

**FUNCTIONAL REQUIREMENT OF PORTABLE TRACK GEOMETRY MEASUREMENT  
SYSTEM FOR POINT AND CROSSING**

**(TM/SM/PTGMS (P&C)/421 dated 01.02.2018)**

**1.0 Functional Requirements:**

- 1.1 Portable Track Geometry Measurement System shall be a compact, light weight and easy to carry trolley like device which should be able to measure and record the track parameters for all turnouts (BG) with 52 Kg / 60 Kg rails under floating conditions on Indian Railways like (a) Gauge (b) Cross Level (c) Twist (d) Unevenness (e) Curvature/Alignment (f) Track Distance in switch, lead and crossing portion for straight track and turnout portion.
- 1.2 PTGMS should be able to record following items visually and compare it with Indian standard. It should be able to display and print in Y/N as well as green and red ink.

<b>Particulars</b>	<b>Details of inspection</b>
<b>General-</b>	Good (Y/N)
1. Condition of sleeper	Good (Y/N)
2. Condition of ballast and drainage	Good (Y/N)
3. Availability of: a) Ballast in shoulders and cribs b) Clean ballast cushion	(Y/N) (Y/N)
4. Condition of tongue rails: a) Whether chipped or cracked over 200 mm length within 1000 mm from ATS. LH: RH: b) Whether twisted or bent LH: RH: c) Whether knife edge LH: RH:	Visual (Y/N) ----mm ----mm
5. Condition of fittings of switches	Good (Y/N)
6. Packing condition under the switch assembly	Good (Y/N)
7. Housing of stock and tongue rails: LH: RH:	Good (Y/N)
8. Seating of tongue rails on slide chairs: LH: RH:	Good (Y/N)
9. Type of crossing	Built-up/CMS
10. Condition of check rail fitting viz bearing plates, keys, blocks, bolts and elastic fastenings	Good (Y/N)

11. Ballast: Availability of :	
i) 150 mm additional ballast shoulder width on outside of turn in curve.	----mm
ii) Clean ballast cushion	----mm

1.3 PTGMS should be able to store manual entry of following items and compare it with Indian standard and undesirable data shall be marked in red ink in printout.

Particulars	Details of inspection(mm)
1. Divergence at heel block a) Right hand b) Left hand	Value
2. Throw of switch a) Right hand b) Left hand	Value
3. Creep at toe of switch	Value
4. Distance between gauge faces of stock rails at JOH	Value
5. Distance between web to web of tongue rails at respective stretcher bar locations: a) Leading stretcher bar b) 1 <sup>st</sup> following stretcher bar c) 2 <sup>nd</sup> following stretcher bar	Value
6. Gap between top edge of stretcher bar and bottom of rail foot at: a) Leading stretcher bar b) 1 <sup>st</sup> following stretcher bar c) 2 <sup>nd</sup> following stretcher bar	Value
7. Clearance at JOH: i) When set for main line a) On open tongue rail side b) On closed tongue rail side  ii) When set for turnout side a) On open tongue rail side b) On closed tongue rail side	Value
8. Condition of crossing a) Sign of propagation of crack(if any) in crossing assembly: b) Burring on top surface at nose;	(Y/N) (Y/N)
9. Clearance of wing rail opposite nose of crossing and up to 450 mm towards heel end. a) Right b) Left	Value
10. Clearance of check rails: a) Opposite ANC: Left Right	Value

<ul style="list-style-type: none"> <li>b) At following locations with respect to Centre of check rails. <ul style="list-style-type: none"> <li>i) 500 m ahead towards toe of crossing: <ul style="list-style-type: none"> <li>Left</li> <li>Right</li> </ul> </li> <li>ii) 500 mm behind heel of crossing <ul style="list-style-type: none"> <li>Left</li> <li>Right</li> </ul> </li> </ul> </li> <li>c) At the flared end towards heel: <ul style="list-style-type: none"> <li>Left</li> <li>Right</li> </ul> </li> <li>d) At the flared end towards toe; <ul style="list-style-type: none"> <li>Left</li> <li>Right</li> </ul> </li> </ul> <p>11. Straightness of straight stock rail: (measured on 10m chord)</p> <p>12. Straightness of straight tongue rail: (measured on 10m chord)</p>	
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1.4 PTGMS should be able to store manual entry of WEAR of following items and compare it with Indian standard and undesirable data shall be marked in red ink in printout.

**a. Switch assembly and lead portion**

Particulars	Details of inspection
1	2
<ul style="list-style-type: none"> <li>a) Vertical wear <ul style="list-style-type: none"> <li>Right Hand <ul style="list-style-type: none"> <li>i. At point with 13 mm head width</li> <li>ii. At point where tongue rail and stock rail level is same</li> </ul> </li> <li>Left Hand <ul style="list-style-type: none"> <li>iii. At point with 13 mm head width</li> <li>iv. At point where tongue rail and stock rail level is same</li> </ul> </li> </ul> </li> <li>b) Lateral wear (to be measured at 13 mm to 15 mm below top of stock rail) <ul style="list-style-type: none"> <li>Right Hand <ul style="list-style-type: none"> <li>i. At point with 13 mm head width</li> <li>ii. At point where tongue rail and stock rail level is same.</li> </ul> </li> <li>Left Hand <ul style="list-style-type: none"> <li>i. At point with 13 mm head width</li> <li>ii. At point where tongue rail and stock rail level is same.</li> </ul> </li> </ul> </li> </ul> <p>Vertical and lateral wear may be measured starting at point 'Q' (13 mm head width) and at a point where the tongue and stock rails are at same level</p>	

**b. Condition of stock rail**

Particulars	Details of inspection
a) Right hand: i. Vertical wear ii. Lateral wear (to be measured at 13 mm to 15 mm below top of stock rail)  b) Left hand i. Vertical wear ii. Lateral wear (to be measured at 13 mm to 15 mm below top of stock rail)	Value

**C. Wear of crossing**

A. Built up/ Heat-treated welded crossing (wear to be measured with straight edge at 100 mm from ANC):  i) On left wing rail ii) On nose iii) On right wing rail  B. CMS crossing ( wear to be measured with straight edge): i) On left wing rail(opposite ANC) ii) On nose (At 100 mm from ANC)  Actual wear for 52 Kg section: Measured wear – 2.0 mm  Actual wear for 60 Kg section: Measured wear – 2.5 mm  iii) On right wing rail (opposite ANC):	Value
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- 1.5 The system shall be based on chord-offset principle of track geometry measurement. There should be provision to measure the Twist, Curvature/Alignment etc. on user selectable chord from 3 m to 20 m every 1m with maximum length of chord measuring beam of 2 m.
- 1.6 The System shall have the facility of recording, storing and transferring Data. The on-board system shall have a capacity (Nonvolatile memory) to record and store track parameters for at least 500 no. of turn-outs.
- 1.7 The device shall also be capable of recording and storing the locations of turnout. GPS system and an odometer (tachometer) both may be available to record distance. Distance shall be recorded by either odometer or GPS based system. Accuracy of GPS should be as below:
1. Horizontal  $\leq 3$  m
  2. RMS ( $2\sigma$ )  $\leq 5$  m
- 1.8 System Data shall have compatibility for use in Track Management System (TMS) software being used in Indian Railways. Data should be stored in CSV/ASCII format.
- 1.9 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 two persons and kept off track during any approaching train. Total weight of the system should be up to 30Kg max.

- 1.10 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.
- 1.11 Rechargeable battery shall be used as power source for operation of the system. The battery shall have sufficient capacity for continuous working of at least 06 hrs.
- 1.12 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 52.
- 1.13 The system shall be capable of recording in a speed range from 0 to 05 km/h.
- 1.14 Sampling distance/ measurement interval of the system should be user selectable of 0.10m or multiple of 0.10m and reporting/exporting interval can be decided by user.
- 1.15 Facility to suspend 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.
- 1.16 The system should have the facility for recording and storage of various track features and track defects along with their locations through keyboard entry by operator during recording. The track features to be recorded along with track geometry parameters are at least: Kilometer post (KM), Points & Crossing (P&C), Missing rail fittings (RF), Rail fracture, Missing ERC, Rubber pad, Fish plate, Loose bolts, Broken Rail, Broken Sleeper.
- 1.17 The system must have the provisions to transfer the measurement data from Portable Track Geometry Measurement System (P&C) to PC computer. The measurement data files should be tamper-proof.
- 1.18 The system must have the provisions to generate off-line report & output on different user-selectable chord lengths from 3 to 20m every 1m.
- 1.19 Latest technology transducers of rugged quality and high precision shall be use. Transducers and their connecting cables shall be well protected against flying objects, debris and shall be properly secured. Proper resilient mounting may be provided.
- 1.20 System shall have the facility for calibration of tachometer and sensor.
- 1.21 Display of the data on the screen should be clearly visible with naked eyes in direct sunlight.
- 1.22 Height of the display above ground level shall be within the range between 0.8m to 1.6m.

**Technical Features:**

Range and accuracy of the system shall be as under:

<b>SN</b>	<b>Parameter</b>	<b>Chord</b>	<b>Range</b>	<b>Accuracy</b>	<b>Least Count</b>
i.	Unevenness	User selectable	$\pm 50$ mm	$\pm 1.0$ mm/3m	0.1 mm
ii.	Alignment (measured 14 mm below rail table)	User selectable	$\pm 50$ mm	$\pm 1.0$ mm/3m	0.1 mm
iii.	Twist	User selectable	1 in 50 to 1 in 1250	$\pm 1.0$ mm	0.1 mm
iv.	Gauge (measured 14 mm below rail table)	_____	-30 to + 50 mm	$\pm 0.5$ mm	0.1 mm
v.	Cross level	_____	0 to +200 mm	$\pm 1.0$ mm	0.1 mm

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