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Government of India
Ministry of Road Transport & Highways
(S&R (P&B/New Technology) Zone)
Transport Bhawan, 1, Parliament Street, New Delhi-110001

CODE NO.406

Dated: 3rd October, 2024

CIRCULAR

To

1. The Chief Secretaries of all the State Governments/ UTs.
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department/ Road Construction Department/ Highways Department (dealing with National Highways and other centrally sponsored schemes).
3. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
4. The Managing Director, NHIDCL, World Trade Centre, New Delhi-110029.
5. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
6. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs/ Road Construction Department/ Highways Departments (dealing with National Highways and other centrally sponsored schemes).
7. The Secretary General, Indian Roads Congress
8. The Director, IAHE, Noida, UP
9. All CE-ROs, ROs and ELOs of the Ministry.

Subject: Use of Whitetopping Technology for Rehabilitation/Strengthening of National Highways -reg.

Madam/Sir,

India has presently about 1.46 lakh km length of National Highways (NH) network. As we are building more and more 2/4/6/8 lane National Highways and Expressways, the quantum of aged asset is increasing which warrant rehabilitation to extend its life further. Flexible pavement constitutes the most important and largest component of ageing NH network. There are several rehabilitation/strengthening techniques/treatments available for flexible pavement and Whitetopping is one of them.

2. **Whitetopping Technology (WT)** - is defined as a concrete overlay on the top of an existing in-service bituminous pavement. A few advantages of WT are given below:

- Extends the lifespan of the pavement by 20-25 years;
- Much less lane closures during design period ;
- Lower life-cycle costs when compared with bituminous overlay;
- Durable wearing course in high rainfall regions;

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- Concrete is relatively light in colour and hence concrete surface is more reflective to light, absorb less heat and reduce the urban heat island effect. Improved reflection of lights from vehicles enhances safety, lowers energy requirement of external lighting, lower contribution to heat in environment; and
- Fuel consumption on concrete roads has been found to be less than the bituminous roads.

3. Indian Roads Congress has published IRC:SP:76 " Guidelines for Conventional and Thin Whitetopping", wherein three types of Whitetopping, namely Conventional Whitetopping(Unbonded, thickness more than 200mm), Thin Whitetopping(TWT, thickness greater than equal to 100mm and less than equal to 200mm, though constructed for bonded condition, however bond condition is not considered in design to have in-built factor of safety) and Ultra-Thin Whitetopping(UTWT, thickness less than 100mm and shall be designed & constructed for bonded interface condition).Further, it is mentioned that unbonded conventional Whitetopping is appropriate for badly damaged bituminous pavement and it should be designed and constructed similar to conventional concrete pavement in accordance with IRC:58 and IRC:15. Further, it is specified that UTWT is not appropriate application for National Highways works. Thus, the most suitable Whitetopping Technology for NHs is Thin Whitetopping (TWT).

4. Clause 1.5 of IRC: SP: 76 stipulates that "For all kinds of Whitetopping, continuity of subgrade/subbase support is to be ensured and Whitetopping should not be done at locations where availability of continuity of support in doubt". Further, Clause 6.3 stipulates that "TWT should be used only when the condition of the existing bituminous surface is fair without wide cracks and without material/sub-grade related problems". The specified criteria for selection of TWT application are essentially in **qualitative terms**, hence need was felt to have a user friendly selection criteria matrix in terms of measurable performance parameters (visual, functional, structural, compositional, etc.). After careful examination, it has been decided to provide TWT as a preferred treatment in following cases:

4.1 **Selection of Road Section**: Following road sections may be provided TWT treatment:

The existing NH section which has been bypassed and need to be de-notified and one time improvement has to be done prior to handing over to concerned authority.

or

The existing NH section for which lane addition for capacity augmentation is not envisaged for a minimum period of 20 years.

or

The existing NH section passing through National Park/Wildlife Sanctuary/Protected Forest for which lane addition for capacity augmentation is not envisaged for a minimum period of 20 years with requisite approval/clearance/permission from statuary authority of MOEF&CC/concerned State Forest Authority.

or

The existing NH section which is not responding to applied bituminous overlay and experiencing re-rutting of bituminous layer due to heavy axle load in tandem with

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prevailing high ambient temperature/aggregate related issues and recurrent wearing course disintegration/reflection cracking due to high rainfall.

Any road section meeting any of the above 4 criteria shall be further evaluated against the following parameters and decision to provide TWT shall be taken only after all the parameters are satisfied:

i. **Surface Disintegration**-Cracked and patched surface area<=20.0%. Cracking is initiated by raveling and crack depth propagation limited to wearing course only;
ii. **Surface Deformation**-Measured Mean Rut Depth<=20mm and any single measured value not more than 40mm;
iii. **Roughness**- The measured roughness shall be less than that of 4000mm/km;
iv. **Composition of Bituminous Layer**- It should be more than 125mm;
v. **Composition of Base and subbase Layer**- It should be more than equal to 300mm in case of granular courses or 200mm in case of stabilized courses;
vi. **CBR of in-situ Subgrade**-4-days soaked CBR@field dry density should be more than equal to 5.0%;
vii. **Characteristics Deflection**- Calculated Characteristics Deflection using Benkelman Beam Deflection should be less than equal to 1.8mm;
viii. No substantial level raising i.e. not more than design thickness of TWT+50mm is warranted; and
ix. It is possible to divert the regular traffic for minimum 14 days preferably 28 days from laying of TWT.

4.2 **Good Design and Construction Practices**: Design & construction of TWT shall be generally in adherence to IRC: SP: 76, moreover following best practices based on the experiences gained over the years shall also be adhered to:

- 4-days soaked CBR of in-situ subgrade soil at field dry density shall be considered in Fig 1 & 2 of IRC: SP: 76. Thickness of bituminous layer post milling shall be considered in same Fig.
- The bond between existing surface and new overlay and uniform levelled surface across the width is prerequisite for performance of TWT. The existing bituminous surface shall be milled to the required design grade to a depth of minimum 20mm or limited to the depth of crack propagation or maximum to the thickness of wearing course (20-50mm) by cold milling. Cold milling also increases the evenness of the existing pavement by removing brittle age hardened oxidized bituminous materials and unstable rutted/shoved bituminous mix and other surface distortions. Herringbone texture of milled surface properly cleaned can enhance the bond between the new and old layers and may reduce the possibility of slippage of the overlay over the existing surface. A pavement surface that has been milled is typically very dusty and dirty. Once the pavement has dried, multiple sweepings with a mechanical broom are usually needed to remove all of the residual grit from the milled surface. In some cases, it may be necessary to dampen the milled surface before sweeping or to air blow or flush the milled surface with water to remove dust and very fine material completely. Any dust and dirt left on the milled surface will greatly affect the bond. The post-milled thickness of existing bituminous layer shall not be less than 100mm. Milled surface shall be levelled, otherwise a levelling layer such as DBM/BC shall be laid prior to placement of TWT overlay. Unsound loose surface materials after milling shall be removed.

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- **Pre-overlay Repair**- Pre-overlay treatments are the corrective measures to repair the damages on existing bituminous surface so that their re-appearance can be prevented/delayed, improve surface evenness and provide uniform support for the overlay. If the distress in the existing pavement is likely to affect the performance of the overlay within a few years, it should be repaired prior to overlay placement. Generally, milling is recommended as pre-overlay repair for most of the sections. If there are cracks observed on the milled surface, the cracked portion shall be treated. Pre-overlay treatment of settled/cracked portion shall be carried out by removal of such portions and redevelopment with material similar to existing crust. If the existing bituminous pavement is in good condition i.e. cracked area less than 5% or rut depth less than 10mm, in lieu of milling it is better to lay a profile corrective course layer of 30-40mm BC or 50mm DBM.
- **Mist Surface**-It is imperative that the existing bituminous surface temperature be maintained at a temperature below $35^{o}C$ when placing the concrete overlay to decrease the potential of false set shrinkage cracking. The surface can be misted with water to reduce the temperature of the bituminous surface.
- Misting the surface will bring the surface of the existing bituminous surface up to a saturated surface dry condition, so that it is not pulling moisture from the concrete mixture.
- Generally, the design thickness of TWT for NHs varies in the range of 180 to 200mm considering bonded interface condition. However, thickness may increase depending upon the traffic.
- Preferably Concrete shall be laid in full cross-section width having same camber or crossfall in single paving pass.
- The panel size shall preferably be 1.0mx1.0m and not more than 1.25mx1.25m.
- If wind velocity during concrete laying is more than 15km/hr, then necessary arrangements shall be done on either side to avoid shrinkage cracks.
- Due to large surface area to volume ratio, TWT mix is prone to plastic shrinkage crack. To minimize the same, polypropylene fiber shall be added $0.9kg/m^3$ of concrete mix. To adjust for the reduced slump due to addition of fibers, cement content shall be slightly increased (5.0% approx.) and also the super plasticizer dosage shall be suitably increased. Mixing time shall be sufficient enough so that fibers get dispersed uniformly in the concrete.
- Curing is critical because their high surface area-to-volume ratio makes them more susceptible to rapid moisture loss. Caution should be taken not to spill curing compound onto an area of the existing bituminous surface yet to be resurfaced, because it will deter bonding between the two layers. Wax based curing compound shall be used. Curing compound should be sprayed on all exposed surfaces/edges. Further, the finished concrete surface including the exposed vertical face shall be covered with hessian cloth and moist water curing shall be done for minimum14 days or preferably 28 days continuously. Not a single pin-hole surface shall be left uncovered.
- Dowelled Transverse Joint shall be provided only at construction joint.
- Longitudinal joints with tie bars shall be provided at the center of the slab or at the longitudinal saw cut closest to the center in case of paving width more than 6m.Tied Longitudinal construction Joint shall also be provided when full width of pavement is not laid in a single paving pass.
- **Sawing of Joints**- The thickness requirement of TWT is less compared to the conventional concrete pavement and hence the surface area to volume ratio is more for TWT, which may increase the possibility of drying shrinkage. This can

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cause random cracking if joint sawing is not completed within the joint sawing window (4-12hours) for the prevailing ambient conditions. To determine correct timing of joint sawing, concrete strength gain with time may be measured using Maturity Meter or similar equipments. Joint sawing shall be divided into two stages. Initially the concrete layer should be sawed into larger slabs, later the larger slabs should be sawed into further smaller slabs of required size. This initial joint sawing into larger slabs is very important if the available number of joint sawing machines are limited, as this prevents the formation of shrinkage cracks in the TWT that generally get initiated at approximately 4 to 5 m spacing. Typically, the 9 m wide TWT layer should be initially sawed into larger slabs (3 m X 3m) and later further sub divided into smaller slabs of (1 m X 1 m). The depth of saw cut shall be 1/3rd of the thickness of TWT and its width shall be 3-5mm.

- **Sealing of Joints**- In TWT, joint sealant is usually not necessary as the joint groove width is less than 5 mm as there is only a single saw cut with a blade of width 3-4 mm. However, if the project road is geographically located in high rainfall(more than 2000mm annually) or a continuous downpour during monsoon season or ponding of surface run-off for the prolonged time more particularly in urban/built-up areas, initial saw cut (without any groove widening) joints shall be sealed with some suitable sealant or preformed compression seal.
- The existing earthen shoulder drop-off resulted due to TWT overlay shall be leveled-up with suitable material, re-graded to the required camber/crossfall and adequately compacted.
- The newly laid TWT shall be opened to traffic only after attaining the strength of 80% of the grade of Concrete.
- The post-construction roughness (measured with a properly calibrated Bump Integrator) of the TWT surface shall not be more than 2200 mm/km.

5. It is requested that the contents of the circular may be brought into the notice of all concerned for immediate needful compliance.

6. This issues with the approval of Competent Authority.

Yours sincerely,

Bidur Kant Jha
03/10/2024

(Bidur Kant Jha)

Director (New Technology for Highway Development)

For Director General (Road Development) & Special Secretary

Copy to:

1. All CEs in the Ministry of Road Transport & Highways
2. All ROs of the Ministry of Road Transport & Highways
3. All CE(NH) of PWD/R&B dealing with National Highways
4. Technical circular file of S&R (P&B) Section
5. NIC-for uploading on Ministry's website under "What's new"

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6. Sr. PPS/ PPS to JS (RT&MVL)/ JS (EIC) / JS (Logistics)/ JS (NHIDCL)

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