



## Whitetopping a Viable and Sustainable Option for Rehabilitation of Roads

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| Peer Review Information                                                                                                                                                                                                                | Abstract                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| <p><i>Submission: 20 Jan 2025</i><br/><i>Revision: 24 Feb 2025</i><br/><i>Acceptance: 27 March 2025</i></p> <p><b>Keywords</b></p> <p><i>Whitetopping</i><br/><i>Bitumen</i><br/><i>PCC</i><br/><i>Asphalt</i><br/><i>Concrete</i></p> | <p>The study has been undertaken &amp; investigate White topping is a concrete and asphalt restoration technique. It is characterized as an overlay of plain cement concrete on asphalt concrete. It provides a new innovative method of rehabilitation at a very inexpensive, little upkeep, and excellent outcomes. In addition, rapid development sin concrete material technology and mechanization are favoring concrete overlays as a sustainable option. Whitetopping is gaining progress nationwide in the building of roads. It can serve as a long-term substitute for road restoration or structural reinforcement.</p> |

### INTRODUCTION

Over the years, there has been a steady increase in road traffic. This is a global occurrence. Such a rise is expected to continue in the foreseeable future, according to a worldwide projection. Even in industrialized nations, there is a lack of funding for new infrastructure projects, both for their construction and, more importantly, for their upkeep and repairs.

In a developing nation like India, the situation is obviously far worse. In recent years, the weight of trucks and tire pressure on our pavements have increased, pushing In a developing nation like India, the situation is obviously far worse. Our pavements are under more pressure to perform now than they were a few years ago due to the rise in truck weights and tire pressures. There has

been longitudinal cracking in several asphalt pavements and rutting in many others. Because of this, an increasing number of roads are deteriorating, and it is frequently discovered that the current pavement structure is insufficient to handle the current traffic.

The conventional approach of reinforcing and repairing this vast network will require significant financial and physical resources, both of which are quite limited.

Thin bituminous layers make up the majority of the network's current flexible pavements. The issue with bituminous pavements in general is that they deteriorate with time. The majority of our roadways generally have the following flaws:

- Fatigue cracking
- Block crack (D-cracking)
- Rutting

## BACKGROUND ON WHITETOPPING ROADS

### Structural Behaviour of Whitetopping

Conventional white topping is designed and constructed like a new rigid pavement without assuming any composite action. In this type of white topping, dowel bars are provided across the transverse joints for load transfer and longitudinal joints are generally provided with tie bars for holding the slab together. The load transfer across the joints is possible through dowel bars, granular interlocking or by combined action of both these mechanisms. The dowel bars are not used in TWT/UTW. Conventional white topping is unbonded while TWT/UTW is bonded.

### Whitetopping- A Viable and Sustainable option for Rehabilitation of Road

The Romans (300 BC–476 AD) were the first to construct concrete roads. Using 'Pozzolana' cement from the village of Pozzuoli, close to Italy, horse hairs as fibers in concrete, and admixtures in their rudimentary form (such as animal fat, milk, and blood) were some of the creative elements they used in their construction. Because of their long lifespan and scientific design and construction, these roads gave rise to the proverb "all (concrete) roads lead to Rome." Airports pavements were the first to use prestressed concrete, which was first introduced in the late 1940s. At Biggs Military Airfield in Texas, two-way prestressed slabs were in use around 1959. Nine-inch (230 mm) post-tensioned slabs were used in place of the 24-inch (610 mm) plain pavement. Unfortunately, this concrete saving method has been slowed down by contractors' mile-a-day resistance to adopting this unproven technology, their fear of the unknown, and the requirement for more specialized labor. In the United States, between 1970 and 1990, about a dozen highways

with prestressed concrete pavements of various designs were constructed.

## RELATED WORK

The goal of white topping research is to increase the effectiveness, longevity, and economy of applying concrete overlays over pre-existing asphalt pavements. Key highlights in whitetopping research include:

### 1. Structural Performance & Design

**Bonded vs. Unbonded Whitetopping:** Studies differentiate between bonded whitetopping (thin overlays with strong adhesion to asphalt) and unbonded whitetopping (thicker overlays designed to act independently).

**Thickness Optimization:** Research explores minimum thickness requirements for load-bearing efficiency while maintaining durability.

### 2. Material Innovations

**Fiber-Reinforced Concrete (FRC):** Enhancing tensile strength and crack resistance by incorporating synthetic or steel fibers.

Whitetopping research continues to evolve with advancements in materials, design, and construction techniques to enhance pavement durability and cost-effectiveness.

### 3. Construction & Maintenance

**Surface Preparation Techniques:** Research into asphalt milling and cleaning methods to improve concrete-asphalt bonding.

**Maintenance Strategies:** Evaluation of crack sealing, joint resealing, and patching for extended service life.

## LITERATURE BASED FINDINGS

*Table 1 summarizes key related work in whitetopping*

| LQ | Related Work (Author and Title)                                                            | Findings                                                                                                                            | Remarks                                                                                                                                       |
|----|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | <b>Design &amp; execution of thin white topping Road</b> (Ganeshraju Naidu, B-Ramesh-2018) | stresses of detection in conventional whitetopping<br>Pavement Roughness<br>Inconventional whitetopping<br>Life cycle cost Analysis | The performance of pavements is satisfactory within permissible limit. Life cycle cost analysis is more cost-effective as compared to others. |
| 2  | <b>Rehabilitation of low volume flexible pavement by white topping.</b> (Author.-)         | crust details<br>Traffic volume<br>count<br>Pavement Distress survey                                                                | flexible pavement structurally inadequate - needs structural overlay<br>shorter joint spacing of thinest                                      |

|   |                                                                                                                                                 |                                     |                                                                                                             |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------|
|   | VinayH.Nsunils.2014)                                                                                                                            |                                     | overlayresultinlowestCritical stresscombination                                                             |
| 3 | <b>Bond strength of white topping &amp; overlay constructed with self compacting high performance concrete</b> (Pablo Pujadas, sergio Hip-2017) | bond strength Roughness measurement | In case of substrates roughness is negligible effect on direct tensile strength because of chemical bonding |

### GRAPHICAL REPRESENTATION OF RESULTS

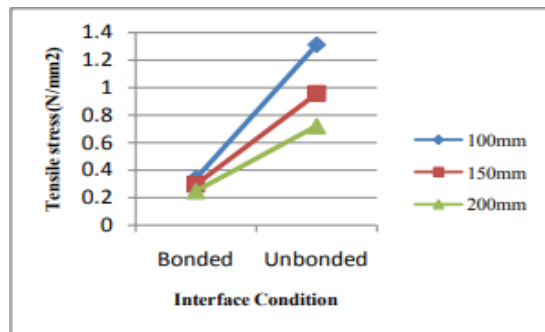


Fig 1: Concrete Tensile Stress vs. Interface Bonding Condition for different thickness of Whitetopping pavement with bituminous modulus 1000 N/mm²

### DISCUSSION

The graph in Fig. 1 indicates that the tensile stress of concrete at various contact conditions. An unbonded interface condition is more affected by whitetopping thickness than a bonded situation. Partial bonding between the interfaces was also taken into consideration in this study since the interface bonding state has a significant impact on the behavior of whitetopped pavements.

### CONCLUSION

According to the study, whitetopping has become a rapidly expanding pavement restoration technology. White topping, which offers the improved performance and durability of concrete, has become a quick and affordable solution for the rehabilitation of rutted asphalt pavement.

By bonding white topping overlays to pre-existing asphalt, a composite section is produced, offering better durability and performance at a reduced cost.

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