

SCHEDULE OF TECHNICAL REQUIREMENTS

FOR

PITLESS IN-MOTION RAILWAY

ELECTRONIC WEIGHBRIDGE

(15 KMPH SPEED)

(Amendment No.-1 of May. 2006)

(Amendment No.-2 of Jan. 2007)

(Amendment No.-3 of May. 2009)

(Amendment No.-4 of Sep. 2009)

(Amendment No.-5 of Feb. 2010)

ISSUED BY:

**WAGON DIRECTORATE
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AMENDMENT NO. 5 of FEBRUARY, 2010 APPLICABLE TO THE SCHEDULE OF TECHNICAL REQUIREMENTS NO. WD-29- MISC-05 FOR 15 KMPH PITLESS IN-MOTION ELECTRONIC WEIGHBRIDGE (JUNE 2005)

1) Clause 3.3 is modified & shall now read as :

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

3.3.1 The color of visual indication will be **purple**, with provision of LED's as the light source & it will have two aspects:

- Steady - When the speed of the train is within specified limits.
- Pulsating – When the train is over-speeding.

2) In Clause 5.1, the word “DOS” will be deleted & it shall now read as:

5.1 Software should be on window platform and should be easily transferable and should not have protections of dangle/ adapter on parallel port. It should be capable of using extended memory. It should be password protected for operation and editing.

3) Addition of new Clause 5.1.1 , which shall read as :

5.1.1 PC should be able to receive & transfer text based files over a local area network.

AMENDMENT NO.4 of SEPTEMBER, 2009 APPLICABLE TO THE SCHEDULE OF TECHNICAL REQUIREMENTS NO. WD-29- MISC-05 FOR 15 KMPH PITLESS IN-MOTION ELECTRONIC WEIGHBRIDGE (JUNE 2005)

4) Clause 3.5 has been modified & shall now read as:

3.5 Wagon Type identification - The measurement technique used may be either axle-by-axle or bogie-by-bogie. However, the machine shall identify two axle & 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 & parcel vans available on Indian Railways, which include container wagons i.e. BLCA & BLCB and their variants and, also, VPU, VPH & their variants.

5) Clause 4.1 has been modified & shall now read as :

4.1 Weigh rails - Weigh rails with transducers/load cells suitable for the purpose. The length of these rails shall be at least 5.5 meters. The rail section will be the same as the adjoining rail section (52kg/60 kg/any other as the case may be)

4.1.1 "IRST-12-Grade 880" rails shall be used in the weighbridges if they are installed on main/loop lines.

4.1.2 Industrial use (or IU) rails may be used for private sidings, where there is no movement of passenger trains

AMENDMENT NO.3 of May, 2009 APPLICABLE TO THE SCHEDULE OF TECHNICAL REQUIREMENTS NO. WD-29- MISC-05 FOR 15 KMPH PITLESS IN-MOTION ELECTRONIC WEIGHBRIDGE (JUNE 2005)

6) Additional clause 10.3 & 10.4 are being added;

10.3 Any change of design of the existing weighbridge or introduction of a new design of weighbridge, for any location/s wherein operational /commercial implications exist for Indian Railways, shall require prior approval of RDSO

10.4 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.

AMENDMENT NO.2 OF January, 2007 APPLICABLE TO THE SCHEDULE OF TECHNICAL REQUIREMENTS NO. WD-29- MISC-05 FOR 15 KMPH PITLESS IN-MOTION ELECTRONIC WEIGHBRIDGE (JUNE 2005)

- 7) The existing Clause 4.6, introduced vide Amendment no.1 of May 2006, to be replaced & now to be read as follows;

4.6 Lightning and Transient Protection

4.6.1 Power & Data Lines Protection :

- 4.6.1.1 Adequate protection against electrical surges arising from high voltage traction system, line transients and lightning should be provided to avoid damage/mal-functioning in the equipment, **which includes all the sub-systems like rail transducers, track sensors, weighing system electronics, power equipment & battery back up, etc.**

All the electronic equipments should be tested for disturbances from bursts and Electro-static discharge in compliance with clause A.9.2 and A.9.3 of OIML R106-1, Edition 1997 (E).

In addition, the IEC standards 61312, 61024, 61643, 62305 and VDE 0100-534 pertaining to protection against lightning and surges shall apply for all electronic equipment to withstand static electricity, electric fast transient and surge voltage.

The power line of electronic equipment shall have Class B & C type 2-stage protection in TT configuration. Stage 3 protection is also required for protection of power/signalling/data lines. Class B & class C type protection devices shall preferably be pluggable type to facilitate easy replacement.

- 4.6.1.2 **Stage 1 Protection (Power line protection at Distribution Level)**

The protection of class 'B' type, against Lightning Electromagnetic Pulse (LEMP) & other high surges shall be provided at the power distribution panel. Wherever available, the modules shall have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed SPDs. The device shall be spark gap type and certified as per the VDE 0675 A1/A2 & IEC 61643. It shall be provided with a 63 Amp fuse in phase line. The protection shall be in compliance of IEC 61312, IEC 61024 & VDE 0100-534 with the following characteristics:

SN	Parameters	Limits	
		Line & Neutral	Neutral & Earth
1	Nominal Voltage (U_0)	230V	230V
2	Maximum continuous operating voltage (U_c)	$\geq 255V$	$\geq 255V$
3	Lightning Impulse current between R, Y, B & N (I_{mp})	$\geq 50KA,$ 10/350 μs for each phase	--
4	Lightning Impulse current between N & E (I_{mp})	--	$\geq 100KA,$ 10/350 μs
5	Response time (T_r)	$\leq 100 \text{ ns}$	$\leq 100 \text{ ns}$

6	Voltage protection level (U_p) between L & N	$\leq 1.3KV$	--
7	Voltage protection level (U_p) N & PE	--	$\leq 1.5KV$
8	Short circuit withstand and follow up current extinguishing capacity without back up fuse (I_{sc})	$\geq 10KA$	--
9	Operating temperature / RH	$70^{\circ} C / 95\%$	$70^{\circ} C / 95\%$
10	Mounted on	din rail	din rail

4.6.1.3 Stage 2 Protection (Power line protection at Equipment Level)

The protection of class 'C' type against low voltage surges shall be provided at the equipment input level connected between line & neutral. This shall have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed SPDs. This shall be thermal disconnecting type and equipped with potential free contact for remote monitoring. The device shall be a single compact varistor of proper rating and in no case a number of varistors shall be provided in parallel. This protection shall be in compliance of IEC 61643-12, 61312 & 61024 and VDE 0100-534 with the following characteristics:

SN	Parameters	Limits
1	Nominal Voltage (U_0)	230V
2	Maximum continuous operating voltage (U_c)	$\geq 300V$
3	Nominal discharge current between R,Y,B & N (I_n)	$\geq 10KA, 8/20\mu s$ for each phase
4	Maximum discharge current between L & N (I_{max})	$\geq 40KA, 8/20\mu s$
5	Response time (T_r)	$\leq 25 \text{ ns}$
6	Voltage protection level (U_p) at I_n	$\leq 1.6 KV$
7	Operating temperature / RH	$70^{\circ} C / 95\%$
8	Mounted on	din rail

4.6.1.4 Stage 3 protection (Protection for Power / data lines)

All external Power/signalling/data lines (AC/DC) shall be protected by using preferably pluggable stage 3 surge protection devices which consists of a combination of varistors/suppressor diodes and GD tube with voltage and current limiting facilities.

4.6.1.4.1 Power line Protection (Class D)

The device for power line protection shall be of Class D type. This shall have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed SPDs. This shall be thermal disconnecting type and equipped with potential free contact for remote monitoring. This protection shall be in compliance to IEC 61643-1 and VDE -0675 Pt. 6 with following characteristics:

Nominal Voltage (U_0)	24V	48V	60V	110V	230V
Max. continuous operating voltage (U_C)	30V	60V	75V	150V	253V
Rated load current (I_L)	16A	16A	16A	16A	16A
Nominal discharge current (I_n) 8/20 μ s	≥ 700 A	≥ 700 A	≥ 700 A	≥ 2.0 KA	≥ 2.5 KA
Max discharge current (I_{max}) 8/20 μ s	≥ 2 KA	≥ 2 KA	≥ 2 KA	≥ 5 KA	≥ 5 KA
Voltage protection level (U_P)	≤ 200 V	≤ 350 V	≤ 500 V	≤ 700 V	≤ 1100 V
Response time (T_r)	≤ 25 \tilde{n} s	≤ 25 \tilde{n} s	≤ 25 \tilde{n} s	≤ 25 \tilde{n} s	≤ 25 \tilde{n} s

Note: Minor variations from above given parameters shall be acceptable.

4.6.1.4.2 Data line protection

These devices shall preferably have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed SPDs. If the device has any component which comes in series with data/ signalling lines, the module shall have "make before break" feature so that taking out of pluggable module does not disconnect the line. This protection shall be in compliance to IEC 61643-21 & VDE 0845 Pt. 3 with the following characteristics:

Nominal Voltage(U_0)	5V	12V	24V	48V
Arrester Rated Voltage(U_C)	6V	13V	28V	50V
Rated load current(I_L)	≥ 250 mA	≥ 250 mA	≥ 250 mA	≥ 250 mA
Total discharge current, 8/20 μ s(I_n)	≥ 20 KA	≥ 20 KA	≥ 20 KA	≥ 20 KA
Lightning test current 10/350 μ s	≥ 2.5 KA	≥ 2.5 KA	≥ 2.5 KA	≥ 2.5 KA
Voltage protection level (U_P)	≤ 10 V	≤ 18 V	≤ 30 V	≤ 70 V

Note: Minor variations from above given parameters shall be acceptable.

4.6.1.4.3 If power supply /data lines (AC/DC) are carried through overhead wires or cables above ground to any nearby building or any location outside the equipment room, additional protection of Stage 2 (Class C) type shall be used at such locations for power supply lines and Stage 3 protection for data lines.

4.6.1.5 **Note:**

1. Coordinated type Class B & C arrester shall be provided in a separate enclosure in weighbridge control room adjacent to each other. This enclosure should be wall-mounting type.
2. Length of all cable connection from input supply and earth bus-bar to SPDs shall be minimum possible. This shall be ensured at installation time.

3. Stage 1, Stage 2 & Stage 3 protection should be from the recommended manufacturer/supplier. Weighbridge manufacturer shall provide Stage 1, Stage 2 & Stage 3 protection for the equipment.
4. The cross sectional area of the copper conductor for first stage protection shall not be $<16 \text{ mm}^2$ and for second stage shall not be $< 10\text{mm}^2$
5. Batch test report of OEM should be submitted by the manufacturer /supplier of Lightning & Surge protection devices to the weighbridge manufacturer at the time of supply of these devices. Copy of the same shall be submitted by Weighbridge manufacturer to RDSO at the time of pre –dispatch inspection of weighbridge system.
6. The recommended suppliers for the Class 'B', 'C' & 'D' surge protection devices or SPD's (as per Signal Dte./RDSO letter no STS/E/IPS/Genl dated 31.01.06)are given below

Item	Spec n	Manufacturer	Country	Indian Source
Lighting & Surge protection device	Class B, C & D type	1) Phoenix 2) OBO 3) Schirtec 4) DHEN (Only for Class 'D' type)	Germany Germany Austria Germany	Phoenix Contact, New Delhi Cape Electric Corpn. Nagercoil McML, Bangalore Adhunik Power Systems, Gurgaon

7. **The procurement & the installation of the SPD's shall be done by the weighbridge manufacturer, only through the recommended OEM's or their authorized representative, to ensure that the equipment of the weighbridge & the SPD is matched.**

4.6.2 Use of Ground Enhancement material

For providing effective lightning and surge protection, **earth resistance value should not exceed 2 ohms**. Hence, Ground Enhancement material should be used. This is a low resistance, non corrosive and superior conductive powdered material that improves grounding effectiveness, especially in areas of poor conductivity such as rocky ground, areas of moisture variation and sandy soil, etc. It should be possible to get and maintain the **earth resistance value less than 2 ohms** without periodical watering, only with use of this material

This material should be used around both, ground rod in auger holes or ground conductor in trenches, to enhance their performance. It should not require maintenance and maintain constant earth resistance for the life of the system once in its set form. It should not, also, depend on the continuous presence of water to maintain its high conductivity. The Ground Enhancement material should not wash away under seasonal conditions,

The procurement & the installation of the Ground Enhancement material shall be done by the weighbridge manufacturer, only through the recommended OEM's or their authorized representative, to ensure matching with the equipment of the weighbridge .

The list of recommended manufacturers / suppliers (as per Signal Dte./RDSO letter no. STS/E/SPD/SPN/144 dated 9.6.05) of this material is given below.

SN	Name and address of manufacturer / supplier	Contact Person & Phone no.	Product Name
1	M/s S.M.Creative Electronics Pvt. Ltd., 10, Electronic City, Sector-18, Gurgaon-122015 (Haryana)	Mr. Amit Pandita 9818187277	GRIP (Ground Resistance Improvement Powder)
2	M/s Adhunik Power Systems Pvt. Ltd., 387, Phase-IV, Udyog Vihar, Gurgaon - 122015	Mr. Vikas Almadi, 9811516203	CONDUCTIVER PLUS
3	M/s McML system Pvt. Ltd., No. 4 Club House, Heritage Estate, Doddaballapur Road, Yelahanka, Bangalore – 560064	Mr. G.Sreenivasa Rao, 9341233307	CONDUCRETE
4.	M/s Cape Electric Corporation, 9/2, Vanchiathithan, New Street, Vadassery, Nagercoil – 629001	Mr. S. Maheshwaran, 9810731144	QUIBACSOL
5.	M/s Bhavnidhi Trading Co. Pvt. Ltd., H-54, Summer Nagar, Near Jain Temple, S.V. Road, Borivali (W), Mumbai -400092	Mr.Mukesh Shah 9820089229	GEM (Ground Enhancement Material)

AMENDMENT NO.1 OF MAY, 2006 APPLICABLE TO THE SCHEDULE OF TECHNICAL REQUIREMENTS NO. WD-29- MISC-05 FOR 15 KMPH PITLESS IN-MOTION ELECTRONIC WEIGHBRIDGE (JUNE 2005)

1) Clause 4.1 to be replaced and to read as

4.1 **Weigh rails** - Weigh rails with bonded strain gauges suitable for the purpose. The length of these rails shall be at least 5.5 meters. The rail section will be the same as the adjoining rail section (52kg/60 kg/any other as the case may be).

2) Clause 4.2 & 4.2.1 to be replaced and to read as

4.2 **Rail transducers** - Rail transducers should meet following specifications.

4.2.1 Cables and connectors: suitable for Rail transducers with proper screening to isolate leakage (Elec.)

3) Clause 4.2.4 & 4.5.5 to be deleted and a new Clause 4.6 is added in lieu

4.6 Adequate protection against electrical surges arising from high voltage traction system, line transients and lightning should be provided to avoid damage/mal-functioning in the equipment, **which includes all the sub-systems like rail transducers, track sensors, weighing system electronics, power equipment & battery back up, etc.**

Also, all the above electronic equipments should be tested for disturbances from bursts and Electro-static discharge in compliance with clause A.3.5 and A.3.6 of OIML R106, Edition 1993 (E).

Specification for pit-less in motion electronic weigh bridges

Preamble:

This specification lays down the broad technical requirements of Electronic in motion weigh bridges to be installed on turn key 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.

Tenderer should study type of stock , condition and layout of track and the site in his own interest.

These specifications lay down technical requirements for Electronic in motion weigh bridge suitable for weighing speeds up to 15 kmph. These shall be referred as WB 15 in these specifications.

2.0 General arrangement of weigh bridge

Electronics in motion weigh bridge shall consist of

- (i) Weigh rails.
- (ii) Track switches/sensors for speed and wagon type detection.
- (iii) Control console with electronic cards for implementing track switch logic and receiving signals from load cells for further processing.
- (iv) A personal computer of latest design or a VDU, a key board & a printer computer directly linked to control console, for operation, viewing and printing output.
- (v) Any other kind of equipment required for satisfactory performance of weigh bridge.

3.0 General requirements

3.1 **Weighing speed** - Weighing speed of 15 kmph for WB15 weighbridge.

3.2 **Weighbridge capacity** - Load cells shall be able to measure a load of up to 30 tons for each axle and software/hardware should be able to compute weights up to 120 tons for an individual wagon.

3.3 **Advance over speed warning system** – An 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 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 in the train.

3.5 **Wagon Type identification** - The measurement technique used may be either axle-by-axle or bogie-by-bogie. However, the machine shall identify two axle four axle wagons and locomotives and eliminate locomotives.

It shall be possible to weigh all types of standard wagons available on Indian Railways conforming to IRS specification issued on their behalf.

3.6 **Bi-directional weighing** - The weighing 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.

3.8 **Foundation/support** - A slab type of concrete foundation/ support should be provided for laying concrete sleepers through out the underneath length of weigh rail. Offer should be inclusive of this work and is required to be performed by the tenderer.

3.9 **Working environment** - Complete system should be rugged to work satisfactorily up to 50 degree ambient temperature 95% humidity and tamper proof to the extent possible. The system should also be able to work satisfactorily in hot, dry & dusty conditions of western part of country.

3.10 **Weighing increments/ Scale interval** - Weighing increment/ scale interval should be 100 kg maximum uniformly throughout its capacity.

3.11 **Accidental maladjustment** - Instruments shall be constructed so that maladjustment's likely to disturb metrological performance cannot normally take place without the effect being detected.

3.12 **Tamper Proof** - The junction Boxes, Hardware cabin etc. should have the arrangement of bolting/ locking to prevent it being tampered by unauthorised persons. The sub-assemblies/ assemblies, alteration of which can lead to erroneous weighments should be made as tamper proof as feasible.

4.0 **Equipment requirements**

These shall comprise of weigh rails with load cells, track switches/sensors, weighing system electronics (control console) and processing and printing equipment and any other equipment required for satisfactory performance of the system.

4.1 **Weigh rails** - Weigh rails with bonded load cells suitable for the purpose.

4.2 Load cells - Load cells should meet following specifications.

- 4.2.1 Cables and connectors: suitable for load cells with proper screening to isolate leakage (Elec.)
- 4.2.2 Type or protection - The IP (ingren protection) rating for equipment and enclosure Should be IP67 as specified in AS1939 and EN 6052.
- 4.2.3 Provision of suitable compensating methods for thermal stresses and disbalance of wheat stone bridge under no load conditions.
- 4.2.4 Adequate protection against electrical surges arising from high voltage traction system should be provided to avoid damage/mal-functioning of the electronic equipments offered. Some times high potential difference develops between the rails and the earth in electrified routes. Hence proper earthing of the rails and insulation of electronic instruments including strain gauges should be ensured to protect the whole weighbridges from damage and failure.

4.3 Track sensors (Track switches)

- 4.3.1 Track sensors shall be non contact type of proximity sensors.
- 4.3.2 Track switch combinations used shall be capable of speed measurement, discriminating the type of axle combination and define weighing zone.
- 4.3.3 The switches shall be rugged enough to work in all weather conditions.
- 4.3.4 The junction boxes used shall be suitable to work in all weather conditions.

4.4 Weighing system electronics:

- 4.4.1 It shall consist of control console and a PC. PC shall communicate with the control board through a standard RS 232 C serial port. This condition would not be applicable if PC itself is used for implementing track switch logic.
- 4.4.2 System should be free of relay logic. All the control logic should be achieved through semi conductor devices.
- 4.4.3 A key board shall be provided for inputting the data from time to time.
- 4.4.4 A visual display unit shall be provided for monitoring the contents and results visually.
- 4.4.5 A printer shall be provided for getting a hard copy of the weight of the individual wagons and total train.

- 4.4.6 Suitable fault finding software routines for display of major faults occurring in the system shall be provided. Suitable LED panel should be provided on the console, each LED indicating a specific fault and LED should light up indicating the type of fault for diagnostics.
- 4.4.7 Auto Zero function for eliminating zero error resulting from drift shall be provided after each and every operation. Auto calibration & balance should be possible in case out of balance is within 4% of the capacity of the load cells.
- 4.4.8 Auto calibration of the system after each and every weighment cycle shall be provided for error free weighment.
- 4.4.9 The system shall have a facility for operating a VDU and a printer for monitoring at a remote place through a standard RS422 serial port.
- 4.4.10 The peripheral equipment including the electronic console shall be capable of working in field environment without air conditioning. Any temperature/dust control required for satisfactory and reliable operation of the system shall be considered and provided by the tenderer as part of the turnkey project.

4.5 Power equipment and battery back up

- 4.5.1 The system shall work with $230 \pm 10\%$ volts at 50 Hz mains.
- 4.5.2 A suitable voltage stabilizer of sufficient capacity shall be provided.
- 4.5.3 An uninterruptible power supply UPS unit shall be provided to facilitate uninterrupted working for minimum one hour in case of power failure.
- 4.5.4 The control panel shall have suitable means for memory protection in case of power failures.
- 4.5.5 The system shall have protection from surges resulting from line transients and lightening. Electronic instruments should be tested for disturbances from bursts and Electro-static discharge in compliance with clause A.3.5 and A.3.6 of OIML R106, Edition 1993 (E).

5.0 Software requirements

- 5.1 Software should be on DOS or window platform and should be easily transferable and should not have protections of dangle/ adapter on parallel port. It should be capable of using extended memory. It should be password protected for operation and editing.
- 5.2 Operator's interaction should be through a PC or a control console with a VDU.
- 5.3 Initial screen should be in the form of a indexed block menu or a drop down menu. Selection of items should be possible either by cursor keys or a mouse.

- 5.4 Menu should include items like weigh mode, editing weighed records, printing, auto calibration and balance, diagnostic tests, help etc.
- 5.5 While in weighing mode, screen should show number of axles in the wagon, its gross weight and its sequence number. Date and time should be taken from system date and time.
- 5.6 There should be an option of eliminating last vehicle in the train from weighment during weigh mode to account for brake vans.
- 5.7 Edited items shall be wagon identification number and tare weights. It should not be possible to edit the gross weights.
- 5.8 It should be possible to carry out auto calibration and zero balance by selecting a menu item before starting a weighing cycle.
- 5.9 **Wagon Library:** Software shall be capable of maintaining a wagon library. This library shall be a list/database with three fields viz. wagon identification number, type of wagon and its tare weight the database should be capable of storing more than 10,000 records.
 - 5.9.1 While inputting the wagon identification number and tare weights after a train has been weighed, if any wagon identification number matches with any record in wagon library, then system shall be capable of copying its tare weight from the wagon library without the need of feeding it through the key board.
 - 5.9.2 Search time for such matching and copying should be minimal. It is preferable that such library is loaded into RAM at initialization of the system, to reduce the time for search.
- 5.10 **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 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 exceeds the limiting specified speed of the weigh bridge, weight of the wagon should not be printed whereas all other parameters should be printed.

5.11 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.

- 5.12 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 100 rakes (each rake comprising of about 58 wagons) 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 floppies/ CDs. It should not be feasible to modify these records after off loading on floppies/ CDs.

6.0 Metrological requirements and test scheme

6.1 Metrological requirements

6.1.1 Accuracy class of weighbridges

WB-15 weighbridge - It shall meet the requirement of accuracy class-1 for wagon weighing and accuracy class 0.5 for rake/train weighing.

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

Accuracy class	% of mass of single wagon or total train, as appropriate	
	Initial verification	In-service inspection
0.2	±0.10%	±0.20%
0.5	±0.25%	±0.50%
1	±0.50%	±1.00%
2	±1.00%	±2.00%

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.

6.1.3 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 100 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 Table 2.

Accuracy Class	d (kg)	(maximum wagon weight) /d	
		minimum	maximum
0.5	100	500	2500
1	100	250	1250

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

6.1.4 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
- $1 d$, where ‘d’ is scale interval/ weighing increment.

6.1.5 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.

6.2 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 (if applicable) to yield not less than 60 wagon weights or equivalent in total train weights.

- 6.2.1 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.
- 6.2.2 The weighment readings shall be taken in pulling mode.
- 6.2.3 Readings of up and down direction are to be considered separately for calculating accuracy level.
- 6.2.4 For WB-15 weighbridge, for the initial verification, 90% of the wagon weight should be within $\pm 0.5\%$ of the known weight of the wagon and not more than 10% of the wagon weight shall exceed $\pm 0.5\%$ and be within $\pm 1\%$ of known weight of the wagon. However, during in service all the wagon weight should be within $\pm 1\%$ of the known weight of the wagon.
- 6.2.5 For WB-15 weighbridge, for initial verification, 90% of the total train/ rake weight should be within $\pm 0.25\%$ of the known weight of the train and not more than 10% of the total train / rake weight shall exceed $\pm 0.25\%$ and be within $\pm 0.5\%$ 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.
- 6.2.6 If roll back takes place at the time of testing, that weighing operation has to be repeated a new.
- 6.2.7 Anti roll back test
- Run 75% of the train over the weighing instrument, then stop the train, reverse 25% of the train and complete the weighing of the total train in the forward direction. Check that no wagon is weighed more than once.
- 6.2.8 Verification & calibration:
- The reference wagons for verification purposes should be made available by railways.

7.0 Documentation requirements

7.1 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.

7.2 Maintenance manual

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

- 7.2.1 Drawings and circuit diagrams with component layout wherever required.
- 7.2.2 Complete wiring diagram with all wires numbered and components/cards labeled.
- 7.2.3 List of parts with part number of the assembly and also part number of the original manufacturer and manufacturer's address.
- 7.2.4 Details of assembly and installation with dip switch setting and jumper settings on electronic cards if any.
- 7.2.5 Diagnostics and fault finding with check points and parameters to be measured and their value.

8.0 Maintenance

8.1 Training

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

- 8.2 **Spares and accessories** - Spare parts and accessories shall be separately quoted.

- 8.3 **Calibration, Testing and Certification** - The firm shall arrange for calibration, testing and certification of the weigh bridge.

- 8.4 **Guarantee** - The machine shall be guaranteed against the defects in design and materials and workmanship for a period of 18 months from the date of dispatch or 12 months from the date of commissioning whichever is earlier. During this period all defective parts and accessories shall be replaced promptly and free of cost to the customer and such replaced parts shall further carry the same guarantee.

8.5 Annual maintenance contract

- 8.5.1 Tenderers should quote separately for annual maintenance contract. He shall be required to enter into such a contract for a duration of 5 years from the date of expiry of warranty period.
- 8.5.2 Annual maintenance contract shall comprise of maintenance against break down and at least one visit in a quarter for preventive maintenance and inspection. Any material going into repairs in case of break down and preventive maintenance shall be part of the AMC and no extra levy can be charged towards Railways for material.
- 8.5.3 Break down shall be intimated through fax or telephone. Date of such intimation shall be taken as date of break down. Tenderer shall be bound to repair/set right the weigh system within a duration of 3 days from the date of intimation of break down over

telephone or fax. A penalty of 0.5% of the value of AMC shall be charged for each day exceeding the stipulated period.

8.5.4 AMC shall be entered into for a duration of 5 years payable annually. It should be inclusive of all the charges as no separate/extra payment shall be made for visits and repairs by railways.

8.5.5 Any other arrangement on the terms of Annual maintenance contract can be decided jointly by the tenderers and the Railway Administration to the mutual acceptance and satisfaction of both the parties.

9.0 Tangent level track: A minimum of 100 meter level tangent rail track length shall be made available on either side of the in motion rail weighbridge. This portion of the track should be on ballast cushion, well maintained and well drained so that there is no water accumulation. The level, twist and alignment shall be maintained to main line track standard of IR.

10.0 Structural details:

10.1 Structures required for installation of the equipment (including electronics) shall be provided by the contractor. A pucca room of size 3m x 4m (minimum) and 3m high with RCC roof shall be provided/constructed by the tenderer for installation and operation of control equipment. Details of such requirements shall be indicated in the offer. This room shall be provided with proper air conditioning (dust & temperature control), light fittings & fans by the contractor.

10.2 Slab type of foundation shall be provided underneath the weigh rail with concrete sleepers. Foundation work should be carried out by the tenderer and shall form part of the contract. Foundation drawings shall be furnished with the offer.

11.0 The contractor shall also provide communication equipments such as walki- talki set so that proper communication from control equipment room is maintained with Mechanical supervisor/ staff working the train.