items. Part-II/Sec. 3 Cold Test.
2.	IS: 9000 (Part III/Sec.1 to5) – 1977(Re-affirmed 2004)	Basic Environmental testing Procedures for Electronic and Electrical Items. Part-III/Sec.-3 Dry Heat Test.
3.	IRPWM	Indian Railways Permanent Way Manual (Latest version)

## 3.0 Materials, Processing and Workmanship:

3.1.Light Weight Track Measuring Trolley (LWTMT) shall be a compact, lightweight and easy to carry trolley like device.

Note: Gauge should be reported as variation from nominal gauge of 1676 mm with excess from nominal gauge being shown as ‘+’ and shortage from nominal gauge as ‘-’

3.2.Light Weight Track Measuring Trolley should be supplied with a display unit (min.9 inch screen) having durability as per MIL-STD-810 , IP 67 and in-built software which is able to record following items mentioned in table of para 3.3 and compare it with permissible value for concerned items as per IRPWM (latest version). It should be able to display the value in red color which is beyond permissible limits, during recording and in saved data both. The software/system should have the provision for feeding the permissible values for Indian condition for various parameters to be measured by LWTMT.-System should have the facility to enter the station code, chainage, nomenclature of loop line/ siding, Turn-out No., Curve No., Level crossing No. and Hectometer Post. System should have provision to record name and designation of the inspecting official.

3.3.System shall be able to record following parameters in straight and curved track. System shall be able to measure succession of curves of left and right hands in a continuous way without interrupting/ rotating the trolley.

SN	Station No.	Gauge (mm)	Cross-level(mm)	Twist (mm)	Chainage
1.					
2.					
3.					
4.					

- 3.4. Trolley shall be equipped with a GPS module to enable geo-referencing of the recorded data.
- 3.5. There should be provision to record/report the Twist on user selectable base from 2 m to 4 m at sampling interval.
- 3.6. The System shall have the facility of recording, storing and transferring Data. The on-board system shall have a capacity (Non-volatile memory) to record and store track parameters for at least 200 km.
- 3.7. The device shall also be capable of recording and storing the locations of parameter peaks. An odometer shall be used to record distance.
- 3.8. System Data shall be stored in CSV/ASCII format.
- 3.9. System should be mounted on a light weight framed structure which can be split in main parts and assemble easily within 15 minutes so as to be handled by max one person and kept off track during any approaching train. Total weight of the system (including battery/s) shall be not more than 13 kg max.
- 3.10. It should be insulated to work without interfering signaling equipment and also work in electrified sections. The track recording system and its accuracy of measurement shall not be affected in any manner due to the induction effect of the electric traction and signaling systems.
- 3.11. Rechargeable battery/hot swappable batteries shall be used as power source for operation of the system. The battery/ hot swappable batteries shall have sufficient capacity for continuous working of at least 10 hrs.
- 3.12. The system shall be compact and robust and capable of working continuously during the severe Indian atmospheric and climatic conditions. It shall also be water resistant and dust proof for functioning in harsh environment of dust, vibration, shock, rain, wind and fog, which are normally encountered on Indian Railways. The complete system shall be at least IP 65 except display unit.
- 3.13. The system shall be capable of continual recording while moving at speeds up to 5 kmph.
- 3.14. Sampling distance/ measurement interval of the system should be user selectable of 0.25m or multiple of 0.25m and reporting/exporting interval can be decided by user. However, the sampling interval shall not be changed during measurement.

- 3.15. Facility to suspend/ pause the recording at marked location and again restarting from same location shall be available so that system trolley can be removed from track on arrival of train on the same path. The system should also have the flexibility for intermittent recording i.e. for closing the work at a particular location /time and re-starting from the same location at different time.
- 3.16. The system should have the facility for recording and storage of various track features along with their locations through keyboard entry by operator during recording. The track features to be recorded are tabulated in Annexure 1.
- 3.17. The system must have the provisions to transfer the measurement data from Track Measuring Trolley. The measurement data files should be password protected.
- 3.18. System shall have the facility for calibration of odometer and sensor along with facility of continuous monitoring of odometer and sensor signals to ensure reliable recording of parameters.
- 3.19. Display of the data on the screen should be clearly visible with naked eyes in direct sunlight.
- 3.20. System must have software module to generate all types of reports from the recorded track geometry as per Annexure 2 attached.
- Track parameters (i.e. Gauge, Cross-level) peaks with magnitude above user input threshold value along with its location. (as per Annex 2). The location accuracy shall be  $\pm 1$  meter in a kilometer.
- 3.21. Height of the display above rail head shall be adjustable within the range between 1.0 m to 1.5 m.

#### 4.0 Technical Features:

Range and accuracy of the system shall be as under:

SN	Parameter	Chord	Range	Accuracy
i.	Twist	User selectable	_____	_____
ii.	Gauge (measured 14 mm below rail table)	_____ _____	-25 to +50 mm	$\pm 1.0$ mm
iii.	Cross level	_____	$\pm 200$ mm	$\pm 1.0$ mm (Static*) $\pm 1.5$ mm (Dynamic**)

\* Static means cross level measurement in stable condition of trolley.

\*\* Dynamic means cross level measurement while trolley is in motion.

#### 5.0 Tests:

Following tests shall be carried out in sequence:

### **5.1 Visual & Dimensional Check:**

The machine shall be checked visually and dimensionally. The machine shall be free from all visual defects in material, construction and fabrication. The weight of system device including battery shall also be taken and recorded by the Inspecting officer.

### **5.2 System Functionality Test:**

The data should meet the accuracy requirements and other parameters as given in para 4.0 for technical features. More than 95% measured parameters should fall within the accuracy levels given in the para 4.0. The system shall be checked for its performance in the following manner:

- a) Straight Track: At least one km of straight track shall be measured. The measured data shall be compared with the data recorded manually separately viz. Gauge and cross-level shall be measured by Gauge-cum-Level;
- b) Curve Track: At least two curves of desired length 500 m, if available and minimum 0.5 degree shall be measured with the system. The measured data shall be compared with the data recorded manually. Gauge and cross level shall be measured by Gauge-cum-Level.

**5.3 Environmental Tests:** The firm shall submit the test certificates from NABL accredited laboratory or any government approved laboratory for following:

- a) Dry heat test
- b) Cold test

**a) Dry heat test:** This test is intended to determine suitability of the device to withstand high temperature severities prevailing in hot days of summer. This test shall be conducted as specified in IS: 9000 (Part III/Section 3) at the following severity:

Temperature (Ambient):  $+ 55^{\circ} \text{C} \pm 2^{\circ} \text{C}$   
Duration: 4 hrs.

**b) Cold test:** This test is intended to determine the suitability of the device at the specified low temperature likely to be encountered in coldest days of winter. The test shall be conducted as specified in IS: 9000 (Part-II/ sec 3) at the following severity:

Temperature:  $+5^{\circ} \pm 3^{\circ} \text{C}$   
Duration: 4 hrs.

### **6.0 Acceptance test:**

Inspecting authority shall carry out acceptance test on all the equipment /sub-units. The following shall comprise the acceptance test:

6.1 Maker's test certificate for the outsourced items:

- a) Test certificate for odometer.
- b) License of operating system
- c) License of Antivirus software of reputed supplier with 24 months subscription.

## **6.2 Visual Inspection (As per clause 5.1):**

i) General Workmanship: ii) Portability, compactness, Lightweight of system iii) Indications and displays iv) Mounting, fitment and clamping of connectors v) Painting, labeling and marking

## **6.3 System level Functionality Test:**

It shall be carried out as per clause 5.2.

## **7.0 Inspection:**

**7.1** The inspection of machine during procurement as per Para 6.0 shall be carried out by consignee. This inspection will be conducted in the presence of firm's authorized representative. Minimum level of inspecting official shall be SSE.

**7.2** Each machine shall be inspected for its acceptance as mentioned in clause no. 6.0. If the machines satisfy all the tests prescribed as per acceptance criteria, the machine is acceptable.

**7.3** After the machines have been supplied at consignee's end, the supply shall be considered as complete only after conducting training on operation etc. within four week of supply provided by the manufacturer /supplier as per clause 8.0.

## **8.0 Training and Commissioning:**

Supplier should provide training to Railway officials for three days at consignee's end in calibration, operation, repair and maintenance of the system on site. It shall include both hardware and software training which is required for the smooth operation and maintenance of the system. A video presentation regarding (a) basic features (b) operation of system (c) trouble- shooting (d) precaution during handling and operation should be supplied in English language with sub-title language in Hindi/English.

## **9.0 Documentation:**

**9.1** Operation, maintenance, trouble shooting and training manuals shall be prepared in sufficient detail to the satisfaction of purchaser and supplied in three copies each. However, calibration will be carried out by the supplier after one year of commissioning by deploying specially trained staff and whenever demanded by the consignee within warranty period.

**9.2** Installable version of Software shall be given.

## **10.0 Service Facility:**

**10.1 Spare Parts:** One spare of Data Transfer Module unit (Pen Drive /Data Transfer cable etc.) and battery shall be supplied with the system so that even during warranty period in case of malfunction

of these parts; system can be made functional immediately. An additional battery should also be provided at the time of supply.

10.2 Tools: All tools including measuring equipment required for normal maintenance should be supplied as complete kit in one set. The list of such tools and equipment proposed to be supplied with system shall be furnished as part of technical details of offer.

### **11.0 Warranty:**

11.1 The contractor shall ensure that the system supplied including all parts , components ,etc. used is free from defects and faults in design, material, workmanship and shall be of highest quality and in conformity with the contract specifications.

11.2 The warranty shall expire 24 (twenty four) months from the date of acceptance i.e. from the date of issue of commissioning certificate by the purchaser/consignee for the system except in respect of complaints, which are lodged before the expiry of the 24 months.

11.3 The supplier shall be required to supply and install free of cost all the equipment, components, PCB cards, ICs, cables transducers, connectors, spares which may fail, malfunction, become defective or required for uninterrupted working of system during the currency of Warranty period except external battery(s) in display unit and / or system. However, manufacturer's warranty will be applicable for external batteries.

11.4 The supplier shall also keep adequate stock of such components, spares and modules, which are critical and may require repairs/ replacement from time to time for ensuring uninterrupted working of the system during the warranty period.

### **12.0 Marking:**

Each machine shall be legibly and indelibly marked with the following details:

- a) Name and trade mark of the manufacturer.
- b) Year and month of manufacturing.
- c) Contact details of Manufacturer/ Supplier
- d) Date of supply- The warranty period should be calculated from the date of supply/commissioning of the machine whichever is later.
- e) Warranty period of such machine should be at least 02 years.
- f) Alphanumeric code and of machine exhibiting important features/Specification should be engraved or marked on a plate bolted on.

### **13.0 Packaging:**

System shall be enclosed in a wooden carton/suitable box and care shall be taken during transportation so that no moisture can percolate into the wooden/card board boxes and the functioning do not get hamper due to mishandling.

### **14.0 Preference to Make in India:**

The Government of India policy on 'Make in India' shall be applicable.

Annexure 1

Bridge (Start)-	Level Crossing (LC) In	Kilometer Post (KM
Bridge (End)	Level Crossing (LC) Out	Points & Crossing (P&C)
Curve-IN	Points & Crossing (P&C)	OHE Mast (OHEM) Location
Curve out	Switch Expansion Joint (SEJ)	



## Annexure 2

Peak values above threshold for different parameters

Parameter	Threshold	Recorded Value	Location	
			Kilometer	Meter
Gauge	9.0	11.0	134	567
TW-3.0	6.0	8.0	141	723

**Note-** Data given here is only for illustration purpose.