SCHEDULE OF TECHNICAL REQUIREMENTS

FOR

ELECTRONIC

IN-MOTION RAILWAY WEIGHBRIDGE

(75 KMPH SPEED)

ISSUED BY:

WAGON DIRECTORATE
RESEARCH, DESIGNS AND STANDARDS ORGANISATION
MINISTRY OF RAILWAYS
MANAK NAGAR, LUCKNOW - 226011
Specification for electronic in motion weigh bridges

Preamble:

This specification lays down the broad technical requirements of Electronic In Motion Weigh Bridges to be installed on turnkey basis (including all civil & electrical work) on a Railway track anywhere on Indian Railways and where Indian Railway locomotives and/or rolling stock ply for measurement of tare, gross and net weight of goods wagons while in motion both in coupled and uncoupled conditions.

The Electronic In-Motion Weigh Bridge systems and their installation shall follow the Metrological Rules and norms laid down by the Ministry of Consumer Affairs, Food and Public Distribution, Government of India and as amended time to time.

The weighbridge supplier shall be required to necessarily possess all requisite clearances and approvals from the Metrological department, Government of India for the model of the Electronic In-Motion Weigh Bridge being offered to the Indian Railways. The technical terms used in this document largely draw reference from the Metrological Rules in vogue in India.

1.0 These specifications lay down technical requirements for Electronic in motion Weighbridge. Weighbridge must be capable of measuring wagons weight up to speed of 75 kmph. These shall be referred as WB-75 in these specifications.

2.0 General arrangement of Weigh Bridge:

Electronics in motion Weigh Bridge shall consist of

(i) Accurate, robust and well proven sensor technology not bonded with weigh rail by intrusive method.

(ii) No requirement of cutting the rail for weighbridge installation.

(iii) Control console with electronic cards for receiving signals from load sensors for further processing.

(iv) A personal computer of latest design or a VDU, a Keyboard & a printer computer directly linked to control console, for operation, viewing and printing output.

(v) Machine & software must have adequate biometric security features to preserve an audit trail of all operations/repairs including ID of personnel.

(vi) Complete weighbridge should be OIML certified not simply OIML compliant. Proof must be furnished & renewal will be at firm’s cost.

(vii) Any other kind of equipment required for satisfactory performance of weighbridge.
3.0 General requirements:

3.1 Weighing speed: Weighbridge must be capable of measuring wagons weight up to speed of 75 kmph. Speed of train in non-weighing mode to be intimated by firm.

3.2 Weighbridge capacity: Sensors shall be able to measure a load of up to 35 tons for each axle and software/hardware should be able to compute weights up to 140 tons for an individual wagon/coach.

3.3 Advance over speed warning system: A audio visual warning shall be provided for guiding the driver for controlling the speed before the train approaches the weigh bridge.

3.4 Anti roll back: The system shall take care of the effect of roll back, even up to full train, at the time of weighing so that the reverse movement of the stopping train does not have any effect on the orderly recording of weight of each wagon/coach in the train.

3.5 Wagon or Coach Identification: The measurement technique used may be either axle-by-axle or bogie-by-bogie. However, the machine shall identify four axle wagons & brake vans and locomotives (and eliminate brake vans & locomotives in the weighment). It shall be possible to weigh all types of approved wagons & coaching stock available on Indian Railways, which include container wagons i.e. BLCA & BLCB and their variants, Parcel Vans, variants of passenger coaches and also VPU, VPH & their variants.

3.6 Bi-directional weighing: The weighment shall be possible from both directions.

3.7 Mixed rake weighing: It should be possible to weigh a mixed rake (combination of different type of rolling stock) & rake consisting of empty and loaded wagons and other coaching vehicles.

3.8 Working environment: The system supplied should be rugged to work satisfactorily in all-weather condition.

3.9 Weighing increments/ Scale interval: Weighing increment/ scale interval should be 200 kg maximum uniformly throughout its capacity.

3.10 Accidental maladjustment: Instruments shall be constructed so that maladjustment’s likely to disturb metrological performance cannot normally take place without the effect being detected.

3.11 Tamper Proof: The system should have the arrangement to prevent it being tampered by unauthorized persons.

3.12 The calibration mode shall be disabled through failsafe & tamper proof mechanism in the electronics cards & software which should not be accessible after sealing of system.

3.13 Any calibration done must be by a positive act which must be recorded by audit trail and must contain biometrics & ID of person conducting the same.

4.0 Rail transducers: Rail transducers should meet following specifications.

4.0.1 Wireless in between track and equipment room.
4.0.2 Type or protection - The IP (in-green protection) rating for equipment and enclosure should be IP 67 as specified in AS1939 and EN 6052.

4.0.3 Cables and connectors: Suitable & with proper ruggedization for load sensors with proper screening to isolate leakage (Elect.).

4.0.4 Track Sensors (switches): Track sensors shall be non-contact type of sensors and track switch combinations used shall be capable of speed measurement, discriminating the type of axle combination and define weighing zone.

4.1 **Weighing system electronics:**

4.1.1 Auto calibration of the system after each and every weighment cycle shall be provided for error free weighment.

4.1.2 The system shall have facility of standard remote desktop sharing through LAN/WAN.

4.1.3 System should go to auto sleep mode while non-weighing and wake up when given instruction wirelessly from a remote location.

4.1.4 Suitable hardware & software must be provided so as to last for life of weighbridge and be future proof till end of life of the system.

4.1.5 Suitable fault finding software routines for display of major faults occurring in the system shall be provided. Suitable LED panel/message display should be provided on the console, each LED panel/message indicating a specific fault and LED panel/message should light up indicating the type of fault for diagnostics.

4.2 **Power equipment and battery backup:**

4.2.1 The system shall work with 230 ±10% volts at 50 Hz mains.

4.2.2 A suitable voltage stabilizer/CVT of minimum 2 KVA capacity shall be provided.

4.2.3 An uninterrupted power supply of 2KVA ‘online’ UPS unit shall be provided to facilitate uninterrupted working for minimum one hour in case of power failure.

4.2.4 The control panel shall have suitable means for memory protection in case of power failures.

4.3 **Lightning and Transient Protection:**

It should be as per relevant international standard.

5.0 **Software requirements:**

Software should be on window platform and should be user friendly interface and easily transferable.

5.1 The weighbridge PC and software should be able to receive & transfer text based/other specified files in encrypted mode over a local area network/ wide area network to any remote/local server. The weighbridge PC and software should be able to have FOIS connectivity. The weighbridge manufacturer shall, upon direction from Indian Railways, enable the weighbridge software to transmit the weighment data in the standard syntax, sequence and format with encryption and with standard data transfer protocol specified.
5.2 While in weighing mode, screen should show number of axles in the wagon/coach, its gross weight and its sequence number. Date and time should be taken from system date and time.

5.3 Editable items shall be wagon/coach identification number and tare weights. It should not be possible to edit the gross weights. In the weighment software, there should not be any import/export option to any other software except to FOIS system.

5.4 System must be capable of measuring each vehicle/rake accurately automatically before start of a new weighing cycle without any bias due to previous weighments.

5.5 The software & embedded systems used in the weighbridge should be certified by agencies like CERT-IN etc.

5.6 **Wagon Library**: Software shall be capable of maintaining a wagon/coach library. This library shall be a list/database with three fields viz. wagon identification number, type of wagon/coach and its tare weight the database should be capable of storing more than 10,000 records.

5.6.1 **Print out requirements:**

Print out format should contain the following information.

(a) Date and time

(b) Rake number, time in /time out for the train.

(c) Wagon/coach identification no., tare weight, gross weight, net weight and speed.

(d) Gross and net weight for the complete rake.

(e) In case weighing speed of a wagon/coach exceeds the limiting specified speed of the weigh bridge, gross weight of the wagon/coach should not be printed whereas all other parameters should be printed.

5.6.2 **File retrieval:**

It should be possible to store the information of one rake weighing into a separate file, which can be retrieved and printed at a later date. Such stored information should be complete with original date and time and it should not be possible to edit such file.

5.6.3 The operating software should have in-built security so that no unauthorized person can alter/interfere with the system to ensure reliability of weighment. The system should have adequate capacity to store the record of about 200 rakes (each rake comprising of about 2/3 Locomotive + 59 wagons + 1 Brake vans + 2/3 Locomotive + 59 wagons + 1 Brake vans) weighed without having to delete/off load for storage. These records will be normally preserved for about 6 months and the system should not permit any alteration of records after the weighment is completed. There should be provision to record the weighment on DVDs. It should not be feasible to modify these records after off-loading on DVDs. Operating software should have the capability to store at least last 100 nos. of login particulars without facility of editing.

5.6.4 Weighbridge should have the capability of weighing long haul trains of composition indicated in clause 5.6.3.
6.0 Metrological requirements and test scheme:

6.1 Metrological requirements:

6.2 Accuracy class of weighbridges

WB-75 weighbridge - It shall meet the requirement of accuracy class-1 for wagon/coach weighing and accuracy class 0.5 for rake/train weighing.

6.3 The maximum permissible error for in motion weighbridges shall be as specified in Table-1:

<table>
<thead>
<tr>
<th>Accuracy class</th>
<th>Initial verification</th>
<th>In-service inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 (Train weighing)</td>
<td>±0.25%</td>
<td>±0.50%</td>
</tr>
<tr>
<td>1 (Wagon weighing)</td>
<td>±0.50%</td>
<td>±1.00%</td>
</tr>
</tbody>
</table>

For application of maximum permissible errors refer para 6.1.4 and 6.1.5. On initial verification of weighbridge, weighing coupled wagons, the errors of not more than 10% of the weighing results taken from one or more passes of the test train may exceed the appropriate maximum permissible error given in Table-1 but shall not exceed two times that value.

6.4 Scale interval (d):

For a particular method of weighing in motion and combination of load receptors, all weight indicating and printing devices on the instrument shall have the same scale interval of 200 kg.

The relationship between the accuracy class, the scale interval and the maximum wagon weight divided by the scale interval shall be as specified in Table2.

<table>
<thead>
<tr>
<th>Accuracy Class</th>
<th>d (kg)</th>
<th>(maximum wagon weight) /d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>0.5</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>1</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>

The scale intervals of the indicating or printing devices shall be in the form of 1 x 10k, 2 x 10k or 5 x 10k, “k” being a positive or negative whole number of zero.

6.5 Wagon weighing:

The maximum permissible error for coupled or uncoupled wagon weighing shall be one of the following values, whichever is greater:

- The value calculated according to Table 1, rounded to the nearest scale interval;
- The value calculated according to Table 1, rounded to the nearest scale interval for the weight of a single wagon equal to 35% of the maximum wagon weight (as inscribed on the descriptive markings), or
- \( 1 \text{ } d \), where ‘d’ is scale interval/ weighing increment.


6.6 Train weighing:

The maximum permissible error for train weighing shall be one of the following values, whichever is greater:

- The value calculated according to Table 1, rounded to the nearest scale interval;
- The value calculated according to Table 1, for the weight of a single wagon equal to 35% of the maximum wagon weight (as inscribed on the descriptive markings), multiplied by the number of reference wagons in the train (not exceeding 10 wagons) and rounded to the nearest scale interval or
- 1 d for each wagon in the train but not exceeding 10 d, where ‘d’ is scale interval/weighing increment.

6.7 For WB-100 weighbridge, for the initial verification, 90% of the wagon weight should be within ±0.5% of the known weight of the wagon and not more than 10% of the wagon weight shall exceed ±0.5% and be within ±1% of known weight of the wagon. However, during in service all the wagon weight should be within ±1% of the known weight of the wagon.

6.8 For WB-100 weighbridge, for initial verification, 90% of the total train/rake weight should be within ±0.25% of the known weight of the train and not more than 10% of the total train/rake weight shall exceed ±0.25% and be within ±0.5% of the known weight of the train/rake. However, during in service all train/rake weight should be within ±0.5% of the known weight of the train/rake.

7.0 Test scheme: Verification of weighbridge, initial and in service, shall be carried out using a test train of loaded reference wagons. Each test train shall be comprised of not less than 5 and not more than 15 reference wagons and shall be weighed repeatedly and in each direction to yield not less than 60 wagon weights or equivalent in total train weights.

7.1 Reference wagons are wagons of known weight, which have to be made available by the concerned Railway for verification of weighbridges. The weight of the reference wagon can be known by weighing the same on an accurate, certified, static weighbridge in uncoupled condition.

7.2 The weighment readings shall be taken in pulling mode.

7.3 Readings of up and down direction are to be considered separately for calculating accuracy level.

7.4 Performance should be better than as specified for WB-75.

8.0 Verification & calibration:

The firm shall arrange for calibration and certification of the weighbridge for the initial commissioning the weighbridge. The reference wagons for verification purposes should be made available by Railways. The system shall have facility to auto self-calibration with tamper proof systems.

9.0 Documentation requirements:

9.1 Operator’s manual:
Instructions for operating the system for the purpose of weighing and printing should be clearly laid down in an operators instruction manual. It should contain complete information on using the software, auto calibration and zero balance, carrying out diagnostic tests and system set up before start of weighing.

9.2 Maintenance manual:

It shall contain detailed description of the system and its functioning. This manual shall contain.

9.2.1 Drawings and circuit diagrams with component layout wherever required.

9.2.2 Complete wiring diagram with all wires numbered and components/cards labeled.

9.2.3 List of parts with part number of the assembly and also part number of the original manufacturer and manufacturer’s address.

9.2.4 Details of assembly and installation with dip switch setting and jumper settings on electronic cards if any.

9.2.5 Diagnostics and fault finding with check points and parameters to be measured and their value.

10.0 Maintenance:

10.1 Training:

The supplier shall give adequate training to at least two persons of each mechanical & commercial department in the concerned Zonal Railway for operation and maintenance of the system free of charges.

10.2 Warranty: The weighbridge to be installed on turnkey basis. The machine shall be warranted against the defects in design and materials and workmanship for a period of 30 months from the date of dispatch or 24 months from the date of commissioning whichever is earlier.

10.3 Spares Part Hubs- The EIMWB manufacturers shall be required to maintain spare part hubs at strategic locations, from where they can promptly rush spares to service defective EIMWBs. Each hub shall cater to a cluster of both Railway and non-Railway EIMWBs installed in its geographical vicinity.

10.4 Calibration, Testing and Certification: The firm/owner shall arrange for calibration, testing and certification of the weigh bridge as per terms & conditions of AMC.

10.5 Annual maintenance contract:
Tenderers are required to quote for post warranty comprehensive annual maintenance contract for a period of six years of the M&P along with their offers from the date of expiry of warranty period or 8 year from the date of commissioning whichever is later.

11.0 **Track requirement:** The system should have no constraints on its working from track site conditions including working on curves.

12.0 **Structural details:**

12.1 Structures required for installation of the equipment (including electronics) shall be provided by the contractor.

12.2 **Foundation/support** – Required foundation/support for working satisfactorily of the system should be provided by firm.

12.3 It shall be mandatory to follow standard IRS track structure & fittings, for the weighbridge installation, which shall be as per RDSO drawing no T - 2496 (latest alt), with the provision of slab-type concrete foundation/apron, as per Indian Railway Standards, provided underneath the weigh rail.

13.0 **Delisting:**

Weighbridge manufacturer can be delisted by RDSO as per extant ISO procedure on receipt of serious nature complaint for epidemic failure, unethical practice and any other serious reason reported from Zonal Railways.