

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No.2011/Proj/9/2

New Delhi, Date: 12 .02.2016.

Principal Chief Engineer &
Chief Administrative Officer (Con.)
All Zonal Railways

Sub: Ballastless track of washable aprons on Indian Railways

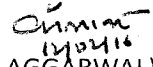
The conventional washable aprons used on Indian Railways have design speed of 30 kmph. As such, these pose serious impediments for run through lines passing through platforms, thereby seriously reducing the sectional capacity. Also, the performance of these washable aprons, have not been satisfactory in service. Other factors such as envisaged increase of sectional speed to 160 kmph, increase in speed of loop lines to 50 kmph, introduction of heavier axle loads etc also necessitate induction of improved technology of ballastless track for washable aprons based on global experience.

The matter has been reviewed by Board. Accordingly "Technical eligibility and technical requirements for design, construction of ballastless track for washable aprons on Indian Railways" have been formulated and are enclosed as Annexure. Other tender conditions are to be kept by the Zonal Railways as per extant instructions. Open tenders with 'Two Packet System' should be adopted for this work. Although the estimated cost of the work may be of low value (less than Rs 10 Crores), Joint Ventures (JV) should also be permitted to participate in the tender in terms of Railway Board letter No 2002/C-1/CT/37 JV Pt VIII dated 14.12.2012. Detailed design and structural drawings submitted by successful bidder for construction purpose shall be approved by RDSO.

Each Zonal Railway shall construct all washable aprons on main line having speed potential in excess of 50 kmph and 2-3 washable aprons on loop lines out of sanctioned works as per the enclosed Annexure.

Please acknowledge receipt and send action plan by 10/03/16 along with details of washable aprons selected for construction as per the above instructions.

Encl: As above (7 pages)


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-DG/RDSO for kind information

TECHNICAL ELIGIBILITY CRITERIA AND TECHNICAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION OF BALLASTLESS WASHABLE APRONS ON INDIAN RAILWAYS

A. GENERAL

- 1.0 Washable apron are required to be provided on platform lines at major railway stations of Indian Railways to facilitate cleaning of large amount of garbage and toilet droppings. Presently, washable apron are being provided mostly with use of existing sleepers over RCC slab with a bituminous layer in between. This arrangement leads to pre-mature failure of washable aprons requiring frequent maintenance impairing its functions.
- 2.0 Indian Railway is in effort to develop the design and construct ballastless track for washable apron systems which are proven and being used in worldwide railways successfully. The proven design may require some modifications to suit to Indian Railways conditions. This present tender is invited for such proven design of ballastless track worldwide from the bidders which can be suitable to Indian Railways conditions.

3.0 Operating Regime on Indian Railways:

a) Axle load and Speed

Traffic Type	Axle Load	Speed
Goods	25T	100 kmph (Proposed)
Passenger	21T	160 kmph (Existing) 200 kmph(Proposed)

- b) Electric Traction (Minimum) : 25 KV AC.
- c) Track Circuits : DC.
- d) Gauge: : Broad Gauge,
Nominal (1673 mm).
- e) Ambient Temperature : (-) 5⁰C to 50⁰C.
- f) Rail Temperature : (-) 15⁰C to (+) 76⁰C.
- g) Humidity : 100%

4.0 Technical Eligibility criteria-

- 4.1 The bidder can be a firm or a Joint Venture (JV) or a collaboration of firms, from India / abroad, who is the system provider and/or the designer and/or the construction executing agency and must have a written 'Agreement' or

'Memorandum of Understanding' to this effect. The bidder may consist of maximum three members as under:

- i) System provider is a firm who has designed & supplied the proven ballastless track system/ washable apron including fastenings & transition.
- ii) Designer is a firm who can modify the proven system to suit the Indian Railway requirements as per technical requirements detailed at para B for ballastless washable apron
- iii) The construction firm is one which can execute the construction of the ballastless washable apron as per modified proposed system on Indian Railway Stations

4.2 The bidder should fulfill the following requirements:

- i) The ballastless track system provider should have successfully supplied ballastless track system for a minimum length of 1 km with minimum axle load of 21T and design speed of at least 130 kmph (50 kmph for loop lines).
- ii) The construction firm should have executed at least one single work of ballastless track or construction of RCC Structures such as bridges etc. for a minimum 35% of advertised value of the work within qualifying period i.e. last three financial years & current financial year. For foreign firms, the tender value in Indian currency will be converted to equivalent foreign currency based on the exchange rate prevailing on the date of publishing of the tender.
- iii) Ballastless track designed and supplied by the bidder in the past as per their proposed design or as per its original design including the fastening system & transition system for a minimum axle load of 21T and design speed of at least 130 km/h (50 kmph for loop lines) should be proven system having satisfactory working performance under traffic of at least 21 T axle load and 130 kmph (50 kmph for loop lines) for at least 5 years since the date of its operation. Five years period will be reckoned from the date of opening of the tender.
- iv) If design for a washable apron is modified to suit the requirement of Indian railways as per para B, then the designer firm engaged / associated should have a proven track record in designing the ballastless track of the same type (including fittings) as is being offered for at least 21T axle load & speed of 130 kmph (50 kmph for loop lines) on any world railway system including Metro systems on BG/ Standard gauge and in use for atleast three years. Three years period will be reckoned from date of opening of the tender.

5.0 At the time of submission of the offer, the bidder should submit preliminary / conceptual design and drawings of washable apron (main line and /or loop

line, as applicable) including fastening system, transition system, drainage system with construction procedure, & maintenance/repair procedure etc. The detail design including fastening system, which will be submitted on award of contract, should not deviate from the preliminary /conceptual design or its generic version on the basis of which the proposal was accepted.

- 6.0 The firm/JV shall indemnify Ministry of Railways against any claims from any other party in connection with the intellectual property rights of the drawings and design/ fastening system/ ballastless track system or any other documents submitted by the firm/JV or any other patent rights.

B. TECHNICAL REQUIREMENTS

1.0 DESIGN REQUIREMENTS

In designing washable apron for Indian Railways, the following parameters may be considered for guidance.

- i) Washable apron shall be designed for the following:-
 - a. Main line for 25t axle load & speed 100kmph (proposed for goods traffic) & 21t axle load & speed as decided by Zonal Railway (for passenger traffic)
 - b. Loop line for 25 t axle load & speed 50 kmph.
- ii) Dynamic augment is taken as 2.5 (as prevailing on IR)
- iii) Spacing of supports to rails – preferably at every 60 cm (where ever rails are supported on sleepers/ discrete supports) so that the permissible bending stress in rails are not exceeded beyond stipulated values. The values of permissible bending stress are as under:-

For LWR section -	25.25 kg/mm ² (for 90 UTS)
For SWP -	30.25 kg/mm ² (for 90 UTS)
For FP section -	36.00 kg/mm ² (for 90 UTS)
- iv) Upward reaction / pressure from support base should be clearly mentioned in design.
- v) Design shall be as per relevant codes of practice such as BIS, EN, IRS, IRC and UIC with latest revision/ edition). If for any item/work, above mentioned codes are not relevant, best available Engineering practice / International codes shall be mentioned.
- vi) Design & detail of suitable Transition System for smooth transition from ballasted track to ballastless washable apron on both ends shall be part of the design of washable apron.
- vii) Design and detail of Expansion / Contraction Joints in washable apron at suitable intervals shall be part of the design of washable apron.
- viii) Technical parameters required for foundation of washable apron shall be suitably considered for Indian conditions and shall be mentioned in

the design along with their test code & procedure. A design monograph of varying sub-grade characteristics, if applicable, to be provided by the firm /designers.

- ix) Design service life of washable apron should be a minimum of 60 years. Concrete for RCC structures should comply relevant para of Indian Standard IS:456 - 2000 & relevant para of IRS-Concrete Bridge Code taking care of relevant durability clause for expected life of RCC as minimum 60 years.
- x) Washable aprons are extensively washed with high pressure water jet on Indian Railways due to various reasons i.e. toilet discharge etc. apart from watering of coaches. Suitable arrangement should be provided for ensuring that washable apron functions properly in view of daily cleaning requirement. Provision of adequate cross slope for drainage purpose and suitable measures to prevent ingress of water must be considered. Design of proper drainage arrangements for washable apron shall also be part of design of washable apron. Necessary field visit to ascertain local conditions may be done for suggesting suitable drainage system.
- xi) No settlements or separation of parts should be developed during service in the washable apron leading to impaired service or failure.
- xii) Washable apron should be designed for almost maintenance free conditions except replacement of worn-out fastening components / rails after their service life is over. The 2% of the fastening components and other replaceable items which are likely to be worn out / damaged are to be supplied as spares for need based replacement in this work. The offer of the firm/JV should be inclusive of the cost of 2% fastening components as spare. No additional cost will be paid for the spares.
- xiii) Ground improvement may be required before construction of ballast track system which needs to be designed to avoid problems in washable apron due to inadequacy of its foundation. The bidder should visit the site and plan for ground improvement works. The offer of the bidder should be inclusive of such ground improvement works.
- xiv) The proposed system should be easy to repair & expeditious to restore in case of damages due to derailment. The time & material requirement for repair should be clearly defined along with detailed procedure of repair.
- xv) Cost effective design & methodology with reasonably less construction period with opening of traffic with suitable speed restriction would be preferable. Firm/JV should advise the total days required for the construction in case of works to be taken up in the existing yards where traffic blocks will be required for taking up the works of washable apron.
- xvi) Adequate corrosion protection measures must be included in design to minimize corrosion of fastening components of proposed system for

ballastless washable apron as corrosion of fastening components in washable apron is a major problem due to toilet discharge and frequent use of water for cleaning of washable apron over Indian Railways. Test report of the proposed fastening system should be submitted as per EN 13146 -6 : 2012- Test methods for fastening system - Effect of severe environmental conditions and EN ISO 9227 , Corrosion tests in artificial atmospheres – salt spray tests or as per any international standard being in practice.

- xvii) The design should be cost effective serving all functional requirements expected of washable apron.
- xviii) Any other factor considered necessary by the designer.

Changes in the above parameters (ii) and (iii) may be considered, in case the bidder is able to support it with the relevant documents and codes as per practice in other Railways.

2.0 Track Details : Ballastless track/ washable apron for Indian railways shall be designed for following track details:-

- i) Rail section: Rail profile shall conform to UIC 60 (90 UTS) and Rail material shall conform to IRS-T-12-2009 class-'A', including manufacturing and testing in accordance with IRS-T-12-2009 with latest amendments.
- ii) Schedule of Dimensions (SOD) and Maximum Moving Dimension (MMD) of Indian Railways for BG shall be followed.
- iii) Ruling gradient: 1 in 400 or flatter
- iv) Rail cant at Rail seat (inward): 1 in 20
- v) Maximum degree of curvature: upto 2° for washable apron.
- vi) Maximum permissible cant: 165mm
- vii) Speed potential: Full speed prevailing on main line & loop line to be decided by Railways.
- viii) Traffic: Mixed – passenger & freight
- ix) During service if some parameter goes out in case of any unforeseen circumstances, the leeway / margin available to correct the parameter. Vertical: + 10 mm / - 3mm, Horizontal: ± 3 mm.
- xix) Design temperature range: 70 degree Celsius variation of rail temperature as per zone & chart of Indian Railway LWR manual and 40 Degree variation of ambient temperature.
- xi) Long welded rails (LWR) are to be used. The proposed design of washable apron should take into consideration of the forces due to LWR and interaction of LWR.
- xii) It should be possible to do in-situ AT/ Flash Butt welding as per the Indian Railways welding manuals.
- xiii) **Track Tolerances:** Track tolerances over washable apron when installed and later during service under floating condition should be as under:

S. No.	Parameter	Installation	Service
1	Gauge (with reference to 1673 mm, measured below 14 mm rail top) for straight track and for curve upto the radius of 350 m.	± 1 mm	± 3 mm
2	Variation in versine on curved track (20 m chord with half overlapping)	± 3 mm	± 6 mm
3	Vertical alignment over a 3.6 m chord	± 1 mm	± 6 mm
4	Lateral alignment over a 7.2 m chord on straight track	± 1 mm	± 3 mm
5	Twist on 3.6 m base	± 1 mm	± 5 mm

The above installation parameters are not sacrosanct and firms/JV can also advise their own limits for the above parameters along with basis for suggesting the changes. Variation in horizontal alignment, vertical alignment, versine, twist and gauge shall not exhibit cyclic pattern.

3.0 Traction Details :

IR has Diesel / Overhead Electric (25 KV) traction. The washable apron design should have adequate electrical insulation and should be able to demonstrate correct performance of signaling and traction equipments even in flooded condition during monsoon for which necessary local field visit may be done and the design should take care of return current as per traction.

4.0 Signaling Details :

For signaling, the track circuiting is provided through the rails. The ballastless track system should take care of the same with adequate insulation. A minimum electrical resistance of 4Ω per Km as per Indian Railway Signaling Manual needs to be ensured.

C. Abstract of the items of work for cost calculation:

The firm/JV should consider following activities /item while offering their Rates-

- a) Deep dewatering by well points (if required).
- b) Dismantling of existing track (if applicable).
- c) Dismantling of existing washable apron (if applicable)
- d) Ground improvement (if required)
- e) Preparation of sub-base/sub -grade
- f) Laying of washable apron (Excluding cost of rails)
- g) Construction of side drains.
- h) Laying of rails (to be supplied free of cost by Railways) and welding etc.
- i) Assembly of track and fastening components
- j) Supplying 2 % of fastening components for spare for need based replacements

- k) Construction of transition system on the approaches
- l) Instrumentation for monitoring performance (optional item)

D. CONSTRUCTION PROCESS

Firms/JV are advised to visit local sites locations as specified in tender to get familiar with typical local station environment like drainage system / extent of platform occupation/ typical cleanliness conditions, water flooding during monsoon period in station area etc. Procedure of construction process of ballastless washable apron should be mentioned in details suitable to local site conditions including necessary ground improvement. Ground improvement works shall be required to be undertaken at locations where washable apron is being constructed on the existing running line already having watering facilities due to saturation of ground below. In such cases, deep dewatering by well point during pre block period shall have to be done. In block period, removal of saturated earth to required level followed by filling of the coarse grained material in layers along with compaction by vibratory roller to have firm base shall have to be undertaken. Construction process & system offered should be easy in construction suitable to conditions prevailing on specified station in tender, clearly demonstrating how it can be constructed & installed within a reasonable time frame.

E. MAINTENANCE AND PERFORMANCE MONITORING:

The defect liability period will be for 3 years from the date of opening to traffic

After construction of washable apron, Zonal railway will monitor the performance jointly with firm/JV on quarterly basis & for three years. The performance monitoring will be based broadly upon following parameters:

- i) Efficacy of fastening: Fastening system should be able to maintain track geometry (gauge, cross level, loose fittings etc.) at all times within track tolerances during service without any components breakage, excessive wear & tear.
- ii) Track tolerances to be maintained at the time of construction & during trial /service should be as per para 2.0 (xiii).
- iii) Any track settlement which impairs the functionality of track & washable apron.
- iv) Any visible crack of width more than as stipulated in IRS Concrete Bridge code- para 10.2.1) in concrete / RCC portion of slab which impairs the functionality of washable apron.
- v) Efficacy of drainage system: e.g. the slope and drains constructed should function properly even during monsoon period.
- vi) Any special observations.

The decision of zonal railway about performance of the washable apron during/ after monitoring period shall be final.
