

Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines

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White topping a Cost effective and Sustainable Technology for Rehabilitation of High-Volume Traffic Highways

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**International Road Federation
India Chapter**

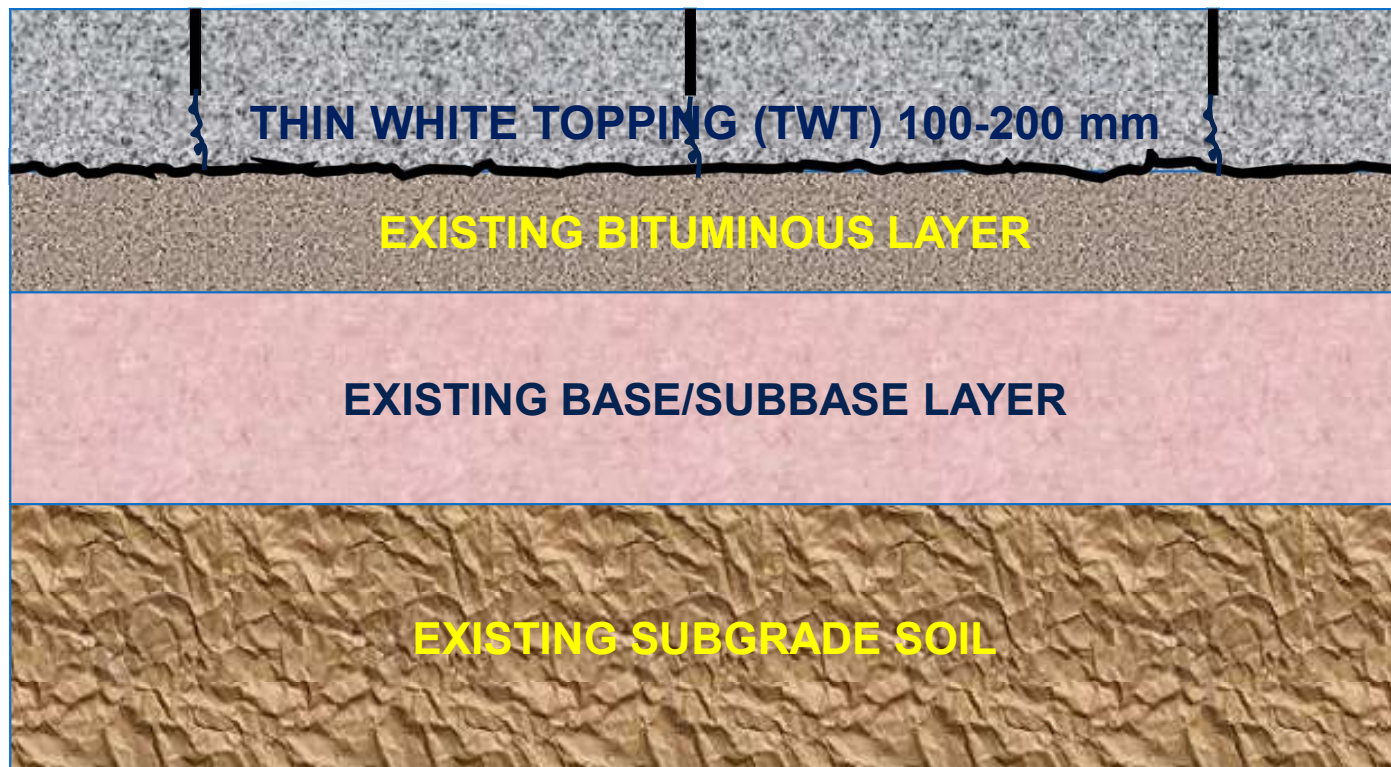
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White Topping Technology

- White Topping is Concrete overlay constructed **above existing Bituminous Pavement**
- Overlay Concrete thickness between 100 - 200 mm known as **Thin White Topping (TWT)**
- Bonded type Overlay with Design Life of 20-25 years
- TWT used to strengthen existing bituminous pavement to **increase life, durability & reduce maintenance**
- **Small Concrete Panel** size 1.0X1.0 m to 1.25X 1.25 m
- **IRC SP:76 2015** for Design & Construction guidelines
- Commonly used on urban roads in cities like Mumbai, Thane, Bangalore, Pune, Jaipur, Hyderabad, Belagavi

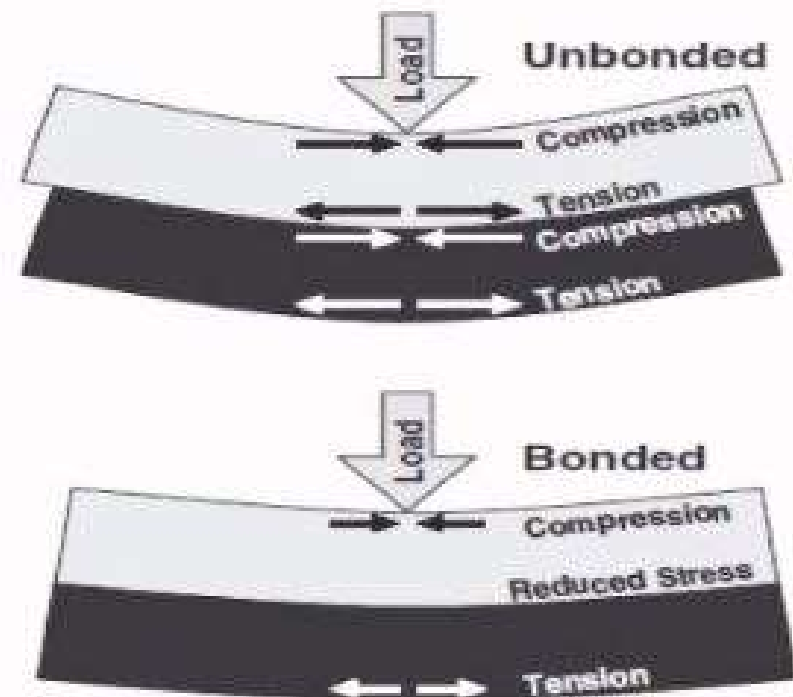


Thin White Topping (TWT) Typical Cross Section



Stress Diagram of Bonded and Unbonded Overlay

- Thin White Topping designed as **Bonded Overlay**
- Neutral axis shifted downwards hence **Concrete mostly in compression**
- Due to smaller slab size **Warping/ Curling stresses are very low**
- Smaller panel size & bonded nature helps in **reduction of overlay thickness** compared to regular PQC slab



Distinct Advantages of Thin White topping

- Lower stresses in short panel Thin White Topping require **lower overlay thickness**
- **35 to 40% lower in Life Cycle cost** as compared to Bituminous Overlay
- Offers **same advantage of regular PQC** pavement at reduced cost due to lower overlay thickness
- Sustainable solution for road rehabilitation, reducing environmental impact and promoting resource efficiency through **use of existing available crust** material
- **Replacing damaged slabs is easier** due to small size
- **No dowel and tie bars** except at construction joint

White topping Projects for High Volume Traffic Highways (*outside India*)

■ United States

- Project: I-35W, Minneapolis, Minnesota, Length: 4.5 Km, 2017
- Project: I-70, Denver, Colorado, Length: 9.0 Km , 2018

■ Europe

- Project: E6 Motorway, Norway, Length: Over 10 Km, 2015
- Project: A1 Motorway, Poland, Length: Over 15 Km, 2016
- Project: A12 Motorway, Utrecht, Length: 8 Km, 2017

■ Australia

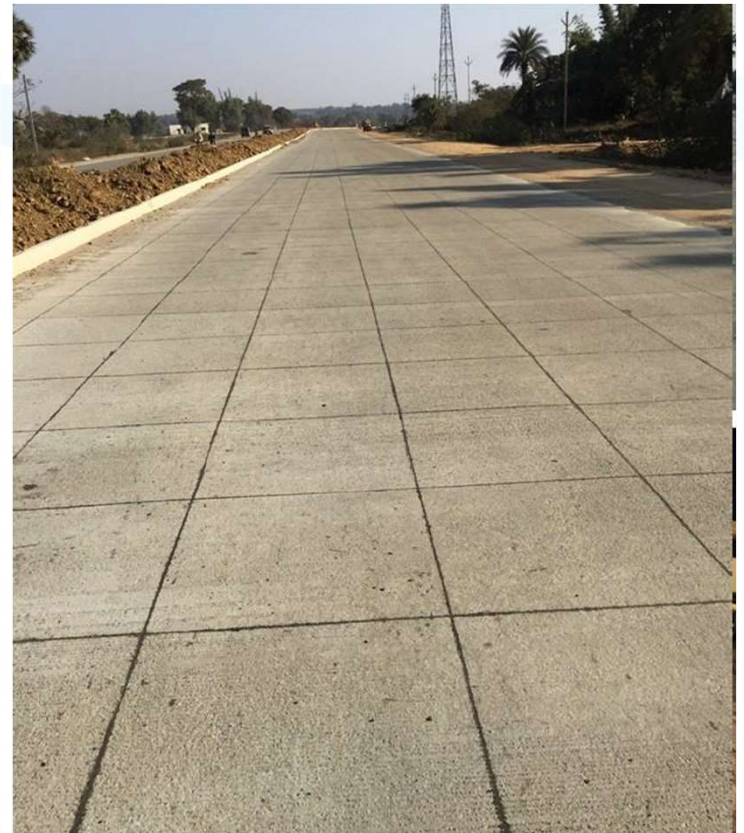
- Project: Monash Freeway, Melbourne, Victoria, Length: Approx 20 Km, 2019



White topping work in India for High volume traffic Highway Bangalore Mysore Infrastructure Corridor 2013



Test Section by IIT Kharagpur on NH 33, NH-18, NH-49 -2017



NH 848 Stretch completed in 2021 in Maharashtra



Ongoing Four Laning Panvel Indapur Section NH 66



Conventional Concrete & White topping Concrete Surface



White Topping overlay 1.0 m X 1.0 m panels above existing bituminous surface



Conventional Concrete Pavement panel 3.5 m X 4.5 m with complete new crust

Appropriate selection of candidate project for White topping technology



Typical pavement condition where White Topping can be implemented



Typical pavement condition where White topping should be avoided

Costing for Bituminous and White topping Overlay (only pavement course)

| Sr | Road Type | Proposed Overlay | Costing (Rs per sqm) | Life (years) |
|----|------------------------------|----------------------|----------------------|--------------|
| 1 | Bituminous Overlay | 75 mm DBM & 40 mm BC | 1150 /- | 5 to 6 years |
| 2 | White topping Overlay | 175 mm | 1500 /- | Min 20 years |

Technical considerations for White topping work

- Selection of candidate TWT project is very crucial
- Existing bituminous layer not less than 75 mm (after milling)
- Existing road free of excessive cracking, major structural damage
- Thorough structural evaluation of existing bituminous crust with FWD/ BBD device for K value determination
- Design of White topping overlay thickness as per IRC SP:76-2015
- Profile correction in overlay concrete layer or separate DBM layer
- **Pre Overlay correction** of damaged portions – removal and crust development with GSB, WMM, DBM

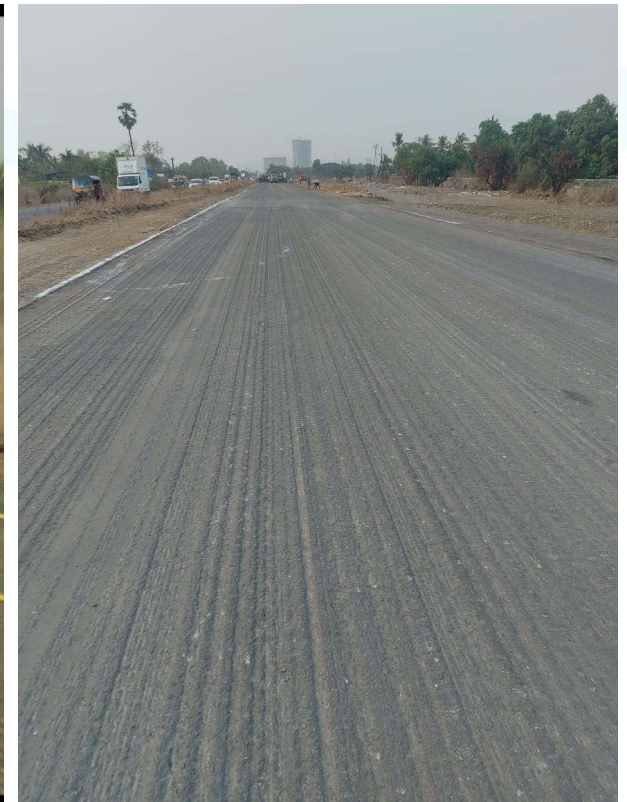
Construction Steps for White topping

- Existing bituminous surface roughened & thoroughly cleaned
- Pre overlay correction of patches & profile correction wherever required
- Laying of concrete with Slip Form paver
- Spreading, Compaction, Finishing, Texturing of concrete with paver
- Groove cutting (1.0 m to 1.25 m square panels) in 14 to 16 hours
- Concrete Curing for 14 days
- Opening to traffic after 14 days
- Joints filled with sealant (after 14 weeks)

Milling of existing bituminous surface for bond creation



Cleaning of Milled Surface with Pressurized Air



Concrete Laying with Slip Form Paver



Concrete Spreading, Finishing, Texturing with Paver



Groove Marking and Cutting



Minimum 14 days complete Curing



Dowel Bar placement only at Construction Joint



Tie Bar placement at Longitudinal Construction Joint





Performance Monitoring of NH 848 Pilot Project

- White topping for NH 848 section undertaken in 2021 through MoRTH as a Pilot Project
- Nashik to Peth Section Km 11/600 to 16/000, Km 34/000 to 39/000 & Km 57/000 to 62/000 in Maharashtra
- Total 15 Km Thin White topping completed in May 2021 for Highway with High Volume Traffic (excess of 4000 CVPD)
- Width of White topping pavement was 10.00 m
- Design thickness 200 mm with M 40 grade concrete and 1.25 m X 1.25 m small panel size



Distress Observations on NH 848 Pilot project

- Performance monitoring of project being done since 2021
- Distresses such as transverse & diagonal cracks, corner breaks and longitudinal cracks observed in some white topping panels
- Total distressed panels observed after 2.5 years - 2.70 %
- Cracks observed at locations where existing bituminous pavement not fully rectified before white topping overlay, locations with drainage issues
- Some cracks observed due to non initiation of full depth cracks under groove cut at joint location

Distress Observations on NH 848 Pilot project



White topping as a Sustainable and Cost effective Rehabilitation option for High Volume Traffic Highways

- **Extensive research work** conducted at IIT Kharagpur along with test sections construction for NHAI in West Bengal on NH 33
- **New short slab concrete pavement design code** is under finalization using findings of IIT Kharagpur Research & Pilot project
- Based on experience with pilot projects & IIT Kharagpur work, White topping offers **Sustainable and Cost effective** rehabilitation solution for bituminous pavements
- White Topping is **not a golden solution to all road rehabilitation problems, issues**
- **Thorough investigation and appropriate selection of candidate projects** is most essential for successful implementation of white topping technology
- **Adequate pre overlay treatment** is required for failed sections and also ensuring adequate drainage to avoid failure of white topping



Thank You

