

Government of India
Ministry of Railways
Research Designs and Standards Organisation (RDSO)
Manak Nagar, Lucknow (INDIA) -226011

Global Notice

(Notice No. CT/SRC/EOI/USP dated 02.01.2018)

for

‘REQUEST FOR PROPOSAL’

Ministry of Railways, Research Designs and Standards Organisation (R.D.S.O.), Lucknow is inviting the proposal from the firms whose product (USP) qualifies the technical criteria given in Annexure-C for short-listing the products for considering for **‘Field Trial for reduction in the ballast cushion upto 100mm in track using Under Sleeper Pads (USP) from standard ballast cushion of 300/350mm on Indian Railways’**.

Firms who can supply the USP for ballast thickness reduction purpose meeting the technical criteria i.e. generic specification / performance parameters of USP as given in Annexure-C of this document are requested can see the complete details and document on RDSO’s website www.rdso.indianrailways.gov.in→Tenders →EoI. For any clarification, Firms may contact Director/Track-IV, RDSO, Lucknow on Telephone No. +91-522-2452796 or/and email: dtd5rdso@gmail.com on any working day for further details.

The firms are requested to submit the proposal and requisite details in the prescribed format to Director/Track-IV, Anusandhan Bhawan, Track Design Directorate, RDSO, Manak Nagar, Lucknow –226011 (INDIA) **upto 15.02.2018**.

Firms submitting proposals shall note that:

1. This ‘RFP is only for the purpose of short listing of the product i.e. USP meeting the stipulated ‘Generic Specification/Performance parameters of USP’ as given in Annexure-C of this document for considering for undertaking field trial of USP in the Zonal Railways of Indian Railways for substantial reduction in the ballast cushion upto 100mm from standard cushion of 300-350mm.
2. Budgetary cost of the proposed under sleeper pads suitable to BG line sleepers to drawing No. RDSO/T-2496 and wider sleeper to drawing No. RT-8527 are also to be given per sleepers separately.
3. The relevant values/properties of the proposed USP for ballast thickness reduction purpose meeting the technical requirements as given in Annexure-C needs to be provided.

Director/Track-IV
for Director General (Track)
RDSO, Lucknow
(for & on behalf of President of India)

Instructions/ Guidelines for the firms submitting proposals against this Global 'Request for Proposal' (RFP)

1. DISCLAIMER:

Indian Railways reserves the right not to proceed with the process or at a later stage to change the process as per the requirements of Indian Railways. It also reserves the right to decline to discuss the process further with any party submitting the proposal. This RFP shall not be considered in any way a proposal for procurement of USP for ballast reduction purpose but only for short- listing of product i.e. USP meeting the technical requirements i.e. generic specifications / performance parameters of USP given in Annexure-C for considering for undertaking field trial for ballast thickness reduction purpose. The intending participants will furnish proposals at their own cost and no claims, whatsoever; in this reference will be entertained by the Railways.

2. PURPOSE OF INVITING RFP:

The purpose of this RFP is to short-list the product i.e. USP for considering for undertaking field trial for ballast reduction purpose and invite the proposals from firms who can supply the under sleeper pads (USP) meeting technical parameters as per Annexure-C to substantially reduce the ballast cushion upto 100mm from standard cushion of 300-350mm on important routes on Indian Railway Network under prevailing and envisaged operating conditions for 25T axle load.

With above objective, Indian Railways seeks to establish proven/promising and cost effective USP through field trial for ballast reduction purpose, meeting the technical requirements i.e. generic specifications / performance parameters of USP for their possible use in future in Indian Railways. The generic specifications / performance parameters of USP for ballast reduction purpose is given in this document as **Annexure- 'C'**.

3. GENERAL INSTRUCTIONS FOR SUBMITTING PROPOSALS to the RFP:

3.1 Eligibility criteria

- i) Applying firm should be an existing manufacturer / supplier of USP or should have Collaboration Agreement or Joint Venture partnership with the firm which is the existing manufacturer / supplier of USP. However, the firm/JV who have past experience in possible use of USP for ballast thickness purpose or have done R&D for possible use of USP for ballast thickness reduction purpose will be preferred.
- ii) The USP for ballast thickness reduction purpose offered by the Firm should meet the generic specifications / performance parameters mentioned in this document (Annexure – 'C').

iii) The proposals with USP not meeting the technical requirements given in Annexure-C shall summarily rejected without further consideration.

3.2 If the offered USP is a proven product, then the Firm shall provide the details of supply & its performance on any of the World Railway in last three years in the following format. However, if the offered USP is not proven one for ballast thickness reduction purpose meeting the technical requirements given in Annexure-C in that case the firm can submit performance details of their earlier proven/supplied product i.e. USP.

Year of supply	Name of the railway where proposed USP has been supplied		Approximate quantity of such USP		Specification*/ performance parameters of the supplied USP		Performance Guarantee Given (if any)	
	For ballast thickness reduction	For other track improvement purpose	For ballast thickness reduction	For other track improvement purpose	For ballast thickness reduction	For other track improvement purpose	For ballast thickness reduction	For other track improvement purpose
2014-15								
2015-16								
2016-17								
2017-18 (till current month)								

* Specification / performance parameters of supplied USP for ballast thickness purpose or for other reasons can be attached as separate document while submitting the RFP proposal.

3.3 Budgetary estimate of approximate cost of USP for Ballast thickness reduction for use with BG line sleeper to Drg. RDSO/T-2496 and for wider sleeper to Drg. No. RT-8527 including its fixing / installation cost to be submitted in a separate envelop. These drawings are attached as Annexure-1 & Annexure-2 to Annexure-C respectively.

3.4 Technical details to be provided by firm: technical details such as relevant values/properties of the proposed USP for ballast thickness reduction purpose as per the technical requirements given in Annexure-C, shall be submitted by the firm along with their proposals. The firm will be required to furnish supporting documents (such as lab reports, field reports etc.) to establish that they are meeting the laid down requirements. Incomplete proposals shall be summarily rejected.

3.5 The details submitted by the firm shall be scrutinized by RDSO. The deficiency as observed in the proposal during technical scrutiny or additional information as considered necessary will be advised to the firm. The additional information must be made available by firm within one month of intimation.

3.6 Submission by firms: The firm shall ensure the submission in the format given in **Annexure - B**.

3.7 The submission by the firms shall be made to Director/Track-IV, RDSO, Anusandhan Bhawan, Manak Nagar, Lucknow- 226011 by **15.02.2018** (17:30 Hrs) in the enclosed

Format for “**Letter of Response at Annexure B**”. In the proposal submitted, the firms should mention RDSO’s Notice No.CT/SRC/EOI/USP dated 02.01.2018.

- 3.8 The firms must furnish the application form & details **in duplicate** as required in the enclosed Format for “**Letter of Response**” at **Annexure-B** and details stipulated in **Annexure-C**. All pages of the documents should be signed with stamp.
- 3.9 The firm shall legally indemnify Ministry of Railways against any possible claims/legal/other disputes at present or which may arise in future from any other party in connection with the intellectual property rights of the drawings and design or any other documents submitted by the firm or any other patent rights.
- 3.10 RDSO reserves all the right of this exercise. In case of any doubt/dispute, decision of RDSO shall be final.

4. SELECTION CRITERIA:

The firms meeting the eligibility criteria will be shortlisted by RDSO for considering for undertaking field trial of their product i.e. USP for ballast thickness reduction on Indian Railways, broadly based on the following criteria:

S. No.	Item
1	Technical suitability of proposed USP for ballast thickness reduction purpose as per the generic specification / performance parameters given in Annexure-C
2	Experience and expertise in the field of USP for ballast thickness reduction or for other track improvements purpose
3 a)	Details of supplies made of USP for ballast thickness reduction or for other track improvement purpose
b)	Performance of the USP for ballast thickness reduction or for other track improvement purpose in track for 3 years duration

**Director/Track-IV,
For Director General (Track)
RDSO, Lucknow**

FORMAT FOR LETTER OF RESPONSE

Respondents Ref No.:

Date:

Director/Track-IV
Building: Anusandhan Bhawan,
Research Designs & Standards Organization (RDSO)
Ministry of Railways, Manak Nagar
Lucknow (INDIA), Pin - 226011

Dear Sir,

Subject: RESPONSE TO – GLOBAL RFP FOR PARTICIPATION

1. We, the undersigned, offer the following information in response to the ‘Request for Proposals’ sought by you vide your Notification No. CT/SRC/EOI/USP dated 02.01.2018.
2. We are duly authorized to represent and act on behalf of _____ (hereinafter the “respondent”)
3. We have examined and have no reservations to the RFP Document including Addenda No(s)_____.
4. We are attaching with this letter, the copies of original documents defining: -
 - 4.1 The Respondent’s legal status;
 - 4.2 Its principal place of business;
 - 4.3 Its place of incorporation (if respondents are corporations); or its place of registration (if respondents are cooperative institutions, partnerships or individually owned firms);
 - 4.4 Self certified financial statements of last three years, clearly indicating the financial turn over and net worth.
 - 4.5 Copies of any market research, business studies, feasibility reports etc sponsored by the respondent, relevant to the project under consideration
5. We shall assist Ministry of Railways (MoR) and/or its authorized representatives to obtain further clarification from us, if needed.
 - 5.1 RDSO and/or its authorized representatives may contact the following nodal persons for further information on any aspects of the Response:

S. No.	Contact Name	Address	Telephone	E Mail

6. This application is made in the full understanding that:
 - 6.1 The RFP is only for short-listing of the products i.e. USP for considering for undertaking field trial of USP and the firms who can supply the USP meeting generic specification / performance parameters for carrying out field trial by Zonal Railways of Indian Railway to substantially reduce the ballast cushion upto 100mm from standard cushion of 300-350mm and suitable for use on IR network under prevailing & envisaged operating conditions for 25T axle load and not for its procurement.
 - 6.2 Information furnished in response to RFP shall be used confidentially by RDSO as required. Confidentiality of the information furnished by the firm in this RFP will be maintained by RDSO.
 - 6.3 RDSO reserves the right to consider or not to consider any or all applications, cancel the RFP without any obligation to inform the respondent about the grounds of same.
7. In response to the RFP, we hereby submit the following details annexed to this application -
 - 7.1 Turn-over of the firm during the last three financial years with the copies of annual report.
 - 7.2 Details of customer(s)/Railways where USP for ballast thickness reduction have been supplied by the firm including quantity during last 3 years.(Para 3.2(i))
 - 7.3 Experience and expertise for the USP for ballast thickness reduction proposed in RFP.
 - 7.4 Details of supply and performance as detailed in Para 3.2 of Annexure-A.
 - 7.5 Specification / performance parameters of supplied USP for ballast thickness purpose or for other reasons as per para 3.2 of Annexure-A.
 - 7.6 Budgetary cost as per 3.3 of Annexure-A.
 - 7.7 Complete details of the USP for ballast thickness reduction with drawing and specification as per **Annexure-C** of this RFP.
 - 7.8 Details of Intellectual Property Rights (IPR) held, patent filed/held and MoU/ agreement signed.
 - 7.9 Details of ISO/equivalent certification, if any.
 - 8.0 Documents in proof of Eligibility criteria
 - 8.1 Para-wise compliance of Requirements as per **Annexure-C** and supporting documents.
8. The undersigned declare that the statements made and the information provided in the duly completed application are complete, true, and correct in every detail.

Yours sincerely,
(Signature)
NAME:

In the Capacity of duly authorized to sign the
response for and on behalf of
Date:

Generic Specification/Performance Parameters of Under Sleeper Pads for ballast thickness reduction in Indian Railway BG Tracks

World over, use of 'Under Sleeper Pads' (USP) is gaining popularity for mainly, improvement in track quality & ballast protection and for noise & vibrations mitigation purpose. However, Indian Railways is exploring the use of USP for possible reduction in thickness of ballast cushion upto 100 mm (as indicated in the UIC Code 713-1 on Under Sleeper Pads) from standard cushion of 300/350mm on its broad gauge track without adversely affecting track behavior on lateral & longitudinal track resistance, ballast & formation pressure, track settlement, performance of sleeper and other track components, retentivity of track geometry etc. in comparison to normal track conditions i.e. in full ballast cushion conditions. The typical operating conditions of BG track on IR are as under:

Existing Track Structure on Indian Railways:

UIC 60 grade-880 Rails laid on Pre-stressed Concrete Sleepers at sleeper density 1540/1660 nos. per km with elastic fastenings and ballast cushion of 300/350 on important Broad Gauge routes.

Operating conditions of IR:

i) Axle load and Speed

Traffic Type	Axle Load	Speed upto
Goods	25T	100 kmph
Passenger	22T	160 KMPH (Existing) 200 kmph(Proposed)

- ii) Traffic Density, GMT(A Route) : 7.0 to 130
- iii) Electric Traction (Minimum) : 25 KV AC.
- iv) Track Circuits : DC (2 – 6 volts) / AC 110V & AFTC
- v) Gauge : Broad Gauge, Nominal (1676 mm)
- vi) Ambient Temperature : (-) 5⁰C to 50⁰C.
- vii) Rail Temperature : (-) 15⁰C to (+) 76⁰C.
- viii) Humidity : Max. 100%

Based on various proposals/submissions received against the 'Expression of Interest' (EOI) invited which was opened in May 2016 and user railways specifications, generic specifications/performance parameters of under sleeper pads suitable for use on Indian Railways for conducting the field trials for evaluating the performance of USP under reduced ballast thickness conditions, are described in following paras. The product / system will be shortlisted for considering conducting of the field trial on the basis of information furnished by the applicants as per technical conditions of RFP. The values given against any parameter are mainly indicative for guidance. However the USP must serve the intended function of substantial ballast thickness reduction and be sufficiently durable under Indian Railway

conditions without causing any adverse effect on track performance which will be verified in trial on Indian Railway Track.

(A) Specification of the USP –

1. Material :

USP shall be made of elastic resilient material suitable for purpose of USP for ballast thickness reduction and meeting all required functional specifications given below. USP are to be made from durable material with no component capable of diffusion. The type of material is to be defined in the data sheet.

2. Thickness of USP –

The USP should be thick enough to achieve a long lifespan but not too thick for the track laying machine and maintenance machine. Thickness of USP shall preferably be between 5 to 12 mm excluding thickness of mesh/bonding layer.

3. Static & Dynamic Stiffness/Bedding Modulus of USP:

The static vertical bedding modulus is one of the basic characteristics of the USP measured as pressure per unit deflection. The manufacturers can suggest the values of this parameter for their offered USP keeping in mind the primary objective of USP is to reduce ballast thickness without degrading track performance, however it is preferred that the USP should have the 'Static stiffness (static vertical bedding modulus) of USP on concrete block with Geometric Ballast Plate (GBP), preferably equal to or more than 0.10 N/mm^3 . The static bedding modulus shall be determined as per test procedure given in EN 16730 (latest version) for track category TC3.

Test values of 'Low frequency dynamic bedding modulus' determined as per EN 16730 shall also be provided along with necessary correlation with static bedding modulus along with load-deflection graphs indicating secant bedding modulus. Bedding modulus curve should be plotted with static and dynamic bedding modulus together versus pressure at different low frequency at 4Hz/5Hz and 10 Hz.

4. Transition Zones:

For transition zones, static stiffness of USP should vary gradually from stiff / medium to soft preferably up to 0.1 N/mm^3 . This modulus aims to provide a balance between the increase in sleeper contact area and increase in total system deflection. Transition zone is to be designed in sections of homogeneous stiffness of length $0.5V$ (where V is speed in m/s) and with differential rail deflection between one section to the next section is limited to 0.5mm.

5. Tensile Strength of USP material:

Tensile strength of USP material is the strength it can bear without tearing apart. The tensile strengths measured during the qualification will determine the reference value of these tensile strengths to confirm the quality of USP alone during the routine tests. The tensile strength of USP is to be tested in accordance with the test procedure given in EN 16730 and should be minimum 3.0 N/mm^2 and adequate enough to bear tensile stress on USP without tearing during full service life.

6. Effect on Lateral stability of Track/Lateral Track Resistance:

There should not be any significant reduction in the lateral track resistance to affect the lateral stability leading to unsafe conditions due to use of sleepers with USP at reduced ballast cushion as compared to use of sleepers without USP at full ballast cushion.

7. Expected Life of USP:

Expected life of USP when fixed to sleeper preferably shall be not less than normal expected life of concrete sleeper i.e. 40 years under normal operating and environment conditions over Indian Railways.

A certificate from supplier clearly demonstrating the satisfactory performance of USP supplied by him for use of minimum 10 years to be furnished.

8. Fatigue Test with USP on concrete block in ballast:

This test should verify the durability of USP in contact with ballast. The fatigue test will quantify the impact of the ballast on the USP depending upon the variation of characteristic of USP. Fatigue testing of the USP on concrete block in ballast shall be conducted in accordance with EN 16730 Annex. D. Fatigue test reports shall be provided to confirm design life of the USP. During fatigue testing, there shall be no significant damage, cracking, perforations or other damage on visual appraisal. Change in static and low frequency (5Hz) dynamic bedding modulus values should not exceed 25%.

9. Capability of stacked storage of sleepers with USP:

During storage of sleepers with USP, there should be no degradation by the load of sleepers stocked on top. Stacking method & work instruction shall be specified to avoid localized loads resulting in permanent deformation or any adverse effect on USP. The test methods in EN 16730 replicates typical sleeper stacking with batten spacers. Change in static and low frequency dynamic (5Hz) bedding modulus values should not exceed 25%. Test report for this test should be submitted as per EN-16730.

10. Ballast Protection Capacity (Determination of Contact Area):

In order to have adequate ballast protection capacity, total contact area with the ballast when the USP is attached to the concrete sleeper shall be a minimum of 15%.

Contact area can be determined by placing a piece of USP of size 250mm x 250 mm over a metal plate and pressed against a 'Geometric Ballast Plate' (GBP as described in EN 16730 & sprayed with chalk powder) by a load in range 0.01 - 0.25 MPa at the rate 0.025 MPa per second for 5 no. of cycles. In the stage2, load range is 0.01 M Pa to 0.25 MPa at 5Hz for one hour.

The effective contact area shall be assessed by measuring the chalk imprint on the USP. The imprint area shall be expressed as a percentage of the total sample surface area. The test shall be carried out 3 times and averaged of 3 results.

11. Resistance to Water and chemical agent & other environmental parameters:

USP shall not suffer degradation as a result of exposure to water or chemical agent typical of a railway environment & used during manufacturing of sleepers e.g. Oils & diesel, rail & point lubricant, toilet discharge and weed killers, hydrocarbons, ozone and shall not modify significantly the performance of USP. Chemical testing shall be carried out in accordance with as per DIN 53428. USP resistance to the above factors shall be less than 20% change in its material properties such as tensile strength. Test reports on offered USP in regard to resistance to water and chemical agents should be submitted as per DIN 53428.

12. Electrical Insulation:

USP shall not affect the Electrical insulation of concrete sleeper adversely/significantly required for signaling in track circuited area.

13. Data Sheet for Under Sleeper Pad (USP) Materials

Data / information on the proposed USP for trial are to be supplied by the Applicant Firm in the tables given below. The design approval tests results are to be submitted along with this RFP. The applicable routine test results are to be given during supply of USPs for trial after supply of every 2000 number of pads, if the product is shortlisted and trial is considered.

Parameter	Symbol	Value (Acceptance criteria)	Unit	Test Procedure	Design approval test	Routine test	Remarks
Material		USP are to be made from elastic resilient and durable material with no component capable of diffusion.			Applicable	Applicable	Firm to provide short description of the proposed USP (e.g. PUR, CR, NR, RR, TPE, multi-layer, single layer, etc.)

Thickness		5 - 12mm (without mesh/bonding layer)	mm		Applicable	Applicable	To be measured by dial /digital caliper taking average of at least 10 points
Design (Shape)		-			Applicable	Not applicable	Figure for shape of proposed USP to be provided by applicant as per the IR sleeper.
Specific mass (mass per area)	m	-	Kg/m ²		Applicable	-	Values to be given
Static and low frequency dynamic bedding modulus of USP on concrete block with GBP	C _{stat} , C _{dyn} ,5 Hz & C _{dyn} ,10 Hz	C _{sta} ≥ 0.1 N/mm ³ along with Load-Deflection curve	N/mm ³	This test has to done in accordance with EN 16730 for (23 ± 5) °C	Applicable	Applicable	The firm has to provide additional indication of p _{test1} , p _{test2} , p _{min} Additional indication of p _{test} , p _{min}
Tensile strength of USP material	σ	≥ 3.0 N/mm ²	N/mm ²	This test has to done in accordance with EN 16730	Applicable	Not Applicable	-
Fatigue test of USP on concrete block	ΔC _{stat} , ΔC _{dyn} ,5 Hz	ΔC _{stat} ≤ 25% ΔC _{dyn} (5 Hz) ≤ 25% The USP shall be visually inspected in order to look for evidence of damage (assessment of evidence of perforation, cracking or other damage)	%	This test has to done in accordance with EN 16730	Applicable	Not applicable	-
Capability for stacked stocking of sleepers with USP on concrete block	C _{stat} , C _{dyn} ,5 Hz	ΔC _{stat} ≤ 25% ΔC _{dyn} (5 Hz) ≤ 25%	%	This test has to done in accordance with EN 16730	Applicable.	Not applicable	-
Contact Area	A _{contact}	≥ 15%	%	This test has to done as per procedure in relevant clause	Applicable	Not applicable	-
Resistance to water and chemical agents	Δσ	Δσ ≤ 20%	%	This test has to done as per DIN 53428	Applicable	Not applicable	-

Note: Geometric Ballast Plate (GBP) used in some of above tests especially for USP–Sleeper contact area determination test may be modified suitably to simulate ballast size being used in Indian Railways. Nominal ballast size in Indian Railways is 40mm with maximum size as 65mm.

(B) Specification of the Sleepers with USP –

1. Geometric Dimensions:

Dimensions of USP shall be as per bottom profile of concrete sleepers of Indian Railways viz.

- a. BG line sleeper as per RDSO Drawing No. RDSO/T-2496 (sleeper bottom profile attached at Annexure-1)
- b. Wider PSC sleeper as per RDSO Drawing No. RDSO/T-8527 (sleeper bottom profile attached at Annexure-2)
- c. Turnout sleepers & other special location sleepers as per respective drawings (turnout sleepers has bottom width of 260 mm and varying lengths as per the 1: 12 layout drawing attached at Annexure-3)

USP shall preferably be consists of 2 pieces covering sleeper bottom surface under rail seat and leaving sufficient central portion of sleeper bottom to minimize centre binding condition of ballast cushion during service.

Dimensions of USP shall be such that a recess of 10 to 25 mm is available from edges of sleeper to avoid damages to USP during handling, transportation, laying and machine & manual tamping during maintenance etc.

The maximum flatness shall be within 2mm over a distance of 300 mm measured with a straight edge.

2. Fixation of USP to the sleeper:

The design of USP shall be such that it facilitates durable fixing to the sleeper. The fixed USP shall not get detached from sleeper under normal/specified conditions of handling, transportation, stacking, laying of sleepers in track and normal operating & environmental conditions over Indian Railways. The method of fixing can be one of under mentioned:

- a. Inserting into wet/unset concrete during manufacturing of sleepers by using an interlocking layer e.g. extruded knobs, wire mesh, geo-membrane, fine grained gravel etc.
- b. Gluing to hardened concrete
- c. Any other suitable method ensuring durable fixing of USP to concrete sleeper for the conditions described above.

3. Resistance to Pull-out on the sleeper:

The bond strength by pull-out of sleepers with USP quantifies an efficacy of anchorage of the USP in concrete sleeper. Resistance to pull-out or bonding strength of the USP connection with the underside of the sleeper shall be a minimum 0.4 N/mm^2 and the average value of 3 point test shall not be less than 0.5 N/mm^2 when tested in accordance with EN 16730. Test report of resistance to pull-out is to be submitted for the offered USP.

4. Effect of severe environmental conditions of sleeper with USP:

This requirement should verify the durability of sleepers with proposed USP as per EN-16730. This test will quantify the effect of the seasons on the sleeper with USP depending on the change of characteristics of sleepers with USP. The acceptance criteria for Effect of severe environmental conditions of sleeper with USP are:

- a. The USP shall be inspected visually. There shall be no evidence of perforation, cracking or other damage.
- b. The low frequency dynamic bedding modulus of USP should not change more than 25%.
- c. The minimum value of pull-out of USP from the sleeper, after the climatic test should not be less than 0.4 N/mm^2 and the average value of 3 point test shall not be less than 0.5 N/mm^2 when tested in accordance with EN 16730.

Test report of effect of severe environmental conditions of sleeper with USP is to be submitted for the offered USP.

5. Effect on Track Deflection, track stiffness & Ballast & Formation stresses:

USP sleepers with reduced ballast cushion at the given loading and operating conditions for Indian Railways shall not adversely affect on track deflection, track stiffness, ballast pressure, formation pressure when compared to normal track conditions without USP with full ballast cushion.

6. Effect on track renewal and maintenance procedure:

The presence of USPs with reduced ballast cushion on the undersides of sleepers shall not adversely affect the normal track renewal and maintenance procedure e.g. by incurring the use of special equipments or additional time for maintenance activities in comparison to track with full ballast cushion and normal sleepers without USPs.

7. Environmental & Disposable criteria:

In general, USP shall not include any additives hazardous to the environment (e.g. fuel containing CFCs). Harmful or toxic substances shall not be released into the

environment either during the installation, during operation and at the end of their lifetime.

The USP should not be track element which quickly propagates fire and which creates toxic fumes while being consumed. The USP should not be an element of the track which pollutes the environment and should be recyclable at the end of life.

8. Data Sheet for Sleepers with USP

Data / information for the proposed USP fitted with sleepers for trial are to be supplied by the Applicant Firm in the tables given below. These are all design approval tests for which results are to be submitted along with this RFP.

Parameter	Symbol	Value	Unit	Test Procedure	Remarks
Sleeper Type					Supplier has to provide name of Sleeper & Figure of bottom surface
Dimensions			mm		Supplier has to provide USP-area, recess from the sleeper edges, amount of USP parts etc.
Mass	m		Kg	-	-
Fixation method	-	-	-	-	Supplier has to provide fixation method e.g. bonding, type of interlocking layer, etc.
Bond strength by pull-out of USP on sleeper	σ_{av} σ_{min}	≥ 0.5 ≥ 0.4	N/mm ²	This test has to be done in accordance with EN 16730	Test required at design approval stage only.
Effect of severe environmental conditions of sleeper with USP	ΔC_{statr} $\Delta C_{dyn,5 Hz}$ σ_{av} σ_{min}	$\leq 25\%$ $\leq 25\%$ ≥ 0.5 ≥ 0.4	% % N/mm ² N/mm ²	This test has to be done in accordance with EN 16730	Test required at design approval stage only.

- Note:**
1. Test reports of USP should be submitted for the same product which has been offered by the firm and its authenticity will be correlated from the Testing Agency.
 2. RDSO reserves the right of final decision regarding product approval.
 3. Various tests reports should be from government recognized / well-established laboratories in India or other country.

C. USP for Point and Crossing Sleepers:

Under Sleeper pads are also required to be proposed for concrete sleepers for point and crossing areas along with the relevant details for these USPs as required in para A & B. A complete package of USP's with varying static bedding modulus for main line & turnout side is to be proposed for sleepers in switch, lead area & crossing area to reduce the variation of deflections over the entire length of point and crossing area.

D. Installation & Maintenance Manual:

The manufacturer / supplier is to provide Installation and Maintenance Manual of USPs giving complete installation/fixing procedure of USP with concrete sleeper, laying of sleeper with USP in track along with necessary precautions and other relevant details with sketches / drawings / photos / videos during laying and maintenance of track so that USP serves its intended purpose effectively.

E. Performance warranty:

The USP supplier would require to give a warranty at the later stage i.e. during the procurement of trial quantity for the material properties of sleeper pads for a period of 5 years from the date of supply. The security amount shall be deposited by the supplier till end of warranty period. If during the warranty period any defect is found in the design, manufacturing, raw material and workmanship of the material supplied and in case of failure of the under sleeper pads before warranty period of 5 years during field trial in Indian Railway tracks, the security amount deposited in form of Bank Guarantee for 10% of estimated cost by the bidder against performance warranty may be forfeited for which the decision of purchaser will be final and binding on the supplier.

F. Quality Control of USP:

In order to ensure continuous quality of supply of USP, the static bed stiffness, thickness of the USPs shall be verified each at the rate of once per 2000 pads. The values of static bed stiffness shall not vary by more than $\pm 15\%$ and thickness shall not vary more than $\pm 1.5\text{mm}$ from the nominal values.

G. Monitoring of Performance of USP:

The performance of under sleeper pads during field trial shall be monitored for assessing the overall suitability of USP for reducing the ballast cushion depth by 50 to 100 mm in track under Indian rail traffic and climatic conditions for a period of atleast 12 months during limited field trial on the trial sections in zonal railways nominated by Railway Board so that the performance is judged during all the seasons of the year under traffic. USP will be fixed to concrete sleepers during manufacturing of sleepers in the sleeper plants or as specified. USP sleepers will be laid in track with reduced ballast thickness over 200mm & 250mm ballast cushion and comparing the track performance with normal track (new sleepers without USP) over 300mm ballast cushion over same track in different stretches of 1 km length for each type of USP of shortlisted firms for trial. Trial period shall start from opening to traffic after laying of USP sleepers and initial machine packing and stabilization by DTS. The gauge / cross levels are to be measured immediately after machine packing & DTS is done during trial period as a special case. In general, during the trial, track performance will be monitored in terms of following parameters in USP and Non-USP section:

1. Retention of Track geometry – measurement of gauge, cross-level & alignment
2. Track maintenance input required - manual & machine tamping

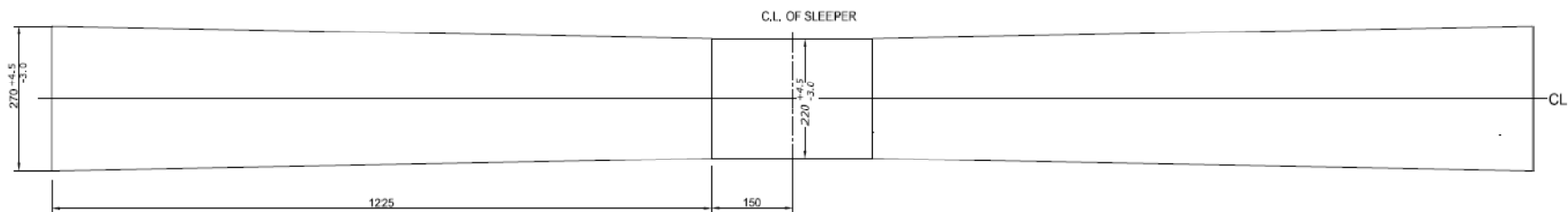
3. TRC results of trial sections (TGI values & other relevant parameters)
4. Ballast recouplement/extent of ballast attrition- to be measured by sieve analysis of ballast collected from area under both rail seats
5. Condition of fastening e.g. wear & tear / working out of rubber pad, liner, ERC & other fittings
6. Condition of sleepers – Notch formation, crack appearance etc.
7. Condition of USP viz. wear and tear of USP, detaching of USP from sleepers etc.
8. Post comparison for annual expenditure on track maintenance in USP and Non-USP section for maintenance input viz. manual / machine tamping, BCM working, deep screening and other maintenance inputs, recouplement of ballast and Cost- Benefit Analysis of USP

Performance of USP shall be monitored jointly normally upto 1 year by zonal railways with representative of USP supplying firms. However, the monitoring period can be extended further by the Railway Administration, if required to obtain conclusive data.

Detail Proforma for observation is given at Annexure-4. This Trial monitoring proforma is tentative which may undergo suitable modifications as per needs of field trial.

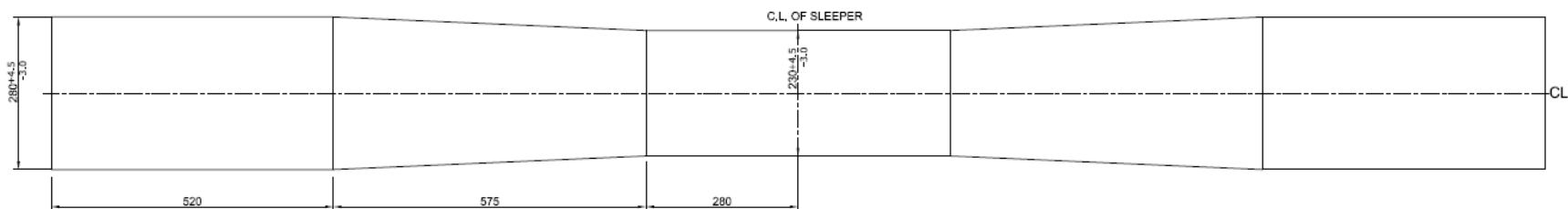
Annexure – 1

Bottom Profile of Normal Broad Gauge Line Concrete Sleeper (Drg. RDSO/T-2496) in use on Indian Railways

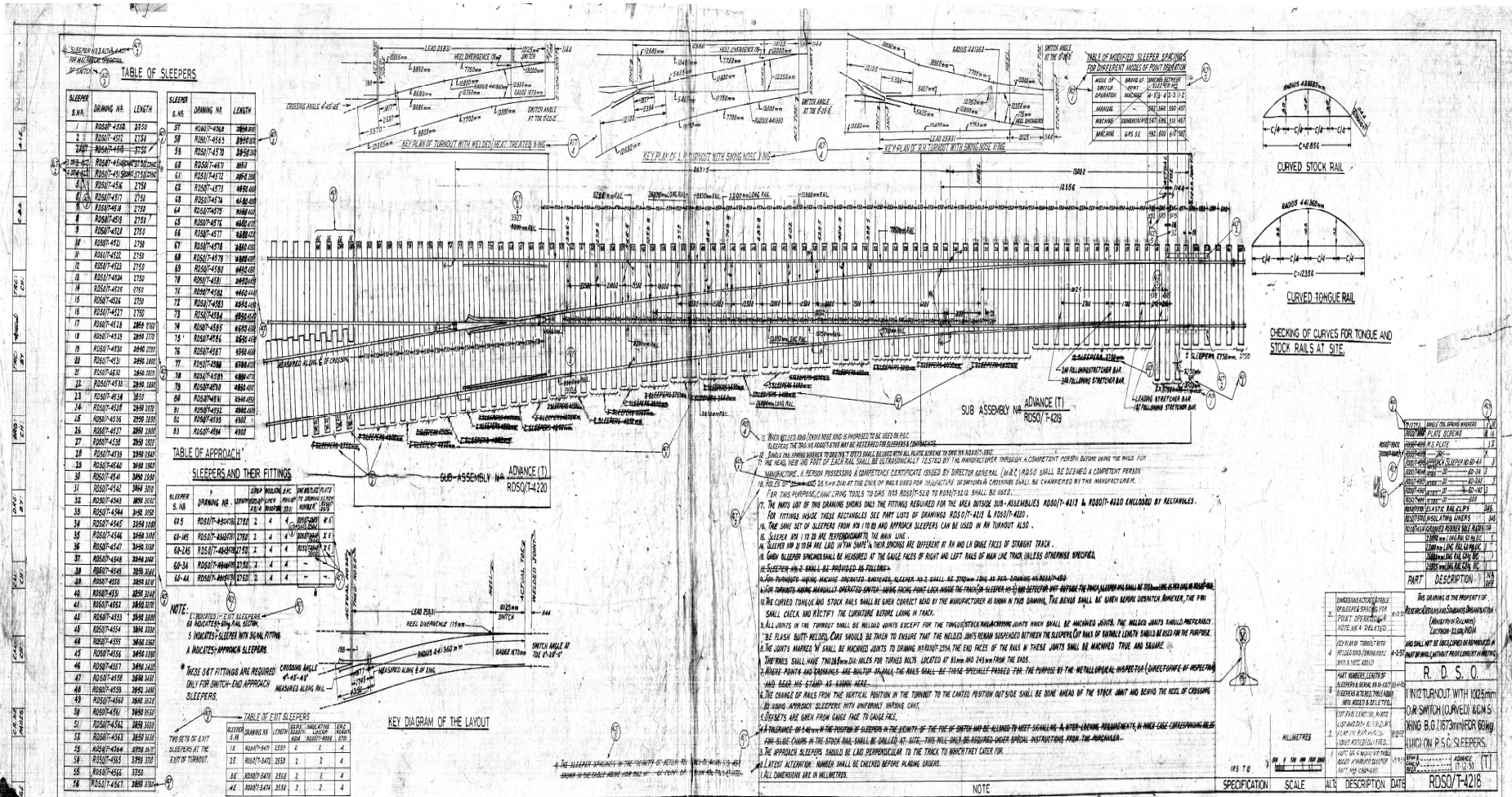


Annexure – 2

Bottom Profile of Wider Concrete Sleeper (Drg. RDSO/T-8527) for Indian Railways



Layout Plan and Sleepers length of 1 in 12 BG Turnout on IR



Annexure-4

TRIAL SCHEME FOR UNDER SLEEPER PADS FOR BALLAST THICKNESS REDUCTION

1. Zonal Railway Division....
2. Laid between station... and ... Km to ... UP/DN
3. Length No. of sleepers.....
4. Sleeper pad manufactured by and sleeper plant
5. Rail section / maximum speed Max. Axle load.....
6. Sleeper Density Depth of Ballast cushion.....mm
7. Date of laying in track.....
8. Date of last tamping First tamping....
9. (a) Number of tamping after first tamping
- (b) Date of tampings after first tamping, if done
10. Date of observation.....
11. Traffic density in GMT.....
- (a) At time of laying.....
- (b) At present.....
12. (A) Behavior of track (at time of observation) of test section with USP sleepers laid over reduced ballast cushion of 200mm and 250mm. (As per attached annexure I)
- (a) No of attention for slack packing - manually machine.....
- (b) Gauge.....
- (c) Cross Level.....
- (d) Alignment.....

Note: - (1) Above parameter should be recorded at every 10th sleeper at an interval of three months after start of the trial i.e. after machine tamping & track stabilization by DTS i.e. at end of 3rd, 6th, 9th & 12th month from the start of the trial.

(2) No. of attention in para 12(A) should be recorded just after stabilization of track by DTS upto date of observation at the end of 3rd, 6th, 9th & 12th month from the start of the trial.

(B) Settlement of Track

Ref I (250m)....mm

Ref II (500m)....mm

Ref III (750m).....mm

Note: - The settlement of Track at top of rail w.r.t. fixed Bench Mark should be measured with theodolite at three reference points for the 10 sleepers each located at 250m, 500m and 750m from one end of test track with USP. The measurements will be taken after 2 days, 3rd month, 6th month, 9th month & 12th month after the start of the trial.

(13) Track recording car results- (As per Running Schedule i.e. 3 months)

(a) USP section with reduced ballast cushion of 200mm & 250mm:

(i) Before laying of USP sleepers -

Km	UP/DN	Date of TRC Run	TGI					Km TGI
			Block 1	Block 2	Block 3	Block 4	Block 5	

(ii) After laying of USP sleepers with reduced ballast cushion of 200mm & 250mm:

Km	UP/DN	Date of TRC Run	TGI					Km TGI
			Block 1	Block 2	Block 3	Block 4	Block 5	

(b) Non-USP section with full ballast cushion of 300mm -

(i) Before laying of Non-USP new sleepers -

Km	UP/DN	Date of TRC Run	TGI					Km TGI
			Block 1	Block 2	Block 3	Block 4	Block 5	

(ii) After laying of Non-USP new sleepers with full ballast cushion of 300mm -

Km	UP/DN	Date of TRC Run	TGI					Km TGI
			Block 1	Block 2	Block 3	Block 4	Block 5	

14. Others.(As per attached annexure I)

- (a) Condition of sleeper.....
- (b) Condition of Fastening components
- (c) Clean ballast cushion mm
- (d) Pulverization of ballast yes/no
- (e) Roundness of ballast yes/no.
- (f) Loosening of fitting ... yes/no
- (g)Wear of railmm

Note:- (1) One sleeper should be opened and taken out at every 100m interval to check the bottom condition of sleeper and ballast condition just below sleeper after one year trial period.

(2) Sieve analysis of ballast collected from the area under both rail seats of the taken out sleepers at every 100m interval should be carried out before and after one year of trial period.

(h) Ballast Sieve Analysis -

(1) In USP section with reduced ballast cushion of 200mm & 250mm :

(i) At the time of start of trial:

S.No.	Chainage / Sleeper No.	Weight of ballast retained on			
		65mm sieve	40 mm sieve	20 mm sieve	Pan
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

(ii) After one year at the end of trial:

S.No.	Chainage / Sleeper No.	Weight of ballast retained on			
		65mm sieve	40 mm sieve	20 mm sieve	Pan
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

(2) In Non-USP section with full ballast cushion of 300mm:

(i) At the time of start of trial:

S.No.	Chainage / Sleeper No.	Weight of ballast retained on			
		65mm sieve	40 mm sieve	20 mm sieve	Pan
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

(ii) After one year at the end of trial:

S.No.	Chainage / Sleeper No.	Weight of ballast retained on			
		65mm sieve	40 mm sieve	20 mm sieve	Pan
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

15. Past history of test section:

- (a) No of attention for slack packing (1) Manually..... (2) Tamping.....
- (b) Date of previous two deep screening / shallow screening
- (c) TGI value (of corresponding period)

16. Behavior of track of adjacent section with new sleepers without USP with full ballast cushion of 300mm (for a length equal to USP test section) (As per annexure II)

- (a) No of attention for slack packing Manually Machine. ...
 - (b) Gauge....
 - (c) Cross-Level.....
 - (d) Alignment
 - (e) Condition of sleepers.....
 - (f) Clean ballast cushion mm
 - (g) Pulverization of ballast yes/no
 - (h) Roundness of ballast yes/no
 - (i) Settlement of Track
- Ref I (250m)....mm Ref II(500m)....mm Ref III(750m)....mm

Note:-Measurement under Sl. no. 16 should be taken in a similar way to Sl. no. 12 to 15.

17. Track maintenance Cost in USP & Non-USP section and cost of USP/Non-USP sleepers:

Observation Period From To	USP section with reduced ballast cushion of 200mm (From km... to km....)	USP section with reduced ballast cushion of 250mm (From km... to km....)	Non-USP section with full ballast cushion (From km... to km....)	Rate	Cost in USP section (Rs.)	Cost in Non-USP section (Rs.)
Parameter						
OMS peaks						
No. of Machine packing						
No. of Gang attentions (picking up slacks) (in Man days)						
Quantity of Ballast Recoupment				per cum		
No. of Rail weld failure						
Any other maintenance input						
Cost of total maintenance inputs during the observation period						
Cost of total maintenance inputs per year						
No. & total Cost of USP / Non-USP sleepers in trial section						

Observations to be recorded for USP Test Track with reduced ballast cushion of 200mm

Between Stations to ... Km to

Date of observation.....

Sl no.	Sleeper no.	Gauge	Cross level	Alignment	*Condition of sleeper and USPs	*Ballast cushion		*Pulverisation of ballast	*Roundness of ballast	*Condition of fastening including rail pad	Track Settlement**			Other observation
						clean	caked				Ref I	Ref II	Ref III	
	10 th													
	20 th													
	30 th													
	40 th													
	50 th													

Observations to be recorded for USP Test Track with reduced ballast cushion of 250mm

Between Stations to ... Km to

Date of observation.....

Sl no.	Sleeper no.	Gauge	Cross level	Alignment	*Condition of sleeper and USPs	*Ballast cushion		*Pulverisation of ballast	*Roundness of ballast	*Condition of fastening including rail pad	Track Settlement**			Other observation
						clean	caked				Ref I	Ref II	Ref III	
	10 th													
	20 th													
	30 th													
	40 th													
	50 th													

Note :- * Condition of ballast, sleepers, fastenings & USP will be measured after trial period of one year.

** The settlement measurement will be taken after 2 days, 3 month, 9 month and 12 month after the date of start of the trial.

Annexure-II

Observations to be recorded for unpadded Track (Non-USP Test Track with full ballast cushion of 300mm)

Between Station to ... Km to

Date of observation.....

Sl no.	Sleeper no.	Gauge	Cross level	Alignment	*Condition of sleeper and USPs	*Ballast cushion		*Pulverisation of ballast	*Roundness of ballast	*Condition of fastening including rail pad	Track Settlement**			Other observation
						clean	caked				Ref I	Ref II	Ref III	
	10 th													
	20 th													
	30 th													
	40 th													
	50 th													

Note :- * Condition of ballast, sleepers, fastenings & USP will be measured after trial period of one year.

** The settlement measurement will be taken after 2 days, 3 month, 9 month and 12 month after the date of start of the trial.