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Tender No.: HORC/HRIDC/PSC-02/2024 **Date: 21.02.2024**

Reference: Notice Inviting Tender dated 10.02.2023.

E-Tender No: 2024_HBC_356031_1

CORRIGENDUM NO. 1

Name of Work: PSC-02: Manufacture and Supply of Pre-stressed Mono Block Concrete Line Sleepers conforming to RDSO Drg. No. T-8746 in connection with laying of New BG Double Railway Line for C-1 Section of Haryana Orbital Rail Corridor (HORC) Project.

S. No.	Tender Document Part / Section/ Clause No.	Description of Existing Clause	Modified Description of Existing Clause / New Clause
1.	Part 2, Section VII - Schedule of Requirements		**Add the following Annexures at the end of Section VII - Schedule of Requirements** Annexure 1 and Annexure 2 to Part 2 Supply Requirements is annexed as **"Attachment 1"** of this Corrigendum No. 1.

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GM/IP&IT,
Haryana Rail Infrastructure Development Corporation Limited,
IRCON International Tower-2, Plot No. 16, Sector-32, Gurugram, Haryana- 122003

Tender No. HORC/HRIDC/PSC-02/2024

Attachment 1

to

Corrigendum No. 1

Section VII – Schedule of Requirements

1. **Annexure 1 To Part 2 Supply Requirements and**
2. **Annexure 2 To Part 2 Supply Requirements**

Annexure 1

To Part 2 Supply Requirements

INDIAN RAILWAY

STANDARD SPECIFICATION

FOR PRE-TENSIONED PRESTRESSED CONCRETE SLEEPERS

FOR

BROAD GAUGE, METRE GAUGE AND NARROW GAUGE

SERIAL NO. T-39

(SIXTH REVISION – MARCH 2021)

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

INDIAN RAILWAY

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RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW – 226011

CONTENTS

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FOR PRE-TENSIONED PRESTRESSED CONCRETE SLEEPERS
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0. FOREWORD

0.1 This standard specification (First revision) was adopted by the Indian Railways in May 1985 after the draft was finalized by the Sub-committee of Track Standards Committee.

0.2 The last revision (Fifth Revision) was adopted by the Indian Railways in February 2016.

0.3 The present revision (Sixth Revision) has been taken up with a view to incorporate modifications found necessary as a result of use of the specification both by the manufacturer and user.

0.4 The significant modifications incorporated in this revision are as follows :-

0.4.1 All Correction slips /Corrigendum (Corrigendum no. 1 to 6) issued till date have been incorporated.

0.4.2 Guarantee Clause has been revised to make it applicable for all type of line sleepers plying on Indian Railways.

0.4.3 List of specifications (IS/IRS codes) needed for daily use and referred to in this specification has been updated in Annexure-VI.

0.4.4 Clause for acceptance of lot has been revised to make it applicable for all type of line sleepers plying on Indian Railways.

0.4.5 Annexure-I has been revised.

0.4.6 Annexure-IIB showing gauge to measure toe gap at rail seat with SGCI Insert to Drg. No. RT/6901 has been added.

0.4.7 Annexure-III has been revised to make it applicable for all type of line sleepers plying on Indian Railways.

1. SCOPE

1.0 This specification covers the manufacture and supply of pre-tensioned pre-stressed concrete sleepers for broad gauge, metre gauge and narrow gauge. For production of PSC sleepers through long line method, some of the provisions of this Specification may not be implementable. In such cases, manufacturer shall approach RDSO for specific dispensations, wherever required and these dispensations will be considered by Track and Quality Assurance Directorate of RDSO.

2. GENERAL

2.1 The manufacture of sleepers shall be to the Purchaser's drawing or to drawings approved by the Purchaser and the production shall commence with the prior approval of the Inspecting Officer. Any subsequent change in material or production technique shall require prior approval of Inspecting Officer.

2.2 The reference to IRS specifications and drawings in this specification relates to the latest version of these standards as amended from time to time. The provisions of this specification shall override the corresponding provisions of IS: Specifications. Any special requirements given in the drawings of the sleepers will override the relevant provisions of the specification. Annexure-VI shows the list of specifications required for manufacturing of sleepers.

3. MATERIALS

3.1 High Tensile Steel

3.1.1 High tensile steel in the form of plain wire or strand shall conform to IS: 1785 Part-I and IS: 6006. It shall be procured only from BIS approved manufacturers who shall furnish the proof of approval by BIS with the first consignment during the currency of approval and for each fresh approval. Each consignment of high tensile steel must be accompanied by a test certificate showing the serial no. of coils. Each coil shall carry a tag in accordance with the IS specifications mentioned above. In addition to the normal tests stipulated in the IS specifications for every consignment, results of "relaxation test" shall also be furnished once in six months. In case of change of source the first test certificate shall include "relaxation test" results also.

The steel shall be used for production only after ascertaining that it meets the provisions of relevant specifications.

3.1.2 Whenever directed by the Inspecting Officer, the manufacturer shall get the steel in stock tested at his own cost.

3.2 Cement

3.2.1 Cement shall be OPC 53-S conforming to IS: 269 (as amended upto date). However, upper limit of SO_3 and C_3A content in 53-S grade cement is revised as 3.3% & 9.0% respectively for improvement in quality of PSC sleepers on IR. Upper limit of initial setting time (IST) of 53-S grade cement is specified as 120 minutes preferably but not more than 150 minutes.

3.2.2 Each consignment of cement shall be covered by a test certificate. Each consignment shall be stocked separately, tested in the laboratory of the plant immediately for all relevant properties and shall be clearly identified. Cement more than 3 months old, if free from lumps, shall be tested for physical properties by an independent government approved laboratory or as directed by the Inspecting Officer and may be used after his approval.

3.2.2.1 The Inspecting Officer has the right to have the cement in stock tested at any time at the cost of manufacturer.

3.2.2.2 In case the source of supply of cement is changed, the mix design shall be reviewed and modified, if necessary, as per instructions given in para 3.6.3.1.

3.2.3 The cement content of the mix shall not be less than 350 kg/cu. m. and not more than 450 kg/cu.m.

3.3 Admixture

3.3.1 Super Plasticizer conforming to IS: 9103 may be used with the prior approval of RDSO. At this stage the revised concrete mix design shall also be submitted to RDSO for approval. However, following shall be observed:

3.3.2 Use of any admixture containing chloride in any form is prohibited.

3.3.3 Generally one admixture at a time should be used.

3.3.4 The admixture should be stored as per specified conditions by its manufacturer and its shelf life should be monitored continuously. Regular testing of admixture shall be done annually from NABL approved laboratory/NCCBM/IITs/NITs.

3.3.5 All containers should be correctly labeled. Reliable liquid dispenser for liquid admixtures should be used and calibrated.

3.3.6 The admixture containing Cl and SO_3 ions shall not be used. Admixtures containing nitrates shall also not be used. Admixture based on thiocynate shall be prohibited.

3.4 Aggregates

3.4.1 The aggregates shall conform to IS: 383 and shall, before use, be got tested through an approved testing institute, and results submitted in accordance with Annexure B of IS: 383 to the Inspecting Officer for approval. These tests shall be got done at the manufacturer's cost once in a year or at the time of approval/review of mix design or as desired by inspecting official. The aggregates shall have maximum 30% abrasion and maximum 30% impact value suitable for wearing surfaces when tested in accordance with IS:2386 (Part-IV). Flakiness & elongation shall be determined in accordance with IS 2386 (Part-I) on the same sample. The combined flakiness and elongation index so obtained shall not exceed 40 % when tested in accordance with IS: 2386 (Part-I).

3.4.2 Coarse and fine aggregates shall pass sodium or magnesium sulphate accelerated soundness test specified in IS: 2386 (part V).

3.4.3 Aggregates shall not contain harmful material such as pyrites, coal, lignite, mica shale or similar laminated material clay, alkali, free lime, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of concrete. Aggregate to be used for reinforced concrete shall not contain any material liable to attack steel reinforcement. Maximum limit of deleterious material in aggregates should conform IS: 383 when tested in accordance with IS: 2386 (Part-II).

3.4.4 Aggregates which are reactive with alkalies of cement are harmful as cracking of concrete may take place. Potential reactiveness of aggregates shall be tested as per IS:2386 (part VII).

3.4.5 Coarse aggregates shall be crushed stone, angular in shape and gravel shall not be used.

3.4.6 Different sizes of aggregates shall be stacked in different storage bins or stock piles on proper hard floor surface. The bins near batching plant must be located under a covered shed to avoid any chance of raw material getting wet due to rains. Alternatively, auto sensors may be used to record the moisture content in the aggregate along with auto mechanism for adjusting water to be added to concrete in the weigh batcher.

3.4.7 If crushed stone sand is being used as fine aggregates then bond strength (pull out test) of concrete shall be tested as per IS: 2770 (Part I) during mix design approval and after production of every 5000 sleepers during regular production.

Crushed stone sand being used should not be by-product of any other manufacturing process.

3.5 Water

3.5.1 Water to be used in making and for curing concrete shall conform to IS: 456. However use of sea water is prohibited.

3.5.2 If water needs any treatment before use, adequate storage of treated water for daily requirement shall be made. Facilities for testing treated water shall be provided in the plant. Treated water shall be tested daily or as directed by the Inspecting Officer.

3.5.3 The total water content per batch shall be regulated with conform with the ratio by weight of free water to cement required for the particular design mix as established by preliminary tests. The total water content of a batch includes:

(a) Absorbed water in the aggregates;
(b) Free water in the aggregates; and
(c) Free water added to the mix.

3.5.3.1 The water to be mixed at the mixer shall be free water content required per batch less the amount of free water in the aggregates, if wet, or plus the amount of water the aggregates will absorb, if dry. Free moisture content shall be determined at least once a day.

3.6 Concrete

3.6.1 The concrete shall be of controlled quality with the nominal maximum size of aggregates limited to 20mm. Where wire spacing permits, aggregates upto 25mm may be used. The manufacturer shall get the concrete mix design along with the upper and lower limits of granulometric curves approved by the Inspecting Officer.

3.6.1.1 The granulometric curves shall be plotted on semilog graph once in a week and shall be between the approved limits.

3.6.1.2 Coarse and fine aggregates shall be batched separately.

3.6.2 The concrete shall satisfy the following design parameters:

i)	Minimum release strength after steam curing	40 N/sq.mm (For Mix M-55) 40N/sq.mm (For Mix M-60)
ii)	15 days characteristic strength after water curing	55 N/sq.mm (For Mix M-55) 60 N/sq.mm (For Mix M-60)
iii)	Percentage of cubes with strength less than the characteristic strength as per mix design/statistical analysis	Not more than 2.5%
iv)	Co-efficient of variation	Less than 7%

3.6.3 Concrete mix shall be designed as per guidelines in IS: 10262 and complying design parameters as per para 3.6.2 by the sleeper plant, checked by zonal railways and got approved from RDSO before start of the sleeper production. RDSO will check and verify the new mix design at the sleeper plant by testing of trial cubes as per para 3.6.4 and complying design parameters as per para 3.6.2.

3.6.3.1 Zonal railways shall review the concrete mix design themselves whenever the source of cement or water or admixture is changed as per guidelines in IS: 10262 provided the quantity of cement is not reduced. All new ingredients must be got tested before hand from reputed laboratory to ascertain whether they are suitable to be used as per relevant standards/ specifications. The copy of test report of all ingredients, mix design calculations, record of trial cube testing and records of modification should be communicated to RDSO for information and should be available with zonal railway as well as with CSP, so that the same can be inspected during oversight inspection by RDSO official. However, if the source of aggregate changes, RDSO should be approached by the zonal railways for approval of the source and also for reviewing/revising the mix design.

Zonal Railway or RDSO will check and verify the revised mix design at the sleeper plant by testing of trial cubes as per para 3.6.4 and complying design parameters as per para 3.6.2.

3.6.3.2 Workability of mix should be kept low i.e. compacting factor in range of 0.75-0.80 for stress bench method. For long line method, workability should be kept slightly higher with slump up to 25mm if required, for proper compaction of concrete, but not leading to segregation to constituents of concrete mix under vibrations.

3.6.4 At the time of approval/review of mix design, 80 cubes shall be cast, using materials proposed for regular manufacture, in 10 separate concrete batches of 8 cubes each, 4 for steam curing and 4 for water curing.

3.6.4.1 All the 40 cubes cured according to the proposed steam curing cycle shall attain the specified minimum release strength.

3.6.4.2 The statistical analysis of the compressive strength values of the 40 water cured cubes shall satisfy the design parameters of clause 3. 6.2 (ii), (iii) & (iv).

3.7 SGCI Inserts

3.7.1 SGCI inserts shall conform to IRS Specification No.T-46 as amended up-to-date and will be procured only from RDSO

approved manufacturers. Each consignment of SGCI inserts shall be accompanied by a test certificate from inspecting agency for inspection conducted prior to dispatch of consignment from supplier's premises.

3.7.2 Whenever directed by the inspecting official, the sleeper manufacturer shall get the SGCI inserts in stock tested at his own cost.

4. MANUFACTURE

4.1 Moulds

Moulds shall be of steel with minimum plate thickness of 10 mm in Rail seat area as well as for end plates. For other locations minimum plate thickness is to be 6 to 8 mm. Moulds shall be of rigid construction so as to prevent any in-service distortions. Moulds shall not allow any appreciable leakage of cement mortar in casting. The holes in the end plates shall be accurately drilled for correct placement of prestressing wires.

4.2 Stretching of wires

The prestressing wire shall be stretched either individually or collectively by an approved method. The tensioning force shall be as shown on the sleeper drawing. The final force to be adopted, duly considering the losses while stretching shall be approved by the Inspecting Officer. However, the stretching force shall in no case exceed 75% of the minimum specified UTS of the wire. The pre-tensioning force in the wire shall be applied by a tensioning device equipped with automatic load cut off unit along with measuring gauge. The final force shall also be verified by measuring the extension of the wire.

4.3 Mixing and consolidation of concrete

4.3.1 Manufacture of sleepers shall be done under a shed.

4.3.2 Batching of different ingredients shall be done by weight only. A modern, mechanized, or automatic weigh batcher shall be used for weighing aggregates and cement. The weigh batcher shall have an accuracy of +/- 3% for aggregate, admixtures & water and +/- 2% for cement.

4.3.3 Modern high speed mixer, pan, turbine or any other suitable type, approved by the Inspecting Officer shall be used for mixing concrete. Concreting shall commence within 2 hours of stressing of wires, failing which the HTS wires shall be checked and re-tensioned, if necessary.

4.3.4 Concrete shall be thoroughly mixed and consolidated by means of vibrators of at least 9000$\pm$4% revolutions/minute. The vibrator should normally be fixed at the bottom of the mould, at

least at two different locations for a sleeper. Any other vibration system should have prior approval of RDSO.

4.3.5 Freshly cast sleepers shall be protected during the first stage of hardening from adverse weather conditions.

4.4 De-tensioning of wires

Anchoring system shall provide a device for gradual de-tensioning of the wires. Back pulling of wires for releasing any wedge shall be strictly prohibited. De-tensioning of wires shall be undertaken only after the concrete has attained a compressive strength of 40 N/sq.mm.

4.5 Curing

4.5.1 Initial curing of concrete sleeper shall be done by steam at atmospheric pressure till the concrete attains a compressive strength of 40 N/sq.mm. Pre-steaming period shall not be less than the initial setting time of cement.
Total steam curing cycle duration can vary approximately from 10 to 12 hours depending on time taken in the steam curing stages e.g. presteaming, temperature rising (heating), constant temperature duration, cooling etc. Total cycle time depends on ambient temperature.

i) Normal pre-steaming period is recommended as 2 hours or initial setting time (IST) of cement whichever is greater.
ii) Temperature rising time is recommended as 2.0 to 2.5 hours keeping maximum rate of rise of temperature as 15°C per hour.
iii) Maximum steam curing temperature shall be not more than 60°C keeping constant temperature in range of 55 – 60°C. Constant temperature duration can be kept between 3.5 to 5.0 hours.
iv) Cooling of sleepers shall be gradual and cooling period is recommended in range of 2 to 3 hours with cooling rate not exceeding15°C per hour.

Extra one hour cooling of sleepers after taking out from steam curing chamber at ambient temperature before demoulding is desirable/recommended to minimize difference in external and internal (inside) temperature of sleepers.

Mix design shall be revised, if minimum strength of 40 steam cured cubes is less than 40 N/mm^2 following the above mentioned stipulations on steam curing cycle. The steam

curing cycle which is proposed to be adopted shall have prior approval of the inspecting official.

4.5.2 After de-tensioning & de-moulding, the sleepers shall be cured for a further period of not less than 14 days (as per mix design) by submerging in water. Water used for curing should conform to the quality prescribed for water to be used for concrete mix.

4.5.3 Each steam chamber in stress bench method or production line in long line method shall be attached with a separate digital thermal sensor, temperature shall be recorded continuously and record shall be maintained.

4.6 Supervision

4.6.1 Suitably qualified persons as per Schedule of Technical Requirement shall be engaged by the manufacturer for supervising the following items at the works:

i) Placing and stressing of prestressing wire;

ii) Batching, mixing, placement and compaction of concrete. Checking of the steam curing arrangement for its adequacy.

iii) De-moulding of sleepers, water curing, stacking/ loading etc.

iv) Inserts shall be checked by suitable jigs before use by the manufacturer.

v) Testing of cement, cement mortar cubes, concrete cubes, concrete beams;

vi) Calibration of testing and measuring equipment and different gauges;

vii) Checking electrical resistance of sleepers.

4.6.2 Supervisor so engaged shall maintain records as directed by the Inspecting Officer and shall present them for scrutiny when demanded.

i) A site register shall be maintained in which inspecting officer shall record observations against which compliance will be recorded by the supervisor.

ii) Suitable records as per Schedule of Technical Requirement shall be maintained in such a manner that it can be correlated at a later date to the sleeper laid in field.

4.7 Finish

4.7.1 All sleepers shall be free from surface defects such as water retaining pockets, air holes or honey combed formations. The underside of the sleeper coming in contact with ballast shall be left rough but the unevenness shall not exceed 5mm. The ends of the prestressing wires shall be cut close to the surface of the sleeper in such a way that there is minimum damage to end plate and the wire in no case shall project more than 3 mm from the concrete surface. Two coats of suitable ISI mark anti corrosive paint, approved by Inspecting Officer, shall be applied at the ends of the sleepers in the following manner:

i) First coat of paint, sufficient thick to form impervious film of paint covering full surface of either ends of a sleeper shall be applied just after de-moulding from sleepers mould, and

ii) Second coat after taking out the sleepers from submerged water curing tank in the above manner, ensuring that surface to be painted is completely dry and clean of dirt etc.

4.7.2 No touching up or finishing by cement mortar etc. shall be permitted on concrete sleeper, after it is de-moulded, except as provided in clause 4.7.3.

4.7.3 Such sleepers which are not found acceptable due to surface defects, shall be accepted up to a ceiling of 1% of the supplies made any time during the currency of the contract provided such sleepers are adequately treated with epoxy compounds to the satisfaction of the Inspecting Officer. However, epoxy treatment of rail seat area is not acceptable. These sleepers shall be marked as shown in Drawing No.RDSO/T-2466 before dispatch. The rectified sleepers shall be paid for at the rates fixed by the Purchaser.

4.8 Stacking

After the sleepers have been cured in terms of clause 4.5.2 and checked both dimensionally and visually they shall be stacked at convenient place in lots. The stacking of sleepers shall be done on leveled and consolidated ground, one over another up to 25 layers. Each layer shall be separated by wooden/concrete battens of 50mm x 50mm size for sleepers having Insert to drawing no.RT-381 and 60mm x 60mm for sleepers having Insert to drawing no.RT-6901, of suitable lengths to avoid any damage.

4.9 Lots

All sleepers cast in one shift shall form one lot.

5. INSPECTION AND TESTING

5.1 The manufacturer shall supply at his expense, all the sleepers required for tests and retests, samples of materials, labour, machine, tools, gauges, apparatus, forms of test reports etc. and any other item which may be necessary or required by the Inspecting Officer for carrying out any or all of the checks and tests mentioned in these specifications and shall render all reasonable assistance in conducting such checks and tests. All measuring and testing appliances shall be got checked and calibrated according to the schedule given in Annexure-I, through government approved agency or as directed by the Inspecting Officer. The calibration certificate shall be furnished to the Inspecting Officer. The cost of all such checks and calibrations shall be borne by the manufacturer.

The plant controlling Railway officer minimum JAG level have liberty to recalibrate the various gauges and testing equipments in the concrete sleeper plant or by engaging the external government approved agency who can bring their calibration equipments at the plant itself, whenever they consider necessary. The necessary arrangements will be facilitated by the manufactures and cost will be borne by the manufacturer.

5.2 Inspecting Officer and the Purchaser shall have free access at all reasonable times to the works in which the sleepers are manufactured. They shall be at liberty to inspect the manufacture of sleepers at any stage and to reject any material supplies not conforming to the terms of the specifications and to reject sleepers not manufactured according to approved manufacturing process. They shall be provided with necessary assistance for inspection by the manufacturer.

5.3 Checks and tests

5.3.1 In addition to the control checks exercised on the materials and manufacturing process specified above, the concrete and the finished sleepers shall be subjected to regular checks and tests, after 14 days submerged water curing, as detailed in clause 5.3.1.1.

5.3.1.1 Visual and Dimensional Check

Every sleeper shall be visually inspected for surface finish. No sleeper shall have surface defects except as provided in para 4.7.3.
Sleeper dimensions to be checked are listed below:

(i) Critical dimensions are toe gap, location of inserts, distance between inserts at rail seat, distance between outer most inserts and slope at rail seat.

(ii) General dimensions are depth of sleeper at centre, rail seat and end of sleeper; width of sleeper at top and bottom; length of sleeper, camber and wind at rail seat and position of high tensile steel wires at ends.

The sketch at Annexure-II shows the dimension checking arrangement. The dimensions, shown on the sleeper drawing, shall be checked by means of approved gauges, procured by the manufacturer. (Annexure II/A & II/B shows the gauges for measuring toe gap of rail seat).

(iii) Scale of check

a) Prior to stabilization of production technique*:- Scale of check per lot for critical dimension is 100% (hundred percent) and for general dimensions 10% (ten percent) of sleepers produced.

b) After stabilization of production technique* :- Scale of check per lot for critical dimensions is 10% (ten per cent) and for general dimension 1% (one percent), but the dimensions between outer inserts shall be checked 100%.

c) Notwithstanding the provisions in (a) & (b) above the Inspecting Officer may decide to check the dimensions at scale higher than mentioned in para (a) & (b) above.

* Acceptance of minimum 10000 sleepers and achieving rejection rate less than 2% consistently, whichever is later, shall be one of the major criteria for deciding the stabilization of the manufacturing technique. After stabilization, the rejection rate shall be assessed after every 30000 numbers sleeper production and if it is found beyond 2%, then all the testing have to be done as per the frequency prescribed for pre-stabilized production. The additional cost of sleepers required for testing shall be borne by the firm.

5.3.2 Casting of cubes

15 cm size cubes shall be cast on a vibrating table conforming to IS: 2514 from random samples spread over the entire lot, out of concrete used for casting sleepers for testing prior to transfer of prestress and 15 days.

5.3.2 **Method of testing**

The cubes shall be surface dry at the time of testing. The rate of loading shall be about 400 KN/minute.

5.3.4 Compressive strength of concrete at transfer (release) of prestress

These cubes shall be steam cured along with sleepers in the same manner and tested for transfer of prestress to concrete (at least one cube for every steam chamber/3 for each long line but not less than a total of 3 in any case).

5.3.5 Test for 15 day compressive strength of concrete

These cubes shall not be steamed but shall be water cured for 14 days after de-moulding. Two number of samples per lot (one sample comprises of 3 cubes) shall be taken.

The samples should be spread over the entire period of concreting in a lot. Cubes of these samples shall be tested for 15 days compressive strength of concrete. The test result of a sample shall be the average of the strength of three cubes. Individual variation in cube strength in a sample should not be more than ±15% of the average. If variation is more than ±15%, the test results of the sample is invalid and the lot shall be rejected.

Further, if mean of two test results of two samples is < f_{ck} and / or minimum of the two test results of two samples is < fck – 5 N/mm^2, the lot shall also be rejected. Where, f_{ck} is characteristic strength of concrete i.e. 55 N/mm^2 for M55 and 60 N/mm^2 for M60 grade of concrete.

Otherwise, the concrete is accepted for further testing of sleeper/s as per para 5.3.7.2.2.

5.3.6 Test for 15 day modulus of rupture of concrete

The test for 15 day modulus of rupture of concrete shall be carried out on concrete beams of 10 x 10 x 50 cm size as specified in IS: 516. One specimen shall be tested daily prior to the stabilization of production technique, and once a week thereafter. If any value falls below 5.2 N/mm^2 for M55 and 5.5 N/mm^2 for M60, the mix design shall be reviewed.

5.3.7 Tests for static bending strength of sleepers

5.3.7.1 Method of testing

5.3.7.1.1 The tests shall be conducted in accordance with the arrangement shown in Annexure-III.

5.3.7.1.2 The sleepers shall be loaded gradually (30-40 KN/min) upto the specified load, which will be retained at this level for three

minutes for observing cracks, if any. For the purpose, a crack is defined as one which is barely visible to the naked eye and is at least 15mm long from the tension edge of the sleeper. However, if crack appears at a load smaller than the specified load, that value shall be recorded.

5.3.7.1.3 In case of 'Moment of Resistance' (MR) test, the sleeper shall be deemed to have passed the test if it sustains the loads specified in relevant sleeper drawing without cracking. While loading, load can be applied upto 5KN in excess of specified load.

5.3.7.1.4 In case of 'Moment of failure' (MF) test, the sleeper shall be deemed to have passed the test if it is able to take load beyond the specified test load. The initial cracking loads shall also be recorded for rail seat bottom, centre top and / or centre bottom (as the case be) for further statistical analysis of data during MF test.

5.3.7.1.5 Sleepers for test shall be selected randomly by the inspecting officer.

5.3.7.2 Acceptance tests

5.3.7.2.1 Moment of failure (MF) test (for rail seat bottom)

Prior to stabilization of production technique, one sleeper for every 250 sleepers manufactured shall be tested. After the production technique gets stabilized the testing scale shall be reduced to one sleeper for every 2500 sleepers produced.

5.3.7.2.2 Moment of resistance (MR) test (Rail seat bottom, centre top, centre bottom)

Depending on 15th day test results of samples of the lot as mentioned in para 5.3.5, the scale of testing of sleepers for the lot shall be as follows (as explained in Table -1):

i) Wherever mean of the two test results of two samples is ≥ f_{ck} + 3 N/mm^2 or f_{ck} + 0.825 x established standard deviation whichever is greater and minimum of the two test results of two samples is ≥ f_{ck} - 3 N/mm^2 and the lot is not rejected as per the criteria given in para 5.3.5– one sleeper per lot

ii) Wherever mean of two test results of two samples is < fck + 3 N/mm2 or fck + 0.825 x established standard deviation whichever is greater but ≥ fck or minimum of the of the two test results is < fck - 3 N/mm2 but ≥ fck -

5 N/mm2 or both and the lot is not rejected as per the criteria given in para 5.3.5 – two sleeper per lot

iii) In case, mean of two test results of two samples is < fck and /or minimum of the two test results of two samples is < fck – 5 N/mm2, the lot shall be rejected and no testing for moment of resistance or moment of failure will be conducted.

Note:

a. Prior to stabilization of production technique: Sleeper to be tested shall be subjected to rail seat bottom, centre top and centre bottom tests.

b. After stabilization of production technique: Sleeper to be tested shall be subjected to rail seat bottom and centre top tests only.

Table -1: Acceptance / Rejection Criteria of Concrete and No. of Sleepers for SBT Test per Lot

SN	First condition	Second Condition	Conditions to be complied	No. of sleeper per lot for test
Case 1	If average of test results of two samples is ≥ f_{ck}+ 3 N/mm^2 or ≥ f_{ck} + 0.825 x established standard deviation, N/mm^2 whichever is greater	If minimum of test results of two samples is ≥ f_{ck}– 3 N/mm^2	Both conditions are to be fulfilled and the lot is not rejected as per the criteria given in para 5.3.5.	Concrete is accepted and one sleeper will tested for SBT from the lot.
Case 2	If average of test results of two samples is < fck + 3 N/mm^2 or < f_{ck} + 0.825 x established standard deviation, N/mm^2 whichever is greater but ≥ f_{ck} N/mm^2	If minimum of test results of two samples is < f_{ck} – 3 N/mm^2 but ≥ f_{ck} – 5 N/mm^2	Any one of them or both conditions are fulfilled and the lot is not rejected as per the criteria given in para 5.3.5	Concrete is accepted but two sleepers will be tested for SBT from the lot.
Case 3	If average of test results of the two samples is < f_{ck} N/mm^2	If minimum of test results of two samples is < f_{ck} – 5 N/mm^2	Any one of them or both condition are fulfilled.	Lot rejected without any further testing on sleepers of the lot.

5.3.7.3 Acceptance of 'lots'

5.3.7.3.1 All sleepers tested in accordance with clause 5.3.7.1 should pass all the acceptance tests provided in clause 5.3.7.2 for the lot to be accepted. The specified values of Load for Centre Top, Centre bottom, Rails Seat cracking and MF test shall be as per relevant RDSO's drawings of various PSC sleepers.

5.3.7.3.2 If the sleeper fail in any of the tests conducted as per clause 5.3.7.2.2 (i), the lot shall be subjected to 'retest' as per clause 5.3.7.4.

5.3.7.4 RETEST

5.3.7.4.1 Moment of resistance (MR) test

For every sleeper failed in acceptance tests as per clause 5.3.7.2.2 (i), two more sleepers from the same lot shall be retested as per clause 5.3.7.2.2.

However, in case of testing of two sleepers as per clause 5.3.7.2.2(ii), if any of the sleepers fail, the lot shall be rejected.

5.3.7.4.2 Moment of failure (MF) test

In case of failure of the sleeper in MF test as per clause 5.3.7.2.1, 2 more sleepers from the same lot shall be selected for testing in MF as per clause 5.3.7.2.1 and 5.3.7.2.2 and subjected to all relevant tests. However, if the sleeper has passed MF test and failed in some other test MF test need not be repeated on subsequent sleepers subjected to testing.

5.3.7.4.3 For acceptance of the lot, all the sleepers tested in 'retest' must pass all the tests conducted. However, sleepers failing in any static bending tests shall not be paid for.

Also final passing of the lot is a prerequisite condition for payment for any sleeper having passed all the relevant tests conducted on that sleepers.

Sleeper/sleepers tested for rail seat bottom failure test and passes the test, shall be paid by the purchaser, if that particular lot passes all the relevant retests.

NOTE:

In case where more than one test value is obtained in retests. The lowest value obtained will be taken as strength of the lot for deciding the result of the lot.

5.3.7.5 Testing of PSC sleeper in Zonal Railways testing facility or at RDSO

Three/Four sleepers due for testing selected randomly at the level of minimum JAG will be sent for Static Bend Test (SBT) and Moment of Failure (MF) test to RDSO or at testing facilities available with Zonal Railways such as 'Bridge Workshops/'Soil Testing Lab' or any other Lab of Open line / Construction Unit of Zonal Railways for a frequency not less than once in a year. Zonal Railways should choose testing agency either RDSO or Railways who can perform the testing within 7 to 14 days including transportation time. Out of which one sleeper selected randomly will be tested. If sleeper fails in any of the test as per clause 5.3.7.1, the other two sleepers shall be subjected to retest as per clause 5.3.7.4. The testing cost including transportation etc. for above testing will be borne by the Railway.

If the sleeper fails in above testing:

(i) All sleepers manufactured in that batch will be rejected and re-calibration of the all gauges and various testing equipments in the sleeper plant is to be carried out at manufacturers cost.

(ii) Three/four sleepers from next one batch will also be got tested for Static Bend Test (SBT) and Moment of Failure (MF) test as above from RDSO or at testing facilities available with Zonal Railways such as 'Bridge Workshops/'Soil Testing Lab' or any other Lab of Open line / Construction Unit of Zonal Railways. In case of failure of sleeper in any of the test as per clause 5.3.7.1, two sleepers from the same batch shall be subjected to retest as per clause 5.3.7.4. In case failure of sleepers from next one batch, the concerned batch shall be rejected and further production shall be suspended. The detailed enquiry of the concerned sleeper plant is to be ordered by PCE of Zonal Railway. In addition, the quality audit is to be ordered by an Officer not below the rank of JAG.

All precautions should be taken during handling & transportation of sleepers for outside testing so that these are not received in cracked Condition for testing. The condition of the sleepers received before testing shall also be mentioned in the test report.

(iii) The sleeper plant representative can be permitted to witness the transportation of sleepers and the testing in RDSO/Railways Lab.

5.3.8 Measurement of electrical resistance

5.3.8.1 All sleepers shall be tested as per Annexure-V for electrical resistance for their fitness for use in track circuited area.

5.3.8.2 **Competency Certificate**

For inspection of concrete sleepers, officials having competency certificate issued after due test by RDSO/Chief Track Engineer only shall be posted.

6. STAMPING AND MARKING

6.1 All the sleepers shall have legible permanently inscribed and painted markings on the top as per drawing No.RDSO/T-2466.

6.2 The accepted sleepers shall bear the passing marks of the Inspecting Officer in indelible paints. Sleepers which have been subjected to static bending strength test up to cracking and accepted, shall in addition be marked on the top in indelible paint with the letter 'T'. MF tested and accepted sleepers shall bear the marking 'MF' in paint with yellow bands at ends.

6.3 All sleepers fit for use in track circuited area shall bear the mark 'FTC' at the center of the sleeper.

6.4 Rejected sleepers shall be stacked separately by the manufacturer so as to avoid their mixing with the accepted sleepers. Such rejected sleepers shall be marked in the way specified in drawing No.RDSO/T-2466.

The rejected sleepers shall be permanently damaged so as to render them un-useable and a certification that all rejected sleepers of previous batches have been permanently damaged will be given by manufacturer before offering next batch for inspection. The same shall be verified and ensured by inspecting officials/ SSE's and AIE before issuing the IC.

6.5 All markings mentioned in para 6.1 to 6.3 shall be done with enamel paint of ISI mark and shall be such as to last for at least 3 years under normal weather conditions. Colour and quality of the paint used shall be got approved by the Inspecting Officer. All such markings shall be done by the manufacturer at his cost.

7. LOADING AND DESPATCH

7.1 Only those sleepers which have been passed, properly marked and accepted by the Inspecting Officer shall be loaded for despatch.

7.2 The loading of the passed sleepers in wagon shall be done by the manufacturer at his cost as per the loading arrangement

approved by the purchaser. The sleepers shall be properly secured to avoid movement and displacement during transit. The manufacturer shall be responsible to replace, free of cost, all the sleepers which are found damaged in transit on account of defective loading.

8. GUARANTEE

8.1 The sleepers shall be guaranteed by the manufacturer for a period of five years from the date of manufacturing / 3 years from the date of placement in service (whichever is earlier). If during the guarantee period, sleepers in general are found to develop defects attributable to bad material and workmanship as established during investigation, leading to large scale withdrawal from service, the cost of sleepers and their replacement shall be borne by the manufacturer. The defective sleepers withdrawn from service can be taken over at site by the manufacturer for their disposal. The manufacturer shall make good the cost due within 60 days of advice of defects. The sleeper manufacturer will also be involved during inspection / investigation and his view will be considered by the Purchaser before taking decision. The decision of the purchaser shall be final and binding in this regard.

ANNEXURE-I

SCHEDULE FOR CALIBRATION OF VARIOUS GAUGES AND TESTING EQUIPMENTS IN THE CONCRETE SLEEPER PLANT

S.No.	Equipment	Frequency
1	15 cm concrete cube testing machine (2000 KN capacity)	Once in 3 months
2	Cement mortar cube testing machine (500 KN capacity)	Once in 6 months
3	Sleeper Static Bend Test Machine (1000 KN capacity)	Once in 3 months or after testing 250 sleepers, whichever is earlier.
4	Pre tensioning Jacks (500 KN capacity for single mould bench) & (1000 KN Capacity for twin mould bench)	Once a month or after casting 5000 sleepers for single mould and once a month or after casting 10,000 sleepers for twin mould, whichever is earlier.
5	Pre-tensioning load cell	Once a month or after casting 5000 sleepers for single mould and once a month or after casting 10,000 sleepers for twin mould, whichever is earlier.
6	Concrete Beam Testing Machine (100 KN capacity)	Once in 6 months
7	Aggregate weight batcher	Once every week or after casting 4000 sleepers, whichever is earlier.
8	Cement weighing equipment	Once every week or after casting 4000 sleepers, whichever is earlier.
9	Water Meter	Once every week or after casting 4000 sleepers, whichever is earlier.
10	Admixture dispenser	Once every week or after casting 4000 sleepers, whichever is earlier.
11	Master gauges for checking correctness of dimension measuring gauges	Once in 6 months
12	Dimension checking gauges	Once every 15 days or after inspecting 5000 sleepers, whichever is earlier.
13	Proving rings (2000 KN, 500 KN, 1000 KN and 100 KN capacity)	Once in 24 months or within the validity period of last calibration, whichever is earlier.
14	Weights & Measures	By Weights & Measures Department as per extant rules.
15	Tachometer	Once a year

Note:

1. The items referred at S.No.1 to 6 above should be calibrated by proving rings in the sleeper plant itself.

2. The items referred at S.No.7, 8, 9 & 10 should be calibrated by dead weights.

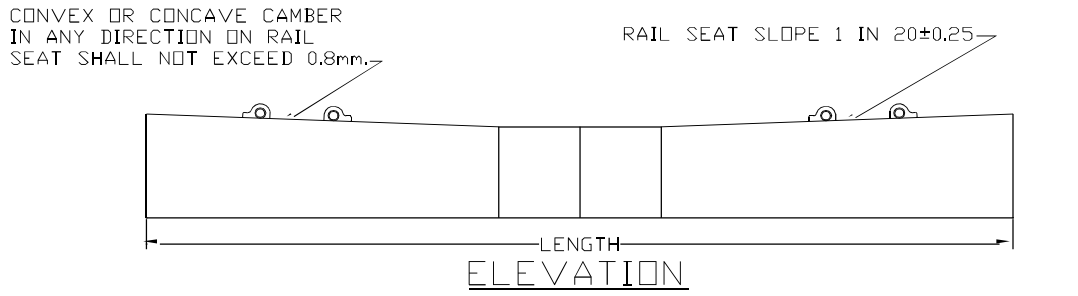
3. The proving rings should be got calibrated from NABL approved laboratory / NCCBM/IITs/NITs.

4. The record of calibration of all the above equipments should be maintained in a manner that previous records can be easily connected.

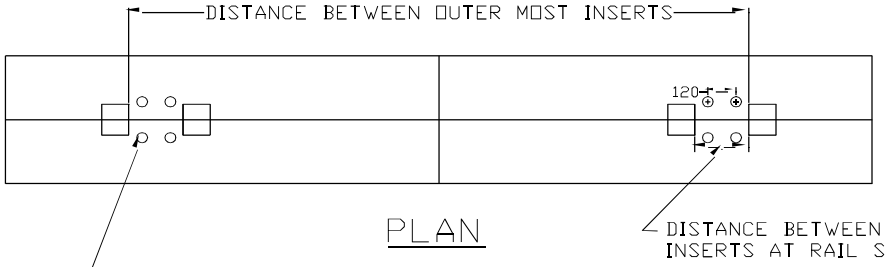
5. The calibration can be done more frequently at the discretion of the Inspecting Official.

ANNEXURE-II

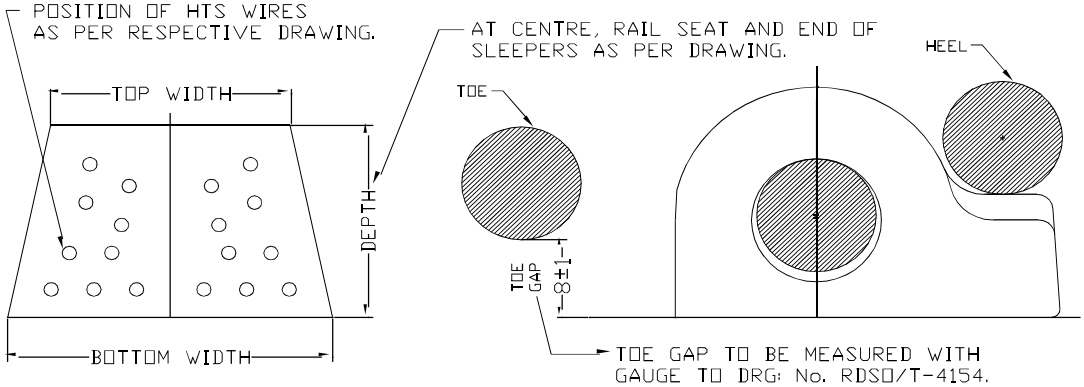
DIMENSIONS CHECKING ON PSC SLEEPER



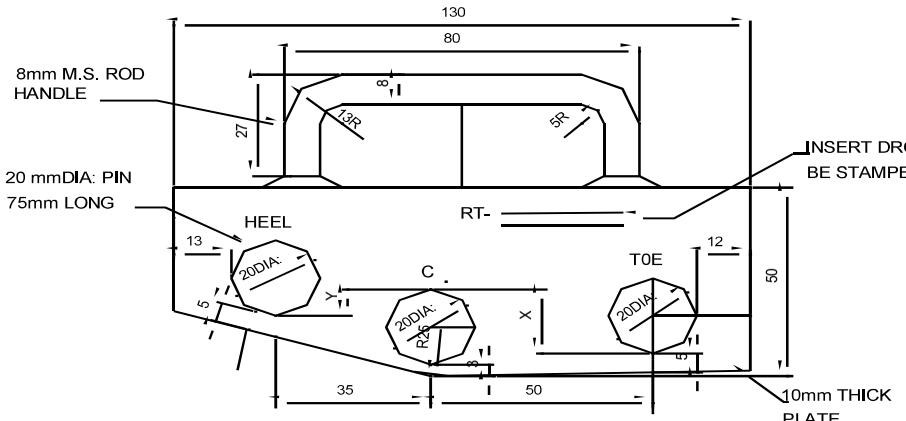
ELEVATION



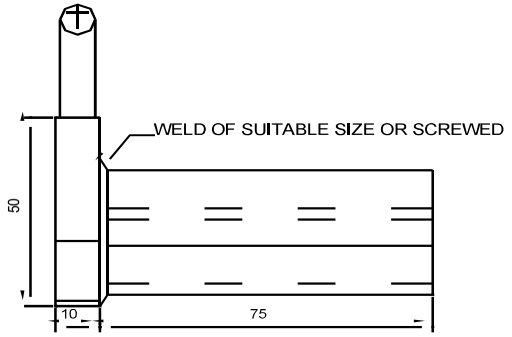
PLAN



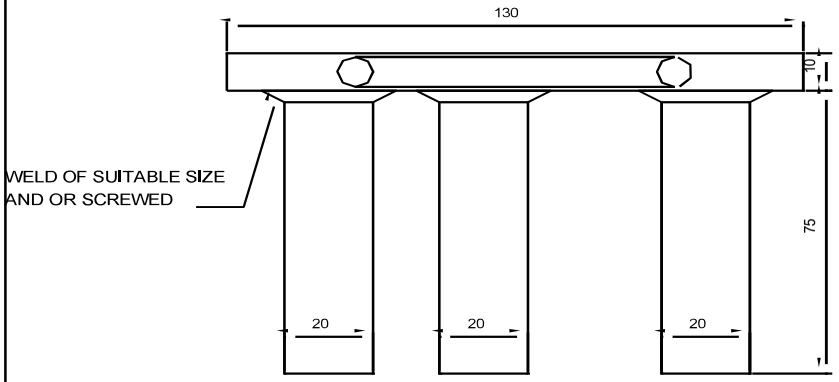
NOT TO SCALE



ELEVATION



SIDE ELEVATION



PLAN

TABLE

INSERT TO DRG. No.	DIMENSIONS mm	
	X	Y
RDSO/T-381	17	7
RDSO/T-4847	9.5	7
RDSO/T-4848	8.2	7
RDSO/T-2479	17.75	7.75
RDSO/T-3705	21.70	7.00
RDSO/T-3087	22.40	9.50

R. D. S. O.

GAUGE TO MEASURE TOE GAP

AT RAIL SEAT ON PRC SLEEPERS.

STAN
CANC
REV 0

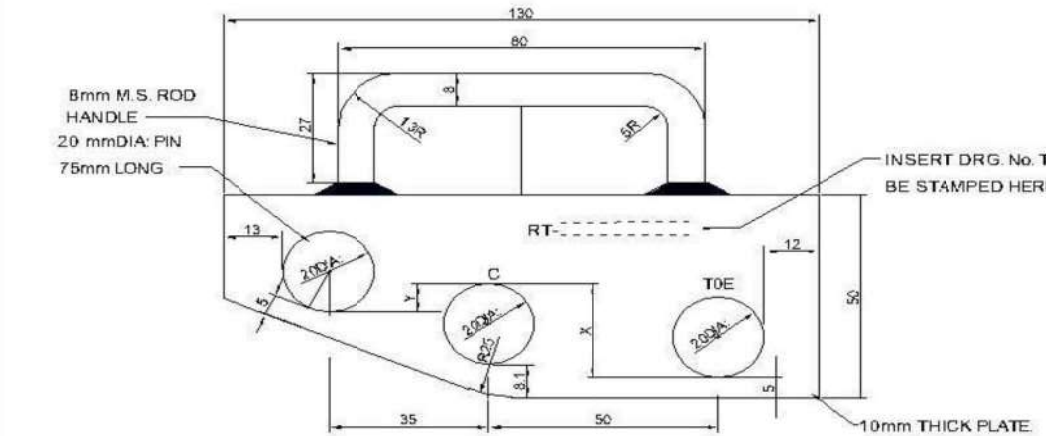
ADVANCE
25-11-92

(T)

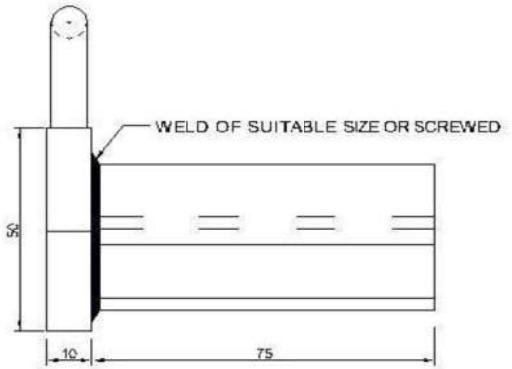
RDSO / T- 4154

3. LATEST ALTERATION NUMBER SHALL BE CHECKED BEFORE PLACING ORDERS.
2. STEP GAUGE SHALL BE USED TO MEASURE TOE GAP OF 8±1 AT RAIL SEAT.
1. ALL DIMENSIONS ARE IN MILIMETRES.

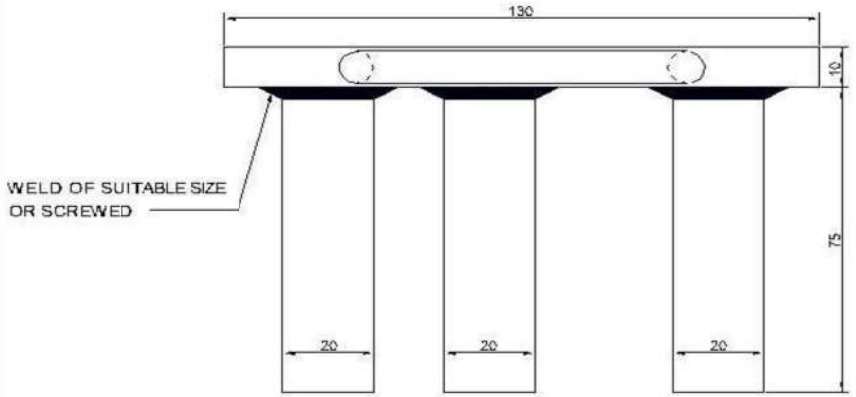
NOTE	SPECIFICATION	SCALE	ALT:	DESCRIPTION	DATE
			1.	REVISED AND REDROWN	



ELEVATION



SIDE ELEVATION



PLAN

TABLE

INSERT TO DRG. No.	DIMENSIONS mm	
	X	Y
RDSO/T-6901	23.1	7

R. D. S. O.

GAUGE TO MEASURE TOE GAP AT RAIL SEAT ON 25T PSC SLEEPER.

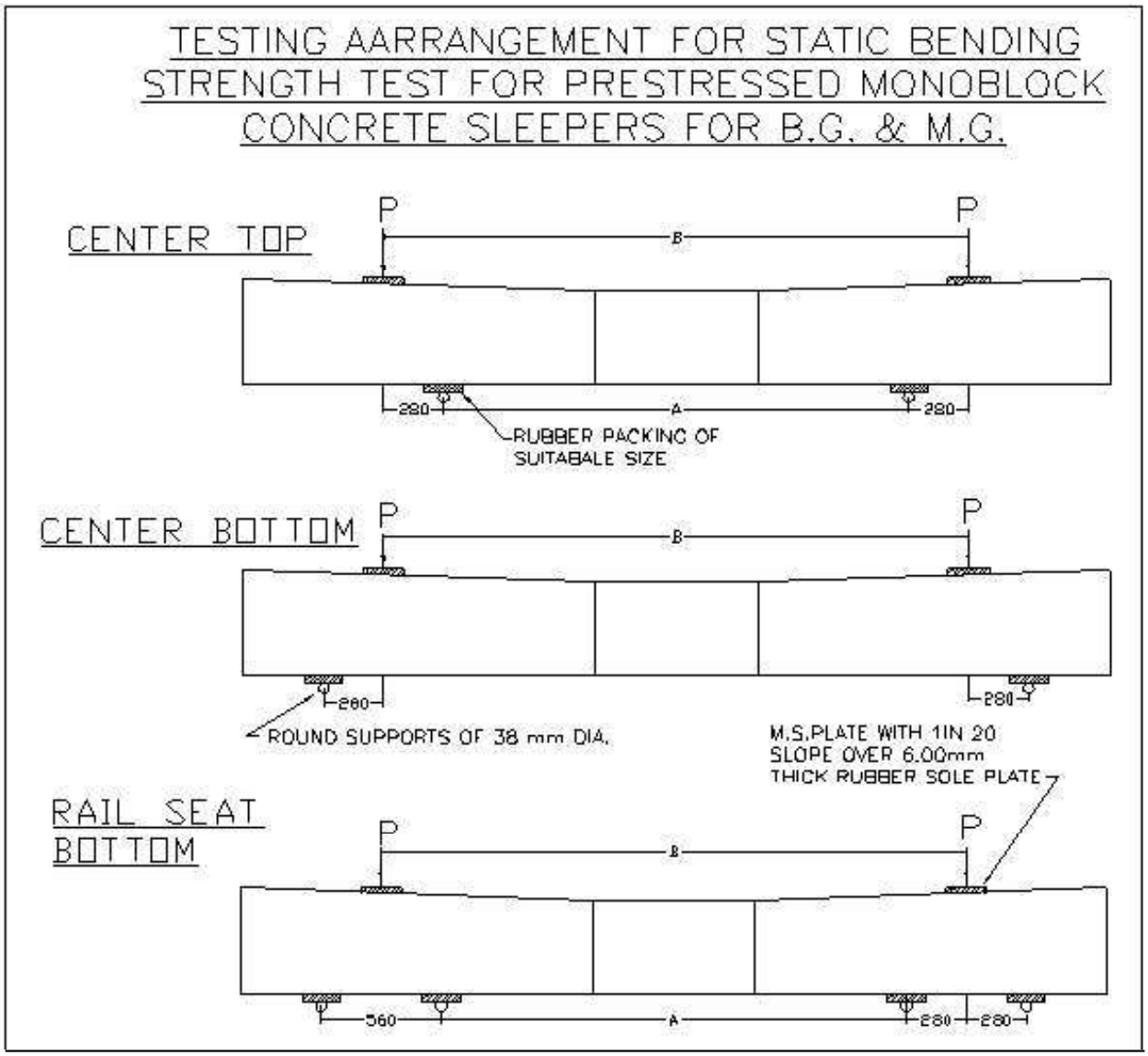
STANDARD
CANCELLED
REVISED
ADVANCE 24-02-2011 (T)

RDSO / T- 8206

3. LATEST ALTERATION NUMBER SHALL BE CHECKED BEFORE PLACING ORDERS.
2. STEP GAUGE SHALL BE USED TO MEASURE TOE GAP OF 8±1 AT RAIL SEAT.
1. ALL DIMENSIONS ARE IN MILIMETRES.

MILLIMETRES
10 0 10 20 30

NOTE	SPECIFICATION	SCALE	ALT:	DESCRIPTION	DATE



Note:- The testing arrangement is for guidance purpose only. Testing shall be conducted as per test loads mentioned in the relevant RDSO's drawings of PSC sleepers. The dimensions A & B mentioned in above testing arrangement shall be referred from relevant RDSO's drawing of PSC sleepers.

1. All dimensions are in millimeters.

2. The load 'P' will be applied at centre line of Rail Seat through pressure distributing M.S. Plate with 1 in 20 slope and size 145X25mm, covering the full width of sleeper.

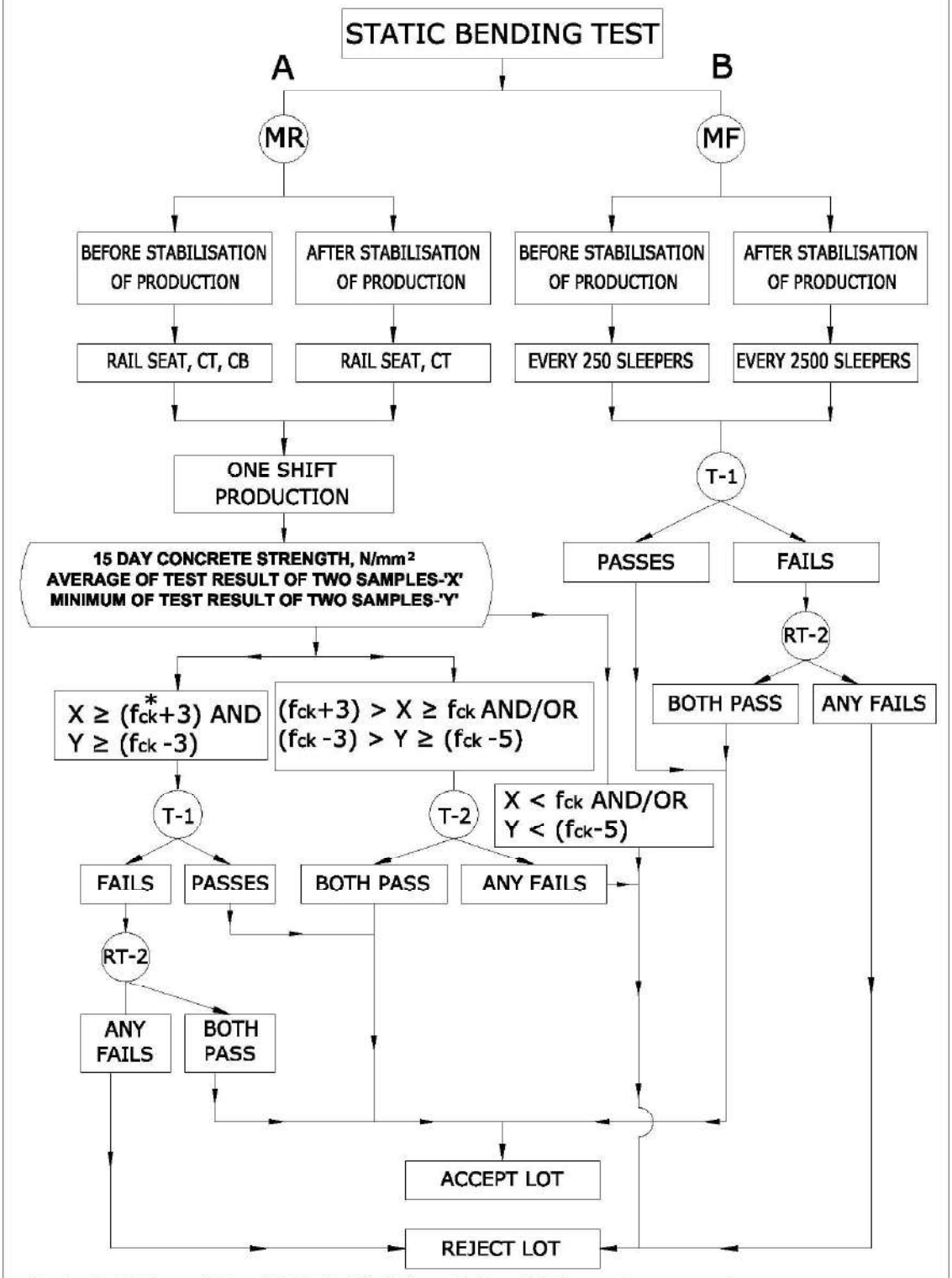
3. One rail seat bottom shall be tested at a time. It shall be ensured that the other end is not restrained in upward direction. The rate of loading is 30-40KN per minute.

4. Cracks shall not appear up to the load mentioned in relevant drawings, when retained for three minute.

5. A coat of lime wash shall be applied on the sleeper surface before testing.

ANNEXURE-IV

FLOW CHART FOR TESTING OF SLEEPER

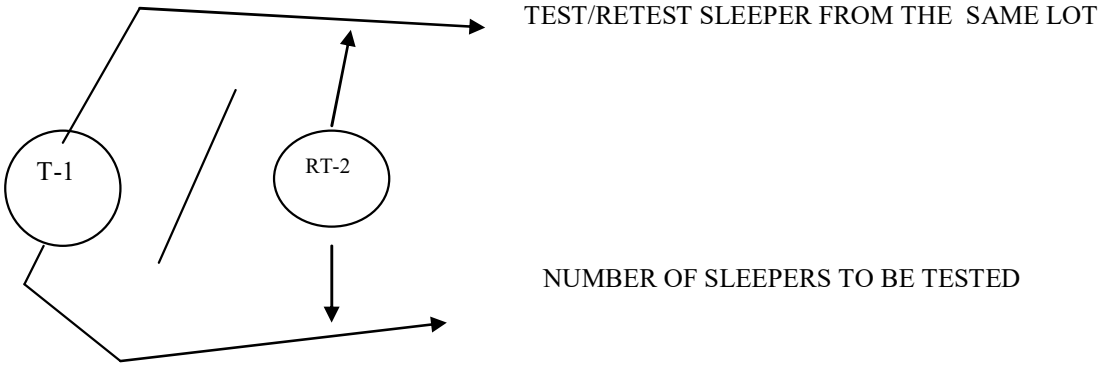


NOTATIONS & EXPLAINATORY NOTES:

MR: MOMENT OF RESISTANCE TEST:

- RAIL SEAT BOTTOM, CENTRE TOP & CENTRE BOTTOM (PRIOR TO STABILISATION)
- RAIL SEAT BOTTOM & CENTRE TOP (AFTER STABILIZATION)

MF: MOMENT OF FAILURE TEST FOR RAIL SEAT BOTTOM



PASSES : SLEEPER PASSES RELEVANT TEST SUCCESSFULLY

FAILS : SLEEPER FAILS IN ANY OF THE RELEVANT TEST

NOTE : (1) WHEN DUE, MF TEST SHALL BE CONDUCTED ON THE FIRST SLEEPER SELECTED FOR TESTING UNDER MR

(2) WHENEVER MF IS DONE, PASSING THIS TEST IS A PREREQUISITE FOR ACCEPTANCE OF THAT LOT UNDER 'A' OF FLOW CHART.

(3) IF THE FIRST SLEEPER HAS PASSED MF TEST BUT FAILED IN ANY OTHER TEST, MF TEST NEED NOT BE REPEATED ON SUBSEQUENT SLEEPERS SUBJECTED TO RE-TESTING.

ANNEXURE-V

PROCEDURE FOR CHECKING FITNESS OF CONCRETE SLEEPERS ON TRACK CIRCUITED STRETCH (AT THE TIME OF INSPECTION IN THE CONCRETE SLEEPER MANUFACTURER'S PREMISES

1. All the sleepers shall be tested.

2. The sleeper shall be checked for electrical resistance at 230 volts AC supply. The circuitry to be followed will be shown in sketch at Annexure-V (Contd.).

3. The 230 volts AC supply will be passed through a not less than 300 W test lamp in series with the pairs of inserts being tested. For the sake of comparison, another comparator bulb of the same wattage directly connected to the 230 volts AC supply will be fitted along side.

4. Since the testing is being done at a higher voltage, removal of the rust layer by grinding shall not be necessary.

5. Resistance will be checked against 2 rail seats.

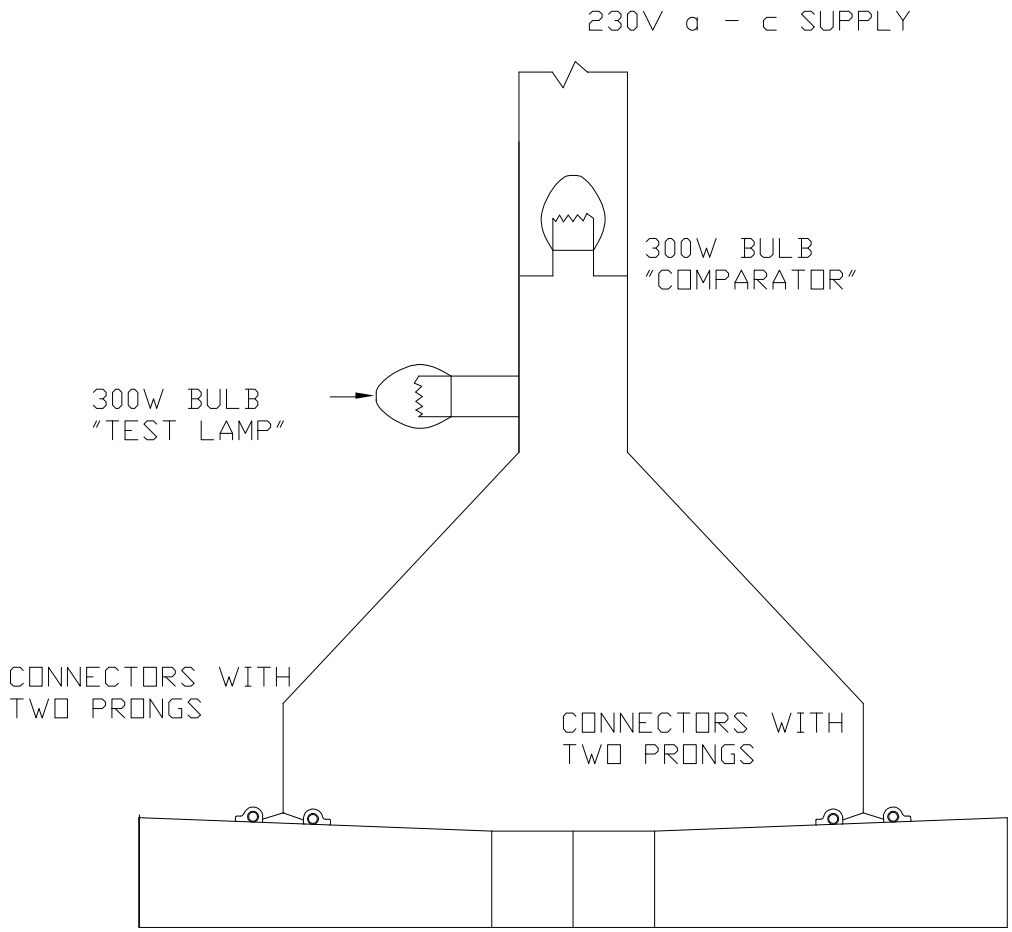
6. If the test lamp emits light dimmer than the comparator lamp in the sleeper, the sleeper shall be accepted and marked 'FTC' (Fit for Track circuit). If it emits light with the same brightness as the comparator lamp, the sleeper will be rejected and marked 'NFTC' (Not fit for track circuit). In case the test lamp does not emit light at all, it indicates that the circuitry is defective and should be rechecked.

7. In the event of doubts regarding comparison of brightness, such sleepers will not be marked. They will be retested with 1.5 V Avometer and marked for fitness, if found fit with 200 ohms resistance.

8. The 'NFTC' marked sleepers should be stacked separately. The FTC/NFTC marking shall be done on top of sleepers in middle portion, as shown on Drawing No.RDSO/T-2466.

9. As the testing is done at higher voltage, all precautions such as use of gloves in the hands, insulated boots and insulated chairs for operator and other necessary precautions shall be taken for the safety purpose.

ELECTRICAL CIRCUIT FOR TESTING CONCRETE SLEEPER IN PLANT



NOTE:

1. THE CONNECTORS SHALL HAVE TWO PRONGS EACH SO THAT BOTH INSERTS AT A RAILSEAT ARE TESTED AT A TIME.
2. NECESSARY PRECAUTIONS FOR WORKERS SAFETY SHALL BE TAKEN.

ANNEXURE-VI

LIST OF IRS & BIS CODES REFERRED TO

(Up-to-date version of Codes/Specifications with latest amendments/correction slips shall be followed)

S.No.	IRS/IS No. & Year	Description
1	IS:269-2015	Ordinary Portland Cement- Specification (Sixth Revision)
2	IS:1343 – 2012 (Reaffirmed-2017)	Prestressed Concrete-Code of Practice (Second revision)
3	IS:383 – 2016	Coarse and fine aggregates for concrete-specification (third Revision)
4	IS:456-2000 (Reaffirmed-2016)	Plain and reinforced concrete- code for practice (Fourth Revision)
5	IS:516 – 1959 (Reaffirmed-2018)	Method of test for strength of concrete
6	IS:650 – 1991 (Reaffirmed-2018)	Standard sand for testing of cement (Second Revision)
7	IS:1785 Pt.I - 1983 (Reaffirmed-2018)	Specification for plain hard drawn steel wire for prestressed concrete Part.I Cold drawn stress relieved wire (Second Revision)
8	IS: 2386 - 1963 Pt. I – VIII (Reaffirmed-2016)	Methods of tests for aggregate for concrete
9	IS:2430 –1986 (Reaffirmed-2019)	Methods for sampling of aggregate for concrete(First Revision)
10	IS:2514 – 1963 (Reaffirmed-2017)	Specification for concrete vibrating table
11	IS:3536 - 2016	Ready mix paint, Brushing, Wood primer-Specification (second revision)
12	IS:4031 –(Part-1)-1996 (Reaffirmed-2019)	Methods of physical tests for hydraulic cement Part -1 Determination of fineness by dry sieving (Second Revision)
13	IS:4031 (Part 2) - 1999 (Reaffirmed-2019)	Part-2 Determination of fineness by specific surface by blaine air permeability method (First Revision)
14	IS:4031 (Part 3) - 1988 (Reaffirmed-2019)	Part-3 Determination of soundness (First Revision)
15	IS:4031 (Part 4) - 1988 (Reaffirmed-2019)	Part-4 Determination of consistency of standard cement paste (First Revision)
16	IS:4031(Part 5) - 1988 (Reaffirmed-2019)	Part-5 Determination of initial and final setting times (First Revision)
17	IS:4031 (Part 6) – 1988 (Reaffirmed-2019)	Part-6 Determination of compressive strength of hydraulic cement (other than masonry cement) (First Revision)

18	IS:4031(Part 14) - 1989 (Reaffirmed-2019)	Part-14 Determination of false set
19	IS:4032 – 1985 (Reaffirmed-2019)	Methods of chemical analysis of hydraulic cement
20	IS:6006 - 2014 (Reaffirmed-2019)	Uncoated stress relieved strand for pre-stressed concrete-Specification (Second Revision)
21	IS:9103 – 1999 (Reaffirmed-2018)	Specification for concrete Admixture
22	IS:10262 – 2019	Concrete Mix Proportioning – Guidelines (Second Revision)
23	IS:2770 (Pt.1)-1967 (Reaffirmed-2017)	Methods of testing bond in reinforced concrete Part 1: Pull-out test
24	IRS/T-46	Specification for Spheroidal Graphite Cast Iron inserts
25	Schedule of Technical Requirement (STR)	Schedule of Technical Requirement for manufacture of PSC Sleepers as applicable from time to time.

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

'Corrigendum No. 1' to 'IRS Specification for PSC Sleepers for Broad Gauge, Metre Gauge and Narrow Gauge

Serial no. T-39
(Sixth Revision –March 2021)

The existing clauses 1.0, 3.6.2 (i), 3.7.1, 4.4, 4.5.1 shall be replaced as under and a new Annexure-VII regarding setting up of new concrete sleeper plant (CSP) has been added:

1.0 This specification covers the manufacture and supply of pre-tensioned pre-stressed concrete sleepers for broad gauge, metre gauge and narrow gauge. For production of PSC sleepers through long line method, some of the provisions of this Specification may not be implementable. In such cases, manufacturer shall approach RDSO for specific dispensations, wherever required and these dispensations will be considered by Track Design Directorate of RDSO.

3.6.2 The concrete shall satisfy the following design parameters:

i) Minimum release strength after steam curing — 40 N/sq.mm (For Mix M 55); 50 N/sq.mm (For Mix M-60)

3.7.1 SGCI inserts shall conform to IRS Specification No.T-46-1996 as amended up-to-date. Each consignment of SGCI inserts shall be accompanied by a test certificate from inspecting agency for inspection conducted prior to dispatch of consignment from supplier's premises.

4.4 **De-tensioning of wires**

Anchoring system shall provide a device for gradual de-tensioning of the wires. Back pulling of wires for releasing any wedge shall be strictly prohibited. De-tensioning of wires shall be undertaken

only after the concrete has attained a compressive strength of 40 N/sq.mm (For Mix M-55) & 50 N/sq.mm (For Mix M-60)

4.5.1 Initial curing of concrete sleeper shall be done by steam at atmospheric pressure till the concrete attains a compressive strength of 40 N/sq.mm (For Mix M-55) & 50 N/sq.mm (For Mix M-60). Pre-steaming period shall not be less than the initial setting time of cement.

Total steam curing cycle duration can vary from 10 to 12 hours depending on time taken in the steam curing stages e.g. presteaming, temperature rising (heating), constant temperature duration, cooling etc. Total cycle time depends on ambient temperature.

i) Normal pre-steaming period is recommended as 2 hours or initial setting time (IST) of cement whichever is greater.

ii) Temperature rising time is recommended as 2.0 to 2.5 hours keeping maximum rate of rise of temperature as 15°C per hour.

iii) Maximum steam curing temperature shall be not more than 60°C keeping constant temperature in range of 55 – 60°C. Constant temperature duration can be kept between 3.5 to 5.0 hours.

iv) Cooling of sleepers shall be gradual and cooling period is recommended in range of 2 to 3 hours with cooling rate not exceeding15°C per hour.

Extra one hour cooling of sleepers at ambient temperature before demoulding is desirable/recommended, if feasible keeping the total cycle time upto 12 hours to minimize difference in external and internal (inside) temperature of sleepers.

Mix design shall be revised, if minimum strength of 40 steam cured cubes is less than 40 N/ sq.mm (For Mix M-55) & 50 N/sq.mm (For Mix M-60) following the above mentioned stipulations on steam curing cycle. The steam curing cycle which is proposed to be adopted shall have prior approval of the inspecting official.

ANNEXURE-VII

Policy on setting up of New Concrete Sleeper Plant (CSP)

Railway Board's letter no.2004/TK-II/22/11/5 (shifting) dated 19.02.2021

There should not be any approval required from Railway Board for setting up any new Concrete Sleeper plant anywhere in India. However following stipulations are to be fulfilled.

1. Zonal Railways shall be asked to carry out an exercise of availability and requirement/demand of main line PSC concrete sleepers on the Railways every 2 years or as needed. During this exercise, Zonal Railway deficient in sleeper production shall be identified based on the gap between available latest rated capacity of CSPs (as per calculation of RDSO) and average sleeper demand for next 2 years period. An extra margin in sleeper requirement of 30% more than the demand in each zonal railway over next 2 years is proposed to be kept. This extra margin is considered to provide for extra capacity on all zonal railways for ensuring better competition as well as guarding against any sudden spike in demand due to sanction of more projects in a particular year or failure of one or more CSPs. Based on such exercise Zonal Railways shall be asked to submit sleeper demand statements. Only those Zonal Railways will be treated as deficient, which have projected average demand (with 30% extra margin discussed above) for 2 years period, more than the total rated capacity of CSPs in that Zonal Railways. The "Deficient Railway Zones" thus identified shall be advised by Railway Board to RDSO and all Railways for publishing on RDSO's website.

2. Any firm satisfying the qualifying requirements laid down in subsequent paragraphs is allowed to setup new CSP at any location to serve Railway sleepers requirements with an intention of supplying PSC sleepers from a location nearby consumption centers so that the cost of freight of sleepers is limited. Railways will give preference and priority (in terms of giving early inspections and approvals by RDSO) to firms desirous of setting up concrete sleeper plants in deficient Railways as identified in para 1 above. This is done to encourage new

firms to setup concrete sleeper plants in deficient Railways as Railways will gain in terms of lesser freight by setting up of new concrete sleeper plants. However, firms are free to setup concrete sleeper plants anywhere in India without the need of advance approval from Railways.

3. Firms desiring to setup new concrete sleeper plants in either a deficient Railways or any other Railway can submit proposal on a customized RDSO's web-portal (or in offline mode till such time the portal is not operational). The details of deficient Railways also will be available on the website.

4. The Concrete Sleeper plant at the new location should be set up on private land only. Required siding would also have to be developed at firm's cost, however required connectivity from existing railway yard shall be provided as per the extant rules, by the concerned zonal railway.

5. Firms desiring to setup new CSPs have to approach RDSO by application on a customized web-portal (or in offline mode till such time the portal is not operational) for setting up of new CSP along with compliance of latest STR, IR Specification for manufacturing of PSC sleepers, their Quality Assurance Plan (QAP) and layout plan of the proposed CSP. RDSO will scrutinize the proposal and approve for setting up of new CSP first as a Developmental Plant after necessary inspections and scrutiny.

6. Qualifying Requirements:

   Firms desiring to setup new CSPs shall fulfill the following eligibility criteria which shall be scrutinized by RDSO:

   (a) The firms should be of sound financial standing and should have a total turnover of at least Rs. 10 crores from all business activities in any of the preceding 3 financial years. In support of financial standing, necessary document as per latest instructions to be submitted.

   (b) The firms shall be financially solvent for at least Rs. 1.50 crores and a certificate to this effect issued by a Scheduled Bank shall be enclosed with the proposal.

7. Other terms and Conditions:

7.1 The term new CSP would mean CSP being set up at a new geographic location whether a new plant or a shifted plant. For shifting of concrete sleeper plants within the Zonal Railway, procedure as per Railway Board's letter No. 2004/Track-II/22/11/5 dtd. 22.02.2006 is to be followed.

7.2 New CSPs would require to offer sleepers duly loaded in railway wagons from a rail siding. New CSPs are required to develop such sidings at their own cost. Necessary connectivity from an existing yard shall be facilitated as per the extant rules in this regard.

7.3 New CSPs to have minimum production capacity of 2.4 lakh PSC BG line sleepers per annum.

7.4 Tenders for procurement of PSC mainline sleepers for Indian Railways requirements shall be dealt as per extant policy and instructions.

7.5 Once RDSO certification as a developmental CSP is available to a Concrete Sleeper Plant (CSP) for any category of PSC Sleeper, that CSP shall become eligible for all types of concrete sleepers requirements of all Railway zones and these plants are eligible to participate in all sleepers tenders of Railways as Developmental Plants.

7.6 After setting up of a new Concrete Sleeper Plant (CSP) at new location, its RDSO certification would be mandatory, to qualify as a Developmental Plant, eligible to participate in sleeper procurement tenders.

7.7 During tendering process of mainline PSC sleepers, as the product of New CSPs is not yet tested/proven, these will qualify as Developmental Plants. A suitable initial quantity of PSC sleepers till stabilization of production would have to be passed by RDSO.

7.8 Quantity of sleepers allocation on sleeper plants including the developmental plants shall be based on a competitive web based open online tendering process, including electronic reverse auction (e-RA).

7.9 RDSO's guidelines for upgradation from Developmental to proven/regular category for all types of PSC sleepers required on Indian Railways, shall be followed.

7.10 RDSO shall be certifying all concrete sleeper plants every 2-3 years and only RDSO certified plants will be eligible for supplying sleepers to Indian Railways.

7.11 RDSO and Railways may even take help of RITES and accredited third parties approved by National Accreditation Board for Certification Bodies (http://nabcb.qci.org.in/accreditation/ reg bod fsms.php) for inspection and certification processes, with onus of such inspections/certification from accredited laboratories/third parties on the sleeper manufacturers. Costs for all such quality tests and costs of certifications have to be borne by the concerned CSPs. However, final responsibility of quality and approvals shall rest with the RDSO and Railways only.

7.12 Once the Developmental Plants are certified as Proven/Regular/Approved by RDSO based on extant RDSO rules/guidelines, these will become eligible for the bulk/regular orders.

Annexure 2
To Part 2 Supply Requirements

SCHEDULE OF TECHNICAL REQUIREMENT (2023)
FOR
MANUFACTURE OF PSC SLEEPER
DOCUMENT NO.TDG 0046
(JUNE 2023)

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAYBOARD)

SCHEDULE OF TECHNICAL REQUIREMENT (2023) FOR MANUFACTURE OF PSC SLEEPER

DOCUMENT NO.TDG 0046

(JUNE 2023)

RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW–226011

SCHEDULE OF TECHNICAL REQUIREMENT (2023) FOR MANUFACTURE OF PSC SLEEPER

DETAILED INFORMATION

1.0 Name of Sleeper Plant:

a) Location :
b) Railway :
c) Nearby Railway Station :
d) Nearby Main Station :
e) Distance from Main & Nearby Station :
f) Telephone / Fax No.
g) Address :
   i) Office:
   ii) Factory :
h) Details of Production :
   i) Main Line Sleepers
   ii) 1 in 8½, Turnout Sleepers
   iii) 1 in 12, Turnout Sleepers
   iv) Wider Sleeper
i) Whether Plant is approved for manufacturing any other type of sleeper:

2.0 Method of manufacture (Long line, Stress bench etc.):

3.0 Contract details:

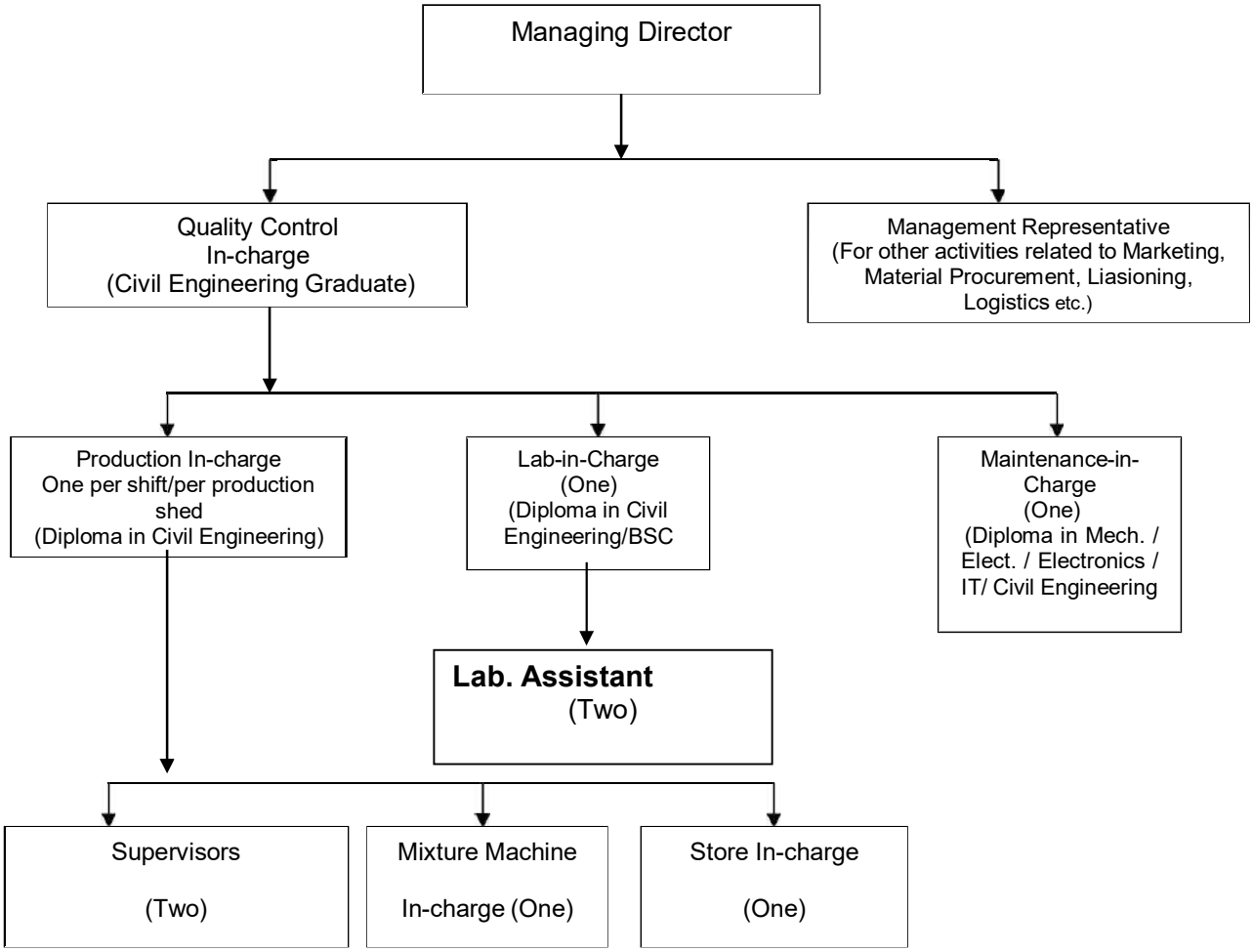
S.No.	C. A. No.	Railway	Type of sleepers	Quantity	Delivery date

4.0 QUALITY ASSURANCE PLAN & ISO CERTIFICATION:

S No	Item	Remarks
4.0.1	QAP Approved by RDSO (Yes / No)	
4.0.2	Date of approval of QAP by RDSO	
4.0.3	Remarks about implementation of QAP	
4.0.4	Whether Plant is having ISO: 9001-2015 (Yes / No)	
4.0.5	ISO Certifying agency & Date of validity of ISO certificate	
4.0.6	Whether Internal Quality Audit of plant is done by the firm at a frequency of at least once a year.	

5.0 ORGANISATION STRUCTURE:

Typical organization structure chart of a Concrete Sleeper Plant is as given below -



5.1 Minimum Level of Technical Supervision:

1. Overall Quality Control In-charge: At least One Graduate Engineer with Civil Engineering degree.
2. Shift In-charge for Production:
   (a) Minimum one supervisors with diploma in civil engineering for each shift per each casting shed.
   (b) Minimum one diploma engineer of mechanical/ electrical / electronic / IT /civil for maintenance of equipments.
3. Quality Control Supervisor for Laboratory and testing: Minimum one supervisor with Diploma in Civil Engg./ BSc .
4. Supervisors & Mixture Machine In-charge should be suitably qualified and their competency shall be certified by the overall Quality Control In-charge of the plant.

5.2 DETAILS FOR LEVEL OF SUPERVISION:

SNo.	Item	Name	Qualification	Experience
5.2.1	Nos. of Engineers			
5.2.2	Nos. of Technical Supervisors			
5.2.3	Name of separate Quality Control Supervisor for Laboratory			
5.2.4	Reason for any deficiency in manpower and planning of compliance.			

6.0 LAYOUT PLAN:

S No.	Item	Remarks
6.0.1	Owner Ship of land/ Lease Agreement with Railway.	
6.0.2	Notarized copy of agreement	
6.0.3	Remarks about deficiency , if any	
6.0.4	Whether Layout plan is fully with in land owned by plant and there is no unauthorized construction on railway property.	
6.0.5	Whether Layout plan is approved if yes then details of approving authority & reference	

6.1 **LAYOUT REQUIREMENT:**

S.No.	Item	Minimum Requirement	Existing	Remarks
6.1.1	Cement Godown	Min. covered godown area = 400 sq.m. (Storage as per IS:4082- 1996)		
6.1.2	HTS Storage	Minimum area of covered godown with EOT for handling of HTS wire coils= 100 Sqm.		
6.1.3	Insert Godown	Minimum Area of covered godown = 100 sqm.		
6.1.4	Steam curing chambers	Minimum no. of chamber = (0.65*N/32) rounded off to next whole number, where 'N' is the proposed daily production capacity. Chambers shall be vertical type with continuous digital temperature recording facility connected with storage of data with servo control automatic steam control arrangement. CSPs having present arrangement of Horizontal steam chamber may continue with existing arrangement.		
6.1.5	Submerged water curing tanks	Minimum Submerged water curing capacity required (In no of sleeper) = (0.65 to 0.75)*N Where, 'N' is monthly production capacity. Capacity of one tank should be maximum 3 days production. Tank should have minimum 30 cm free board.		
6.1.6	Stacking Area for finished sleeper	Minimum 2 month capacity. Maximum layers of sleepers in one stack should be 25. Minimum area=0.08*N sqm. Where N is monthly production capacity.		
6.1.7	Laboratory	**General :** Approximately 40 sqm **Sleeper testing area:** Approx. 30 sqm. The laboratory and sleeper testing area should be illuminated should have 100% power backup. The laboratory shall be provided with adequate air conditioners for temperature and humidity control.		
6.1.8	Inspecting Officials office	Minimum 14 sqm. Fully furnished with adequate communication facilities (Fax, Telephone, Computer with net connectivity etc)		
6.1.9	Rest House	Minimum two room sets fully furnished with attached toilet and other amenities including cooking facility. Min. area 25 sqm.		
6.1.10	Platform for turnout sleepers	At least two platforms of 70mx6m with gantry arrangement for handling for inspection of two sets at a time.		

7.0 Minimum requirement of Plant and Machinery for Concrete Sleeper Plant: Production Line

S. No.	Particulars	Qty.
7.1	**General**	
7.1.1	Concrete mixer along with Automatic Batching Plant using Microprocessor based Weigh Batcher, Pneumatically operated Aggregate Bins, Water meter and automatic Cement feeding, Capacity of Concrete 5m^3/hr. It should be capable of keeping digital record of ingredients used batch wise & data storage capability for one year production and should be capable of providing output in hard copy also.	1 no.
7.1.2	Standard weights of 50 Kg or highest permissible denomination totaling 50kg & Small denominations capable of measurement to the least count of 1 kg for calibration of weigh batcher	1000 Kg
7.1.3	Water measuring cans or automatic water meter for calibration of water meter	1,2,5,10&20 liters
7.1.4	Concrete sleeper Mould should be made with plate thickness 6/8mm with suitable stiffening arrangement to avoid in service distortion of moulds. Rail seat area & end plates are to be made with 10 mm thick Steel plate. Rail seat area should also be made with adequate measures to ensure proper rail seat slope and surface finish. *Minimum for a monthly production capacity of 5000 nos assuming one shiftper day (For higher production capacity no of mould required for daily production plus 20 % for maintenance purpose.)	240 nos.*
7.1.5	Laser based continuous profile measurement system for checking critical dimensions of PSC sleeper	As per production requirement subject to minimum 1 no.
7.1.6	Steam Boiler, Coal /oil fired/electrically operated capacity of 1000 kg/hr, complete withValves, mountings and Chimney. The key parameters of boiler such as steam pressure should be displayed. The boiler & its operators certification from statutory authority should be ensured.	1 no.
7.1.7	Double Acting Hydraulic Jacks 1000KN Capacity	4 nos.
7.1.8	Concrete Bucket for carrying and pouring concrete in moulds by bottom controlled discharge on Monorail Hoist, Movement should be motorized and operator controlled.	1 no.
7.1.9	High Frequency 9000 RPM (+/-4%) Vibrator arrangement bottom fixing type. For PSC line sleepers and Turnout sleepers, vibrators of min 2.0KW capacity are to be used. The vibrator should have recording facility for recording date and time of each operation. RPM should be digitally displayed during operation. Fixing arrangement of Vibrator to the bottom of moulds should be effective enough to transfer the vibrations.	16 nos.
7.1.10	Tachometer 10000 RPM capacity	2nos

7.1.11	High Frequency Converter for Vibrators	2 nos.
7.1.12	Vibrating Table for Cubes 15X 15 X 15, table 1mX 1m	1 no.
7.1.13	Electric Welding Arc Cutting M/c for HTS cutting at de-molding/ Abrasive disc cutter.	2 nos.
7.1.14	Trolley for transportation of Finished Sleeper	10 nos.
7.1.15	Overhead Wire Rope Hoist 2 T capacity, Electrically driven, traveling on I BeamSection, One each for demoulding and curing tank	2 nos.
7.1.16	Overhead Wire Rope Hoist for Steam Curing Chambers 3 T capacity, traveling on IBeam Section (Excluding the structure)	2 nos.
7.1.17	MS Gantry Crane electrically driven with Overhead Wire Rope Hoist 4/5 T capacity for Loading of sleepers and for putting sleepers in water curing tanks.	2 nos.
7.1.18	Diesel Generating Set for 125KVA	1 no.
7.1.19	Workshop Equipments • Lathe Machine • Tower Drilling Machine • AG-7 Angle Grinder • Electric Welding Set • Gas cutting Set • Misc. tools and dies • Misc. measuring tapes, scales	At least oneeach.
7.2	**For Production by Stress Bench Method**	
7.2.1	Steel Stress Benches made of channel and with Jack Anchoring Pockets, for holding 4 sleeper moulds. Design of stress bench should be such so as to have minimum distortion on account of service stresses. *For a monthly production capacity of 5000 nos BG Line sleepers assuming one shift per day however it may be increased in the multiples of the required production capacity.	60 nos.*
7.2.2	Hydraulically operated Pre-Stress Equipment with motorized unit, for 500KN jacks along with Pressure Gauges / pressure transducer with digital display and auto cut arrangement. The data should be displayed on monitor and should be stored for future analysis of past six months data.	2 Sets
7.2.3	Roller and Roller Stand	As per requirement
7.2.4	Trolleys for Transportation of stress benches	6 nos.
7.2.5	Steam curing chamber of adequate size and capacity to hold not more than eight benches containing four moulds each. Provision should be made for perforated pipes of adequate dia., in the steam chamber, for uniform distribution of steam. The steam curing should be with servo controlled valve with steam regulation with auto cut off arrangement following the steam curing cycle. The thermometers should be provided at both ends of steam chamber with digital display. The data of time v/s temperature in each chamber should be digitally displayed and stored and system should have sufficient memory to	

	store at least on year's data with facility to take out print shift wise.	
7.2.6	Pneumatic/Hydraulically operated tensioning gun with upto 2 KN load capacity or similar mechanized arrangement, for initial pulling of individual HTS strands so as to ensure uniform pulling of HTS strands.	02 nos.
7.2.7	Fixture for Insert pocket with rubber lining for holding the insert in fixed position in the mould and for easy demoulding & prevention of slurry leakage.(for stress bench and long line method both)	As per nos. of moulds
7.3	**For Production by long line method**	
7.3.1	End support embedded in ground with device permitting transfer of pre stress	As per design
7.3.2	Tensioning gun with digital pressure gauge, automatic cut off device and automatic elongation & force recording arrangement along with digital display and logging of data on computer with data storage & retrieval for at least six month.	02 nos
7.3.3	Casting bed with moulds. No of moulds should be 10 % more than required for daily production capacity.	As per design
7.3.4	Tarpaulin hoods for covering casting beds for steam curing. With proper drainage arrangement.	For each casting line
7.3.5	The steam curing should be regulated through servo controlled valve with auto cut off arrangement and regulation of steam to maintain the temperature as per steam curing cycle. The data of time vs temperature covering complete casting line should be digitally displayed and stored. The system should have sufficient memory to store at least on year's data with facility to take out print shift wise.	For each casting line

8.0 Laboratory Equipments:

S. No	Equipment	Quantity
8.0.1	Compression Testing Machine, 2000KN capacity, motorized with 2 nos. of pressure gauges (2000KN & 500KN) with digital interface for real time recording of testing results. The system should have sufficient memory to store data of one year production with reporting facility in hard copy as per format mutually agreed.	1 no.
8.0.2	Flexural Beam (Tension) Testing Machine with loading Jacks, 30 KN capacity. The machine should be capable of digital display and recording of data during testing with auto logging off time & date of testing. Data storage & retrieval capability should be for one year production.	1 no.
8.0.3	Motorized pumping unit with 1000KN capacity jacks, pressure gauge, rubber tubes and test frame complete for sleeper testing. The digital display of the load applied should be visible to observer simultaneously along with observation of crack. The data shall be recorded in computer with automatic date and time record with Batch no. and other details for traceability of record.	1 no.
8.0.4	15 cm cubes moulds confirming to IS:516	50 nos.
8.0.5	Beam moulds 10 x 10 x 50 cm size	2nos.
8.0.6	Slump Tester/Vee Bee Testing Machine	1 no.
8.0.7	Compaction Factor test Apparatus	1 no.
8.0.8	Electronic balance with 1gm least count (10 / 20 Kg. capacity) including weights.	1 no.

8.0.9	Blain's air permeability apparatus	1 no.
8.0.10	Vicat apparatus with dash pot and various needles	1 no.
8.0.11	Stop watch	1 no.
8.0.12	Le Chatelier mould for soundness test of cement	1 no.
8.0.13	Steel trowels for mixing cement paste	2nos.
8.0.14	Cement mortar cube casting machine with motor and time switch complete	1no.
8.0.15	7.06 cm (50 cm^2)mortar cube moulds	2nos.
8.0.16	Metallic scoop, pan type container and china tray etc	2 sets
8.0.17	Aggregate Impact testing machine	1no.
8.0.18	Aggregate crushing testing machine	1no.
8.0.19	Aggregate Abrasion testing machine	1no.
8.0.20	Electric thermostatic oven with display of temperature	1no.
8.0.21	Set of IS Sieves 40 mm and below up to 75 micron	1no.
8.0.22	Automatic electric sieve shaker	1no.
8.0.23	Proving rings of 2000 KN,1000 KN, 500 KN, and 100 KN capacity	1 each
8.0.24	1.5 Volt AVO meter	1no.
8.0.25	Glass cylinders and Beakers 50 - 500 cc capacity	1 set
8.0.26	Miscellaneous measuring gadgets like steel tape, Vernier, filler gauge etc.	2 sets
8.0.27	Inspection gauges for dimension checking of sleepers with digital display of parameters as approved by RDSO. (Optional)	2 sets
8.0.28	Master gauges for checking inspection gauges	1 set
8.0.29	Magnifying glass	1no.
8.0.30	Level table steel for checking gauges	1no.
8.0.31	pH meter & TDS meter (Digital)	1no.
8.0.32	Elongation and Flakiness Index Gauges	1 each

9.0 Requirement of IP based CCTV camera and sensors

9.1 IP based CCTV camera monitoring system for remote monitoring of sleeper production in CSPs of Zonal Railways. The live feed from these cameras installed at various critical locations (as given in the table below) shall be provided to concerned Zonal Railways and RDSO.

9.2 Installation of Sensors to automatically measure and record various parameters of design mix such as w/c ratio, moisture content of aggregates etc. production process such as stressing, vibration, curing, etc. and testing parameters such as cube strength, SBT test etc. and to automatically transmit these parameters to Zonal headquarter continuously.

9.3 Minimum requirement of IP based CCT camera and sensors

S. No.	ITEM	Minimum Requirement		REMARKS
		CAMERA	SENSORS	
A	**STORAGE OF RAW MATERIALS**			
1	Cement Godown	2	-	-
2	HTS Storage Area	1	-	Only 1 camera can be provided if HTS storage & Insert storage area are at same location and can be covered by one camera properly.
3	Insert Storage Area	1	-	
4	Coarse Aggregate Storage Area	1	-	Only 1 camera can be provided if CA & FA storage area are at same location and can be covered by one camera properly.
5	Fine Aggregate Storage Area	1	-	
6	Admixture Storage Area	1	-	
B	**CONCRETE PRODUCTION**			Sensor based mechanism system should be provided to remotely record and report weight of every ingredient of concrete in each batch of concrete.
1	Batching Plant Operator	1	-	-
2	Coarse Aggregate CA-1	1	1	Only 1 camera can be provided if CA & FA storage bins can be covered by one camera properly. One Sensor each for testing moisture content in each storage bin.
3	Coarse Aggregate CA-2	1	1	
4	Fine Aggregate (FA)	1	1	
5	Mixing of Concrete and output	1	-	-
C	**SLEEPER PRODUCTION**			
1	Production line for concreting	4	1	It should adequately cover the Sleeper casting, Mould preparation and HTS wire threading activities. One sensor for bench counting
2	Extension of HTS wires	1	1	One sensor for measuring extension of HTS wires
3	Application of Load for stressing of HTS Strands	1	-	-
4	Compaction of concrete / Vibration		1	One sensor per vibrator to measure RPM of vibrator and time of vibration.
5	Casting of concrete cubes / vibrating table	1	1	-
D	**CURING**			
1	Steam Curing Chamber	2	1	Minimum 2 cameras for covering entire steam curing area. One Sensor per Chamber to be

				provided. Temperature of steam curing and steam characteristics to be measured and to be captured in the overall system being used at the centralized location.
2	Water Curing	4	-	Minimum 4 cameras for covering entire water curing area.
3	De-tensioning and de-moulding area	2	-	Only 1 camera can be provided if both operations are at same location and can be covered by one camera properly.
E	**TESTING LABORATORY**			
1	Concrete Cube Testing	1	1	Only 1 camera can be provided if Concrete Cube Testing and Beam Testing are done at same location and can be covered by one camera properly.
2	Beam Testing	1	1	
3	Static Bending Test	1	1	-
4	Testing of various ingredients of concrete viz. Fine Aggregate, Coarse Aggregate, Cement Water, Admixture etc.	1	-	Should cover entire lab activities.
F	**TURNOUT ASSEMBLY AREA**	2	-	-
				-
G	**STACKING AREA**	4	-	-
				-
H	**OTHERS**	2	-	Entrance/Exit etc.
Note: The IP based CCTV cameras should be of high resolution and sensors should be of high sensitivity.				

CERTIFICATE

1. This is to certify that the information submitted in Paras 1 to 9 above is correct.

2. Testing of raw material shall be carried out as per relevant specifications, the details of raw material used is as given in as Annexure-I.

3. Record shall be maintained as per periodicity mentioned in annexure-II and on formats mentioned therein.

SIGNATURE OF PROPRIETOR

NAME & SEAL

Annexure-I

1.0 Raw material details & Source of raw materials

S No.	Items	Remarks
1.0.1	Cement (Brand name)	
	Location of cement plant	
1.0.2	HTS wire (BIS approved source)	
	Validity of BIS approval	
1.0.3	6 mm MS Bar (confirming to IS: 2265)	
1.0.4	Quarry name for CA1	
	Distance of quarry from the plant	
1.0.5	Quarry name for CA2	
	Distance of quarry from the plant	
1.0.6	Source name of Fine aggregate	
	Distance of source from the plant	
1.0.7	SGCI Inserts Source	
1.0.8	HDPE Dowel Source	
1.0.9	Water source	
	Quality and quantity	
1.0.10	Details of Admixture being used	

2.0 Characteristics of raw materials:

2.1 Coarse Aggregate (as per test report submitted at the time of approval of mix design)

S No.	Item	Coarse aggregates, CA1	Coarse aggregates, CA2
2.1.1	Specific gravity		
2.1.2	Impact Value		
2.1.3	Abrasion Value		
2.1.4	Crushing Value		
2.1.5	Combined Flakiness & Elongation Index		
2.1.6	Water absorption		

2.2 Fine Aggregate (as per test report submitted at the time of approval of mix design)

S No.	Item	Fine aggregate river sand	Fine aggregate crushed stone
2.2.1	Specific gravity		
2.2.2	Silt content		
2.2.3	Deleterious materials		
2.2.4	Zone		
2.2.5	Water absorption		

2.3 High Tensile Steel

S No.	Item	Remarks
2.3.1	Conforming to IS: 6006 specification	
2.3.2	Type (Plain, Strand): Nominal diameter	
2.3.3	Breaking Load & Elongation	
2.3.4	0.2% Proof Stress	
2.3.5	Young Modulus	

2.4 Water

S No.	Item	Remarks
2.4.1	Testing agency (Copy to be enclosed)	
2.4.2	pH value =	
2.4.2	Chloride content (mg/lit) =	
2.4.2	Sulphate content (mg/lit) =	
2.4.2	Inorganic Solids (mg/lit) =	
2.4.2	Organic Solids (mg/lit) =	
2.4.2	Suspended Solids (mg/lit) =	

2.5 SGCI Inserts

S No.	Items	Remarks
2.5.1	Name of Suppliers	
2.5.2	Cross check Heat nos. with IC issued by purchaser / Inspection authority	
2.5.3	BHN value =	
2.5.4	Phosphorous content (%) =	
2.5.5	Condition of storage in general	

2.6 6 mm M S Bar

S No.	Item	Remarks
2.6.1	Conforming to IS: 226	
2.6.2	Nominal diameter	
2.6.3	Breaking Load & Elongation	
2.6.4	Yielding stress	

2.7 Admixture

S No.	Items	Remarks
2.7.1	Conforming to IS:	
2.7.2	Properties	

Annexure-II

MAINTENANCE OF RECORDS AND DOCUMENTATION :

Following records shall be maintained for scrutiny at future dates.

1.0 Inventory of Raw materials:

1.1 Aggregates:

a) Coarse Aggregate (CA_1) 20 to 10 mm
b) Coarse Aggregate (CA_2) 10 mm and down.
c) Fine Aggregate (River Sand & Crushed Stone sand)

Details of Receipt, Source, Date of receipt, Truck Nos., Quantity, Balance, Remarks about quality and signature.

1.2 H.T.S. (IS: 6006) :

Date of Receipt, Truck No., Nos. of Coils, Serial No. of each coil, Source (Name of the firm), Details of test certificate, quantity, shift-wise consumption, balance and remarks whether test certificate is OK. Each lot shall bear a lot number and it should be mentioned in the production register to correlate, which HTS used in which sleeper.

1.3 Special Cement (IS 269):

Date of receipt, Source, quantity, Shift-wise consumption, balance, whether Test Certificate received, Details of Lab Tests done at site, Consistency, Initial & Final setting time, Fineness and 7 days mortar cube strength. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which cement used in which sleeper.

1.4 Inserts (IRS: T- 46) :

Date of Receipt, Truck No., Quantity, Source (Name of manufacturer), Consumption, Balance etc shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate which insert used in which sleeper.

1.5 Admixture (IS 9103):

Date of receipt, Source & conformance to IS codes, quantity, Shift-wise consumption, balance, whether Test Certificate received shall be recorded. Each lot shall bear a lot number and it should be mentioned in the production register to correlate with production of PSC sleepers.

2.0 Production Records:

2.1 Production Register: Batch Nos., Nos. Cast in each shift, cumulative production, Bench Nos., Cubes and sleeper testing details, Summary of Rejected and Usable sleepers shall be recorded in the printed register Daily production register shall be maintained for each design of sleepers separately (As per format no. XIV).

2.2 Tension Register: (As per format no. XII).

2.3 Steam Curing Records: (As per format no. XIII).

3.0 Testing Records:

a) Sieve analysis with combined granulometric analysis of aggregates. (As per format no. VI).
b) Combined Flakiness and Elongation indices test. (As per format no. VII).
c) Moisture content and modified (adjusted) quantities. (As per format no. V).
d) Records of Moulds and Benches and repairs.

e) Details of Pressure Gauges, Proving Rings and calibration of Pressure gauges.
f) Steam curing and Release cube testing.
g) Dimensional checking. (As per format no. XV).
h) Proforma for individual batch production records.
i) Proforma for monthly progress Report.
j) Standard deviation and characteristic strength of
ii) Release cubes.
iii) 15 days water cured cubes.
iv) Sleeper cracking loads / Rail Seat bottom and center top.
k) Dispatch Register.

4.0 Statistical Analysis & Report to RDSO:

Statistical analysis along with calculations shall be submitted to RDSO every month in Format-XVII. The statistical analysis should be carried out for following parameters –

i) Release cube strength
ii) 15 days water cured cube strength
iii) Flexural Beam strength
iv) SBT results

Similar analysis shall be carried out for each month and a consolidated report shall be submitted for a given financial year.

5.0 Calibration records:

The record shall be maintained as per Format-IX, X & XI for calibration of weigh batcher, Water meter, SBT machine, Concrete cube test machine, cement mortar cube testing machine, Beam testing machine and tensioning jacks. The schedule is given in Para 6.0 below.

6.0 CALIBRATION SCHEDULE:

Calibration of all the pressure gauges shall be done in the plant itself. Calibration of proving ring should be got done from a Govt. approved test house or a National Test House. The frequencies of all the pressure gauges and equipments are as follows:-

S. N.	Equipment	Frequency (For Normal PSC sleeper)	Frequency (For Turnout sleeper)
1	15 cm concrete cube testing machine (2000 KNCapacity)	As per Annexure-I of IRS/T-39	As per Annexure-I of IRS/T-39
2	Cement mortar cube testing machine (500 KNCapacity)		
3	Sleeper static Bend Test machine sleepers (1000 KN Capacity)		
4	Pre tensioning Jacks (500 KN capacity for single mould bench) & (1000 KN Capacity for twin mould bench)		
5	Pre- tensioning Jacks (1000 KN Capacity)		
6	Pre- tensioning Load cell		
7	Concrete beam testing machine (100 KN Capacity)		
8	Aggregate weigh batcher		
9	Cement Weighing Equipment		
10	Water Meter		
11	Admixture Dispenser		
12	Master gauges for checking correctness of dimensions measuring gauges.		
13	Dimension checking gauges.		
14	Proving Rings (All the Four-2000 KN, 1000 KN,500 KN, 100 KN)		
15	Weights & measures		
16	Tachometer		

Note :-

1) The items referred at S. Nos. 1 to 7 above should be calibrated by proving ring the sleeper plant itself.
2) The items referred at S. Nos. 8 & 9 should be calibrated by the dead weights and item at S. No. ~~9~~ 10 by measuring cans that should be available in the plant.
3) The proving ring should be calibrated from a reputed organization like the IITs, NCCBM or NPL etc.
4) The record of calibration of the all the above equipments should be maintained in a manner that previous record can be easily connected.
5) The calibration can be done more frequently at the discretion of the inspecting Official.

This is to certify that the information given as above is correct and If the information is found to be false then the firm will accept the action taken by Railway.

SIGNATURE OF PROPRIETER

NAME

SEAL

Annexure III

FORMATS

This section contains different formats of recording results of various testing /measurements prescribed. The firm should have sufficient no of serially numbered Registers printed for each format at all times. The formats should only be filled up by the minimum authority mentioned in QAP. The relevant pages of registers pertaining to production of sleepers being inspected must be scrutinized and signed by Railway official responsible for inspecting the sleepers. In addition to following formats Registers required as per contract condition including Site order register, Officer's Inspection Register and Over Sight Inspection compliance Register should be promptly filled up and presented to Railway Officials during inspection.

Format -I

SPECIFIC SURFACE OF SPECIAL CEMENT

WITH THE HELP OF BLAINE'S AIR PERMEABILITY APPARATUS

[IS: 4031 (Part-II) -1999]

Date:

Consignment of Cement = _____

Room Temperature =_____ ^{0}C

Weight of Sample taken =_____ gms.

Liquid falling time of standard cement (Ts) =_____ Seconds

Specific surface of the standard cement (Fs) =_____ cm^2 /gm

S. No.	Liquid falling time of sample cement	Average Time (T)	Remarks
1.			
2.			
3.			

Specific Surface of sample Cement (Fm) = Fs x $\sqrt{\frac{T}{Ts}}$ cm^2 / gm

=_____ cm^2/gm

∴ Specific Surface =_____ cm^2/gm

> 3700 cm^2 / gm. OK / < 3700 cm^2 / gm. NOT OK

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by AEN/XEN/CSP
Name
Designation

Format -II

NORMAL CONSISTENCY OF
SPECIAL CEMENT FOR INITIAL AND FINAL SETTING TIME

[IS: 4031(Part-III & Part-IV) -1988]

Date:

Consignment of Cement : _____

Room Temperature :_____ °C

Weight of Sample taken =_____ gms

S. No.	% of Water added	Volume of Water added in ml.	Time of adding water	Reading Time	Needle reading in mm from bottom of the mould	Normal consistency % (Minimum)	Remarks
1.							Needle reading between 5 to 7 mm from bottom of the mould indicates Normal Consistency.
2.							
3.							
4.							

∴Normal Consistency =_____ %

Quantity of water to be added for making paste of special cement for determination of initial and final setting time is 85 % of the normal consistency.

∴ Quantity of water to be added = 85 % of _____ ml = _____ ml.

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by AEN/XEN/CSP
Name
Designation

Format -III

INITIAL AND FINAL SETTING OF SPECIAL CEMENT

[IS: 4031 (Part-V) -1988]

Date:

Consignment of Cement **=** _____

Room Temperature **=**_____°C

i. **Weight of sample taken** **=**_____**gms**

Normal consistency	=	_____%
Quantity of water added	=	_____ml
Time of adding water	**=**	_____**minutes**
Mould ready for needling at	**=**	_____

S. No.	Reading Time at	Reading of needle from bottom of the mould in mm	Spot of needle for final setting time	Remarks
1.				Initial Setting Time
2.				
3.				is_____minutes.
4.				
5.				> 60 minutes OK
6.				
7.				< 60 minutes NOT OK
8.				

9.				
10				Final Setting Time
11				
12				is_____minutes.
13				
14				< 600 minutes OK
15				
16				> 600 minutes NOT OK
17				
18				
19				
20				

Initial Setting Time =_____minutes

Final Setting Time =_____minutes

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by AEN/XEN/CSP
Name
Designation

Format -IV

7 DAYS COMPRESSIVE STRENGTH OF

CEMENT MORTAR CUBES WITH STANDARD SAND

[IS: 4031(Part - VI) -1988]

&

SOUNDNESS OF CEMENT [IS: 4031-1988] (Part-III)

Date:

A: 7 Days Compressive Strength of Cement Mortar Cubes with Standard Cement

Consignment of Cement: _____

Room Temperature :_____°C

ii.
Normal Consistency (P) :_____% (See Normal Consistency test)

(i) Standard sand = 600 gms.
(3 parts, one part of each grade)

(ii) Cement 1 part =_____200 gms.

Total =_____800 gms.

∴ Water required for the preparation of mortar cubes in ml.

$$= \frac{(P + 3) \times \text{total weight of sample}}{4}$$

$$= \frac{(P + 3) \times 800}{4}$$

=_____ml

S. No.	Mortar cube casting		Mortar cube testing		Load In KN	Strength in N/mm^2	Minimum Strength in N/mm^2	Remarks
	Date	Time	Date	Time				
1								
2								< 37.5 N/mm^2 NOT OK
3								> 37.5 N/mm^2 OK.
4								

B: Soundness of cement

Expansion of Le Chatelier apparatus needles ----------(not more than 5 mm)

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by AEN/XEN/CSP
Name
Designation

FORMAT -V

MOISTURE ANALYSIS [IS: 383-2016]

Date **Shift**

S. No.	Description	Units	CA_1	CA_2	FA	Remarks
A.	Wt. of wet Sample	Gms.				
B.	Wt. of dried Sample	Gms.				
C.	Wt. of Moisture Sample (A - B)	%				
D.	Moisture = C x 100/B	%				
E.	Absorption	%				
F.	Free Moisture = (D - E)	%				
G.	Batch wt. (Dry)	Kgs.				
H.	Free Moisture = G x F/100	Kgs.				
	Adjusted wt. = (G + H)	Kgs.				
	Wt. Adopted	Kgs.				

W/C Ratio =

A/C Ratio =

If aggregates are wet, moisture content in coarse and fine aggregate is to be accounted for, so as to have total water as per approved mix design.

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by AEN/XEN/CSP
Name
Designation

FORMAT -VI

COMBINED GRANULOMETRIC CURVE (M55/M60) [IS: 383-2016]

Date **Time** **Next Due on**

	Wt. of CA_1 (20 mm) = gms.				Wt. of CA_2 (10 mm) = gms.				Wt. of FA (Sand) = gms.				Combined Passing			Combined Passing %	Grading Range
Sieve Size	Wt. Retained grams	Cum. Wt. Retained	Cum. % retained	% Passing	Wt. Retained	Cum. Wt. Retained	Cum. % retained	% Passing	Wt. Retained	Cum. Wt. Retained	Cum. % retained	% Passing	CA_1 %	CA_2 %	FA %		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
20 mm																	
10 mm																	
4.75 mm																	
2.36 mm																	
1.18 mm																	
600 µ																	
300 µ																	
150 µ																	

Signature of Railway Inspector **Name** **Designation**	**Signature of Lab In charge** **Name**
Countersigned by AEN/XEN/CSP **Name** **Designation**	

Format –VII

A. COMBINED FLAKINESS AND ELONGATION INDEX OF 20 MM AGGREGATE (IS: 383, 2016, CL:5.3) & (IS:2386, PART-1)

IS SIEVE		FLAKINESS INDEX		ELONGATION INDEX	
Passing through 20 Sieve(mm)	Retained on IS Sieve(mm)	Wt. of sample taken (At least 200 pieces) (A)	Weight of passed material on thickness gauge (B)	Wt. Retained material on Thickness gauge (C)=A-B	Wt. of Retained material on gauge (D)
20	16				
16	12.5				
12.5	10				
TOTAL					
Combined Flakiness and Elongation Index=[{B/A}+{D/C}]x100 %					
Combined Flakiness and Elongation Index					<40% (ok)

B. **COMBINED FLAKINESS AND ELONGATION INDEX OF 10 MM AGGREGATE (IS: 383, 2016, CL:5.3) & (IS:2386, PART-1)**

IS SIEVE		FLAKINESS INDEX		ELONGATION INDEX	
Passing through 20 Sieve(mm)	Retained on IS Sieve(mm)	Wt. of sample taken (At least 200 pieces) (A)	Weight of passed material on thickness gauge (B)	Wt. Retained material on Thickness gauge (C)=A-B	Wt. Retained material on gauge (D)
12.5	10				
10	6.3				
TOTAL					
Combined Flakiness and Elongation Index=[{B/A}+{D/C}]x100 %					
Combined Flakiness and Elongation Index					<40% (ok)

As per IRS-T-39 the above result of combined flakiness and elongation Index is less than 40 %.

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Countersigned by
AEN/XEN/CSPName
Designation

Format –VIII

A: DETERMINATION OF CRUSHING VALUE [IS :2386 (Part –IV) – 1963]

Aggregate crushing value = (B/A) x 100

Where B= Weight of fraction passing appropriate sieve,

A= Weight of surface dry sample, when carried out as per provision of para : 2.4 IS 2386 (pt.IV)

Note: 1. For aggregates passing through 20mm sieve, 3.35mm sieve size for separating finer to be used.

2. For aggregates passing through 10mm sieve, 1.70mm sieve size for separating finer to be used.

B: DETERMINATION OF IMPACT VALUE [IS: 2386 (Part-IV) -1963]

Aggregate crushing value= (B/A) x100

Where, B= Weight of fraction passing 2.36mm IS sieve,

A= Weight of oven dry sample, when carried out as per provision of para: 4.4 IS:2386(Pt. IV)

C: DETERMINATION OF ABRASION VALUE [IS: 2386 (Part-IV) -1963]

Aggregate crushing value= (B/A) x100

Where, B= Weight of fraction passing 1.7mm IS sieve,

A= Weight of oven dry sample, when carried out as per provision of para: 5.2 of IS:2386(Pt. IV)

Signature of Railway Inspector
Name
Designation

Signature of Lab In charge
Name

Signature by AEN/XEN/CSP
Name
Designation

FORMAT - IX

PROFORMA FOR CALIBRATION OF MACHINES / EQUIPMENTS AT CONCRETE SLEEPER PLANT [IS: 516]

Calibration – I

Calibration of Weigh batcher by Standard Dead Weight

Date Time Next due on

S. No.	Dead load (Kg)	Observed load			Average observed load	Error	% Variation	Remarks
		1	2	3				
1	50							
2	100							
3	150							
4	200							
5	250							
6	300							
7	350							
8	400							
9	450							
10	500							

Signature of Railway Inspector
Name
Designation

Signature of Quality control In charge
Name

Signature of AEN/XEN/CSP
Name
Designation

FORMAT - X

Calibration – II

Calibration of Water meter

Date Time Next Due on

S. No.	Actual water content (in liters)	Observed water content (in liters)			Average Observed water content (in liters)	Error	% Variation	Remarks
		1	2	3				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Signature of Railway Inspector
Name
Designation

Signature of Quality control In charge
Name

Signature of AEN/XEN/CSP
Name
Designation

FORMAT - XI

Calibration – III to VIII

Calibration of Static Bend Testing Machine, Concrete Cube Testing Machine,

Tensioning Jacks and Cement Mortar Cube Testing Machine

PROVING RING NO Date of Calibration Valid up to

Calibration of M/c Date & Time Next Due

Name of machine / equipment :									
S. No.	Proving Ring Deflection Reading	Actual load	Observed load			Average observed load	Error	% Variation	Remarks
			1	2	3				
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Signature of Railway Inspector
Name
Designation

Signature of Quality control In charge
Name

Signature of AEN/XEN/CSP
Name
Designation

TENSION REGISTER ***Format –XII (A)***

[IS: 6006 - 2014]
For Stress Bench method

Batch No. : Shift: Date of Cast: No. of Cast:

S. No.	Bench No.	Length of Wire (Bench) mm	Total cross section al area of HTS wire mm2	Young's Modulus of the Lot KN/ mm2	Initial Reading (KN)	Elongation in mm								Measured Elongation (B-A) (mm)	Pre-stressing force based on measured elongation from 50KN *P=E{(B-A)*a}/L	Total prestress force= (P+50)KN (Not less than486KN)	Remarks
						Reading at 2x25 KN (A) (mm)				Final reading at 2 x 243 KN (B) (mm)							
						Left Side		Right Side		Left Side		Right Side					
						U	L	U	L	U	L	U	L				

*P=E{(B-A)*a}/L,
where P(KN), = pre stressing force (from 50KN to final pre stressing value),
(B-A)(mm),=measured elongation
a(mm2), = total cross sectional area of HTW wires
L (mm) = effective wire length (from wedge to wedge clear length),
E(KN/mm2)= Young's modulus (lot wise/IC wise)

Note: 1. Breakage or slippage of HTS wire, if any shall be recorded.
2. Values of 'A' & 'B' shall be based on the respective sleeper drawings

Signature of Railway Inspector
Name
Designation

Signature of Shift Production In charge
Name

Counter signed by AEN/XEN/CSP
Name
Designation

TENSION REGISTER ***Format –XII (B)***

[IS: 6006 - 2014]
For Long Line Method

No. of Cast: Batch No. : Batch: Shift: Date of Cast:

Line no.	HTS wire no.	Length of Wire (Bed) mm	Cross sectional area of HTS wire mm2	Young's Modulus of the Lot KN/ mm2	Initial Reading (KN)	Elongation in mm		Measured Elongation (mm) (B-A)	Pre-stressing force based on measured elongation *P=E{(B-A)*a}/L	Total prestress force= (P+3)KN (Not less than27KN)	Remarks
						Reading at 3 KN (A) (mm)	Final reading at 27 KN (B) (cm)				

*P=E{(B-A)*a}/L, where, P= pre stressing force(KN), (B-A)=measured elongation (mm),
a= total cross sectional area of HTW wires(mm2),
L= effective wire length for entire length of bed(from wedge to wedge clear length)(Meter.)
E= Young's modulus (lot wise/IC wise)

Note: **1. Breakage or slippage of HTS wire, if any shall be recorded.**
2. Values of 'A' & 'B' shall be based on the respective sleeper drawings

Signature of Railway Inspector
Name
Designation

Signature of Shift Production In charge
Name

Counter signed by AEN/XEN/CSP
Name
Designation

STEAM CURING REGISTER **Format -XIII**

Name of Plant: **Name of Boiler Attendant :**_____ **Batch No.** _____

Shift : 1_____ Date: _____

Shift : 2 _____

Shift : 3_____ Shift: Day / Night

Chamber No.	1	2	3	4	5	6	7	8	9	10	11	12
No. of Bench												
Last Bench Cast at												
Cube No.												
Time	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature
07.00												
07.30												
08.00												
08.30												
09.00												
09.30												
10.00												

10.30												
11.00												
11.30												
12.00												
12.30												
13.00												
13.30												
14.00												
14.30												
15.00												
15.30												
16.00												
16.30												

Signature of Railway Inspector
Name
Designation

Signature of Shift Production In charge
Name

Counter signed by AEN/XEN/CSP
Name
Designation

Format-XIV

PRODUCTION REGISTER

On Date	
Monthly Production	
Cumulative	

Batch No. : **Date of Casting :** **Shift :**

Steam Chamber No.	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}	{10}
Bench No.										
Time of L.B.C										

RELEASE CUBE STRENGTH (STEAM CURED) to be tested by Lab in charge and Railway Supervisor.

Cube No.	Date of Testing	Time (in Hrs.)	Age (in Hrs.)	Weight (in Kgs)	Load (in KN)	N/mm^2	Remarks

WATER CUBE STRENGTH (WATER CURING)

Cube No.	Date of Testing	Time (in Hrs.)	Age (in days)	Weight (in Kgs)	Load (in KN)	N/mm^2	Remarks

FLEXURAL STRENGTH

Beam No.	Date of Testing	Age (in days)	Load (in KN)	Strength (in N/mm^2)	Remarks

STATIC BENDING TEST

Sleeper No.	Date of Testing	CENTRE		MR		MF		Remarks	Initial
		Top	Bottom	I	II	I	II		
		(KN)	(KN)	(KN)	(KN)	(KN)	(KN)		

Cement Source IC NO week no

HTS Source IC NO Heat No/s

SGCI Insert Source IC NO Heat No

HDPE Dowel Source IC NO Batch no

REJECTION DETAILS OF SLEEPERS I.C. No. : DATE OF ISSUE :

Total Rejected

No of sleepers passed as usables

Signature of Railway Inspector
Name
Designation

Signature of Shift Production In charge
Name

Signature of AEN/XEN/CSP
Name
Designation

Signature of Quality Control In charge
Designation

Format -XV

DIMENSION REGISTER

Date of Casting :_____ No. of Cast : _____

Batch No. :_____ Offered for inspection : _____

Nos. of useable sleepers :_____ Date for inspection : _____

Sleeper No.	Outer Gauge	Rail Seat		Toe Gap				Surface defects	Height Gauge			Slope		Wind Gauge		FTC	Remarks
		Firm side	RT side	Firm side		RT side			End	Rail Seat	Centre	Firm side	RT side	Firm side	RT side		
				Outer	Inner	Outer	Inner										
1A																	
1B																	
1C																	
1D																	
2A																	
2B																	
2C																	
2D																	
3A																	
3B																	
3C																	

Nos. of Rejected =_____, Nos. of Usable =_____, Nos. of MF tested =_____

Note: 1. It should be ensured that the rejected (Red Marked) and MF tested (Yellow Marked) sleepers should not be dispatched.

2. AEN/XEN to do Dimension check as and when possible.

Signature of Railway Inspector
Name
Designation

Signature of Shift Production In charge
Name

Signature of AEN/XEN/CSP
NameDesignation

Signature of Quality Control In charge
Designation

Format -XVI

SGCI Insert : DIMENSIONAL & WEIGHT CHECK LIST

Description: SGCI insert to RDSO/T-381 Alt.9 (or latest alteration) & specification IRS/T-46 (latest version)

SGCI Supplier:_____

Gauge Employed: Gauge and fixtures conforming to RDSO/T-454 Alt.9

IC no. and date (As issued by Purchaser/Inspecting authority)

S. No.	Heat No.	Pattern No.	Jig			Length of head 75±1	Thickness of stem 20/25+2/-1	Hole dia 22+1/-0	Width of head 67+1/-0.5	Top radius	Gating position	Square gauge	Wt in Kg. 1.55-3%	Soundness through hammer test
			G	G1	G2									

No. of inserts Checked_____, No. of inserts passed_____,

No. of inserts rejected_____, Rejection Rate :

Note:

1. Railway Inspector will check 1% inserts on random basis.
2. AEN/XEN will check at least 20 inserts, once in 2 weeks on random basis. He will also ensure that tests prescribed for Rly Inspectors are being conducted.
3. Other Instructions contained in Board's letter no. 98/TK-II/22/11/17/Pt. Policy, dtd. 11.08.2003 are to be adhered to.

Signature of Railway Inspector
Name
Designation

Signature of Quality Control In charge
Designation

Signature of AEN/XEN/CSP
Name
Designation

Format –XVI A

SGCI Insert : DIMENSIONAL & WEIGHT CHECK LIST

Description: SGCI insert to RDSO/T-6901 Alt.5 (or latest alteration) & specification IRS/T-46 (1996) (latest version)

SGCI Supplier:_____

Gauge Employed: Gauge and fixtures conforming to RDSO/T-6943 Alt.3 IC no. and date (As issued by purchaser/Inspecting authority)

S. No.	Heat No.	Pattern No.	Jig			Length of head 76 +1/-0.5	Thickness of stem 25/35 +2/-1	Hole dia 23+0.5/-0	Width of head 71+1/-0.5	Top radius	Gating position	Square gauge	Wt in Kg. 1.484-3%	Soundness through hammer test
			G	G1	G2									

No. of inserts Checked_____, No. of inserts passed_____,

No. of inserts rejected_____, Rejection Rate:

Note:

1. Railway Inspector will check 1% inserts on random basis.
2. AEN/XEN will check at least 20 inserts, once in 2 weeks on random basis. He will also ensure that tests prescribed for Rly Inspectors are being conducted.
3. Other Instructions contained in Board's letter no. 98/TK-II/22/11/17/Pt. Policy, dtd. 11.08.2003 are to be adhered to.

Signature of Railway Inspector
Name
Designation

Signature of Quality Control In charge
Designation

Signature of AEN/XEN/CSP
Name
Designation

Format -XVII

STATISTICAL ANALYSIS OF CONCRETE STRENGTH AND STATIC BENDING STRENGTH TEST ON PSC SLEEPERS

SLEEPERS FOR THE PERIOD: FROM_____TO _____

i) NAME OF THE FIRM_____ LOCATION OF PLANT _____ RAILWAY_____

ii) TYPE OF SLEEPERS (MBC, TURNOUT & OTHER) TO DRG. NO RDSO/T – 2496 OR Drg. No. _____

ii. Mix design approved by RDSO Vide letter----------
iii. Compliance of last Over site inspection pending if any----------
iv. Last inspection of Railway official on----------

A. CUBE STRENGTH :

Batch No. From _____ To_____	No. of Cube s	Range N/mm^2		Mean Value N/mm^2	Standard Deviation SD (N/mm^2)	Characteristic value (N/mm^2)	Coefficient of variation CV (%)	No. of observations below the minimum specified values i.e. 55/ 60 (N/mm^2)	No. of batches		Remarks
		Max	Min						Double Testing	More than double testing	
Steam cube (Release strength)											
Water cube (15 days strength)											

B. FLEXURAL STRENGTH OF CONCRETE BEAM:

S. No.	Batch No.	Load (P) (KN)	Flexural strength (N/ mm^2)

Format – XVII Contd..

C. STATIC BENDING STRENGTH TEST RESULTS UPTO CRACKING LOAD OF MBC, TURNOUT, OTHER SLEEPER. :

Description	Batch No.	No. of sleepers tested	Range (KN)	Mean value (KN)	Standard Deviation (KN)	Characteristic Strength (KN)	Coefficient of variation %	No. of observations below the min. specified values	No. of sleepers & No. of batches		Up to date No. of sleepers	
			Min	Max					Sleeper	Batch	Sleeper	Batch
Center top												
Rail Seat Bottom												

D. CONCRETE MIX DESIGN USED DURING THE PERIOD: FROM_____To_____

(A) A/C Ratio _____ (B) W/C ratio _____ (C) Mix Proportion CA-I:____% CA-II_____%, FA_____%

E. SOURCE OF CEMENT USED DURING THE PERIOD:

F. MEASURES TAKEN TO IMPROVE UPON THE DEFICIENCIES OBSERVED IN ABOVE TEST:

Note: 1. Separate analysis shall be submitted for MBC, Turnout and other sleepers.

2. The analysis should be for one calendar month.

3. Indicate change of source of raw materials, water etc, if any furnish a photocopy of their test report (s)

Signature of Railway Inspector
Name
Designation

Signature of Quality Control In charge
Designation

Signature of AEN/XEN/CSP
Name
Designation

Counter Signature of Dy.CE/CSP/HQ
Name

Format -XVIII

YEARLY STATISTICAL ANALYSIS
OF
CONCRETE STRENGTH AND STATIC BENDING STRENGTH TEST OF PSC SLEEPERS

SLEEPERS FOR THE PERIOD: FROM_____TO _____

a) Name of The Firm : _____
b) Location of Plant : ____
c) Railway : _____
d) Type of Sleepers (MBC, Turnout & Other) To Drg. No RDSO/T -2496 or Drg. No. _____

Month	Concrete Strength Water cured					SBT(Rail Seat)				MF			
	Nos. of cubes	Max	Min	CS	CV	Max	Min	CS	CV	Max	Min	CS	CV
April													
May													
June													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
Jan													
Feb													
Mar													

Signature of Railway Inspector
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Name
Designation

Counter Signature of Dy.CE/CSP/HQ
Name

Format -XIX

HTS Inspection Summary

Source: **BIS approval validity:**

IC No. **Date of supply:**

Sl. No.	Description	
1	Lay length	
2	Weight/meter	
3	Breaking load	
4	% elongation	
5	0.2% proof stress	
6	Sulphur & phosphorus content	
7	Coil dia	
8	Packing condition	
9	Sealing of coils	
10.	Any sign of rusting of HTS wires	

Note

1. Item 1-5 are to be recorded from the Tests conducted at HTS factory and recorded in Original IC.
2. Item 6 is to be recorded from the Manufacturer's test certificate.
3. Item 7-10 are to be tested at CSP.

Signature of Railway Inspector
Name
Designation

Signature of Quality Control In charge
Designation

Signature of AEN/XEN/CSP
Name
Designation

Format -XX

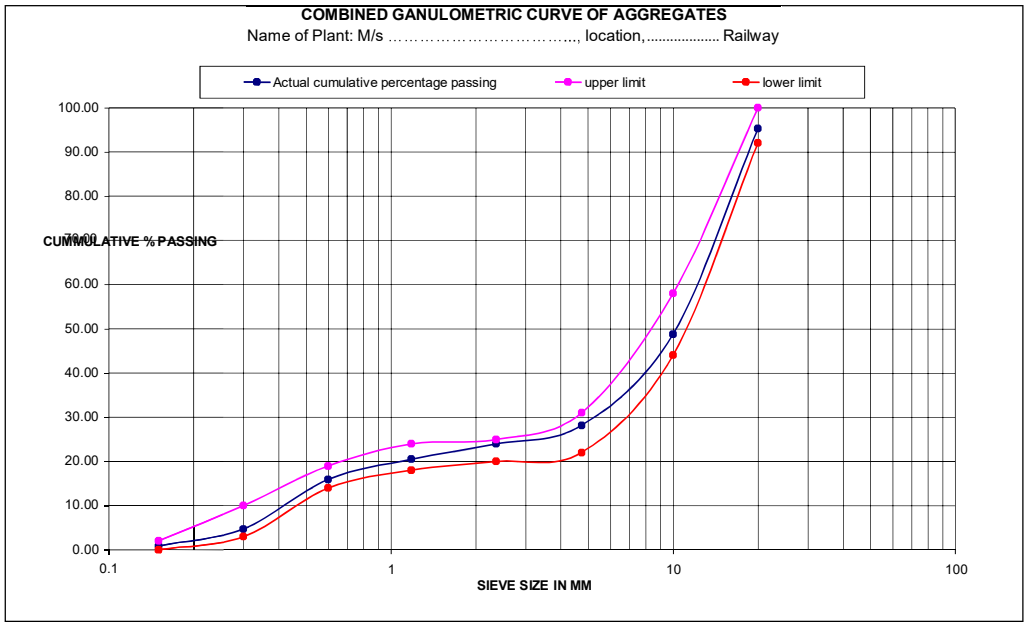
Details of Mix Design

	Mix Design parameters :		
1	Mix Design ⟶	M-55	M-60
	RDSO Authority of approval		
	Date of approval		
	Cement	Kg	Kg
	Coarse aggregates, CA_1	Kg	Kg
	Coarse aggregates, CA_2	Kg	Kg
	Fine aggregates	Kg	Kg
	Admixture	kg	kg
	Water	Liters	Liters
	A/C Ratio		
	W/C Ratio		
	Sand : CA_1 : CA_2 ratio		

11.0 Granulometric limits for combined aggregates:

To be prepared for each Design mix separately as below:

Sieve Size	%Limits (lower – higher)	Limits % passing.
20 mm	…. - …..	…..
10 mm	…. - …..	…..
4.75 mm	…. - …..	…..
2.36 mm	…. - …..	…..
1.18 mm	…. - …..	…..
0.60 mm	…. - …..	…..
0.30 mm	…. - …..	…..
0.15 mm	…. - …..	…..



12.0 Steam Curing Cycle: The steam curing cycle for winter season and summer seasons, if varies may be given separately.

The following cycle is approved as follows:

1.	Pre steaming	=	…. hrs. [> IST of cement]
2.	Rise in temperature	=	…. hrs.
3.	Constant Temp.	=	…. hrs.
4.	Cooling time	=	…. hrs.

	Total	=	….. hrs.

13.0 Submerged water curing: …. days.

14 / 21 days compressive strength on the basis of 40 nos. of submerged water cubes & 40 nos. of steam cured cube analysis is found …… N/mm^2 and ……. N/mm^2 respectively.

14.0 Statistical Analysis of Steam cured and water cured cubes: following details shall be submitted -

S. No.	R	M	SD	CS	CV	Remarks
1	Steam cured cubes					
2	Submerged water cured cubes					

Statistical analysis is done to assess the variation in test results. This analysis contains standard deviation, range of maximum & minimum, coefficient of variation (CV). By knowing the standard deviation, one can obtain characteristic value of corresponding item. Statistical analysis brings out overall health of the concrete sleeper plants. If the testing for working out statistical analysis is not done correctly the basic purpose of doing this whole exercise would be defeated.

Formulae are given below to calculate the mean value, standard deviation & coefficient of variation.

SAMPLE CALCULATION OF STATISTICAL ANALYSIS

S. No.	Compressive Strength (x) in N/mm^2	Frequency (f)		F*x	ABS(X- X_{mean})	f * ABS(x-x_{mean})^2	Remarks
1	52.00	1	I	52.00	5.82	33.87	
2	53.33	2	II	106.66	4.49	40.32	1) Nos. of observations,
3	55.56	2	II	111.12	2.26	10.22	N = 40 nos.
4	56.00	3	III	168.00	1.82	9.94	
5	56.89	2	II	113.78	0.93	1.73	2) Mean, X_{mean} = f*x / N
6	57.33	5	IIIII	286.65	0.49	1.20	= 2312.91 / 40
7	57.78	6	IIIIII	346.68	0.04	0.00	= 57.82 N/mm^2
8	58.22	2	II	116.44	0.40	0.32	3) Standard Deviation
9	58.67	6	IIIIII	352.02	0.85	4.34	SD = SQRT{f * ABS(x-x_{mean})^2 /N}
10	59.56	4	IIII	238.24	1.74	12.11	=1.9598
11	60.00	4	IIII	140.00	2.18	19.00	
12	60.44	3	III	181.32	2.62	20.59	4) Characteristic Strength, CS
13							F_{ck} = (X_{mean} – 1.96 * SD)
14							5) Coefficient of Variation,
15							Cv = (SD x 100) / X_{mean}
16							
17							6) Range = 8.44 N/mm^2
18							(from 52.00 to 60.44)
19							
20							
21							

22							
23							
24							
25							
..							
..							
	Total	40		2312.91		153.64	

Signature of Railway
InspectorName
Designation

Signature of Quality Control In charge
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Designation