e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 7, July 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

International Journal Of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54||Monthly, Peer Reviewed & Referred Journal |

| Volume 6, Issue 7, July 2023 |

Data Analysis of UTWT Pavement for MIDC Road Amravati

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ABSTRACT*:* Due to rapid urbanization and growth of industries the traffic flow is increasing day by day resulting in heavy loading on existing road network of the country. During last three decades, there is sufficient increase in the road infrastructure resulting in increase of the total length of roads in the country. The road network in India carries more than two third of the freight traffic. Due to repetition of wheel loads, variation in temperature and other environmental effects most of pavements get damaged. Covering of asphalt pavement with a layer of cement concrete is termed as White topping. On the basis of thickness of the concrete layer it can be divided into bonded and unbonded or conventional White topping.

In this report the evaluation of Ultra-Thin White Topping using Fibre Reinforced Concrete as an overlaying concrete mix. In India, generally PCC and High Strength Concrete is used at various UTWT sites. In this paper, particular calculation for fatigue data for medium traffic road is carried out. In most of the UTWT pavement it is observed that the common failure type is cracking in pavement. The concrete is a brittle material and it early subjected to cracking. Polypropylene Fibre reinforced concrete is increase the flexural strength of pavement due to which the pavement failure due to cracking is reduced. This paper particularly highlights on Fatigue data by replacing the PCC with PPFRC (polypropylene fibre). These fibre concrete and their mix proportion are design according to IRC-44 guidelines for concrete mix design of rigid pavement. The M40 grade FRC is used for the calculation of fatigue data. Fatigue data is calculated as per IRC SP-76-2008 for medium traffic condition.

KEYWORDS: UTWT, PPFRC, Traffic , Concrete mix and Flexural Strength

I. INTRODUCTION

Ultra-Thin White Topping is a concrete overlay on detoriated bituminous pavement. UTWT is provided for rehabilitation of destress bituminous pavement. At various UTWT sites, these pavements give better results. The concrete overlay improves the performance, riding quality and durability of detoriated HMA surface. These white topping pavements are classified according to the thickness of concrete overlay. Three categories are discussed below.

- Conventional Whitetopping-

This type of overlay has thickness more than 200 mm. These are designed without consideration of the bond between concrete overlay and underlying detoriated HMA surface.

- Thin White Topping (TWT) –

In case of TWT pavements, thickness is greater than 100 mm and not more than 200 mm provided. In most of the cases, this overlay is designed and constructed with an intentional bond to the HMA surface.

- Ultra-Thin White Topping (UTWT) –

This overlay has a thickness less than or equal to 100 mm. In practice, this overlay is designed and constructed having thickness more than 50 mm. This overlay requires a bond between the concrete overlay to the underlying HMA surface to perform well.

In addition to thickness of overlay (a) a substantial degree of bond between the concrete overlay and the prepared asphalt surface, and (b) much closer joint spacing. These UTWT overlays is an emerging technology for the rehabilitation of HMA pavements in India. The short spacing of longitudinal and transverse joint is to reduce the tensile stresses in pavement under the various traffic load. Also, this short spacing reduces the environmental effect such as thermal stresses and curling stresses in overlay due to temperature changes. UTWT projects are beneficial over traditional maintenance by using bituminous or HMA overlay. In terms of life cycle cost, the maintenance cost required for pavement during design period is very less as compared to HMA overlay.

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II. STATE OF DEVELOPMENT

Ultra-Thin White Topping in India: State of Practice", *D. R. Jundhare, K. C. Khare, R. K. Jain*
The paper shows technical benefits and potential economic of white topping pavement. In this study, design of UTW has been carried out as per IRC 58:2002 guidelines and IRC: SP: 76-2008 for a cluster of roads in Dahanukar colony Pune, Maharashtra State. Discuss Historical Perspective, Design procedure. Determination of Modulus of sub grade reaction (K-Value) as per IRC: 81-1997 and Four days soaked California bearing ratio (CBR) Value as per IRC: 58-2002. Behavior of Ultra-thin white topping by various test- Stress Calculation, Temperature stresses and load stresses. Selection of materials, thickness, joint, spacing and other physical design.

Assessment of Wisconsin's white topping and ultra-thin white topping project", *Haifang Wen, PhD, P. E., Xiaojun Li, Wilfung Martono*
The primary objectives of this study are to catalog the white topping (WT) and UTW projects in Wisconsin, document pertinent design and construction elements, assess performance and estimate a service life of these projects. A comprehensive literature review was performed. A database of the WT and UTW projects was established covering 18 projects built from 1995 to 2007 in Wisconsin.

"*Pavement Rehabilitation Through Ultra-Thin White topping (UTW) Overlays", *Dave Amos, Intermediate Research Assistant, Missouri Department of trans.
The objective of this study has been to determine the feasibility of placing an ultra-thin white topping (UTW)overlay as a viable pavement rehabilitation method on low to medium volume asphaltic concrete (AC)pavements where rutting or shoving or both have become a problem, particularly at urban intersections. The procedure of milling and overlaying with asphaltic concrete is the least expensive and most commonly used practice in these areas

Performance Evaluation of Ultra-Thin White topping in India by BBD Test", *D. R. Jundhare, Dr. K. C. Khare; and Dr. R. K. Jain*
This paper discusses about surface deflection at three critical load positions in a panel having age of two years and the Load Transfer Efficiency (LTE) at the transverse joints of 100mm thick in-service UTW overlay constructed in Pune city, Maharashtra State, India by carrying out the non-destructive test of Benkelman Beam for its performance evaluation subjected to Indian traffic and climatic conditions. Ultra-Thin Whitetopping (UTW) is a technology to construct 50-100 mm thick cement concrete overlay on distressed asphalt pavement as a rehabilitation technique. There is a need to study performance evaluation of UTW for Indian traffic and climatic conditions by using suitable technique. In this study, performance evaluation of UTW is presented by conducting Benkelman Beam Deflection test (BBD) as per guidelines given in IRC: 81- 1997.

White Topping as A Rehabilitation Method: A Case Study of Budhel - Ghogha Road", *Mitesh D. Patel, Prof. P.S. Ramanuj, Bhavin Parmar, Akash Parmar*
This paper has represented white topping as cost-effective rehabilitation alternative for preserving bituminous pavements on long-term basis. Cost effectiveness of the white topping alternative in Indian context is proposed by them for analysis. The particular 90 mm, 150 mm, 200 mm HMA and whitetopping overlays are designed as per the guidelines given in IRC codes. After the design and cost calculation particularly saving in cost is 19.04%, 20.32%, 30.04% for 90mm,150mm, 200mm respectively. This saving in construction cost is on per kilometer basis.

A Study on Thin White Topping: An Alternate for Pavement Treatment", *Brajesh Mishra*
Conclude that Construction of White Toppings so speedy with the help of modern equipment's and techniques that it can be opened to traffic within a week of construction. Maintenance is minimized as the life of concrete overlay is around 20 years with slight maintenance. White Toppings Cost-effective in comparison to bituminous overlays when Life Cycle Cost analysis is performed. Its service life is improved due to superior riding quality and improved fuel efficiency of vehicles. Pre-overlay repair is least. Road safety aspect is improved due to better reflection of light particularly in city roads. Around 20% of electricity will be saved as compared to flexible pavements. And Lower Operational costs and lower absorption of solar energy. Beneficial for environment as concrete roads are much greener and less polluting.

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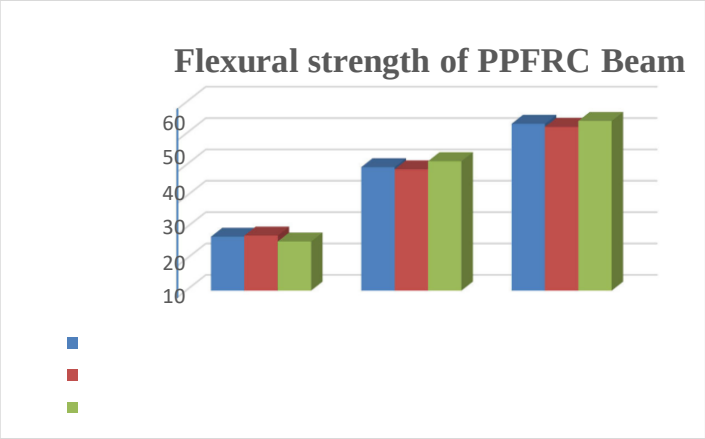
White Topping in Roads: Review", *Prof. Shrikant Harle, Prof. Prakash S. Pajgad*

This paper give information and benefits about UTWT like low cost as compare to concrete roads, low maintains, low traffic roads get better advantages of this technology. Discuss types of white topping Bonded Types, Un-Bonded Types, and Conventional white topping, Thin White Topping (TWT) Ultra-thin white Topping (UTWT). Selection of materials & other physical Design parameters, Design Process. Compare cost of Bituminous / White topping overlay (Per Km. Basis) Source - white topping - A cost - effective rehabilitation alternative for preserving bituminous pavements on long term basis.

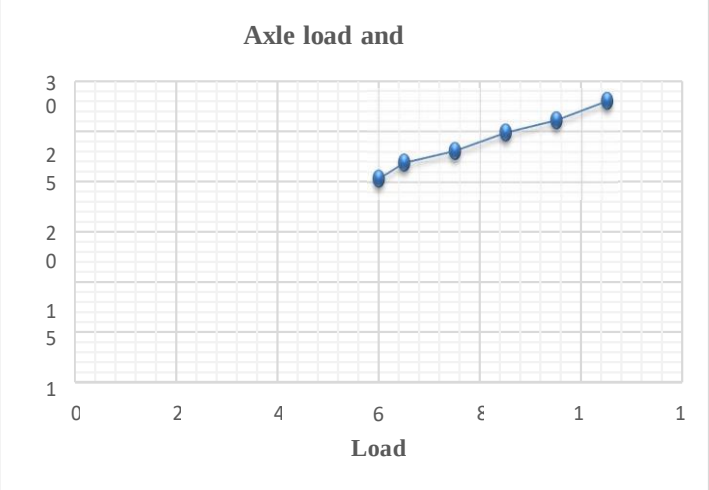
III. MATERIAL AND METHODOLOGY

PCC mixtures used in UTWT are often high strength and high performance concrete. Considerations regarding the existing HMA pavement shall be evaluated by examining pavement deficiencies and the causes of deterioration prior to the selection of the mix, grade of concrete and thickness of UTWT.
UTWT projects are generally constructed with concrete of mix having lower water cement ratio (<0.4). The slump requirement (75 – 100mm) for construction and placing and flow are achieved conveniently by the use of high range water reducers. The mixes may have high cement content (but not greater than 540 kg/m3). A typical mix proportion given in Table 2. maybe tried to achieve characteristic minimum compressive strength of M 50.

IV. RESULT AND DISCUSSION



Graph showing the relation between Flexural Strength and Curing time



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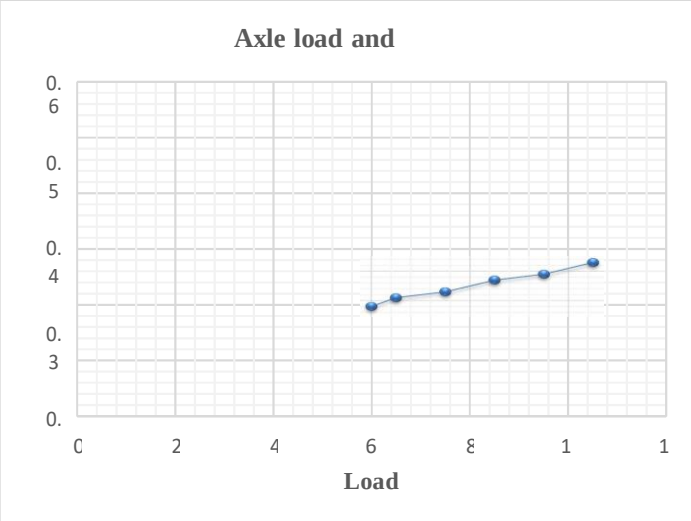
Graph Showing the relation between Load class and Edge Stress for single loaded axle



Graph Showing the relation between Load class and Stress ratio for single loaded axle

Axle Loads (AL) Tonnes	Edge stress	Flexural Strength kg/cm2	Stress Ratio $\frac{Col\ 2}{Col\ 3}$ SR =	Fatigue Life N
(1)	(2)	(3)	(4)	(5)
15-16	34.65	53.147	0.65	7714
14-15	33.985	53.147	0.64	10188
13-14	32.85	53.147	0.62	17768
12-13	31.25	53.147	0.59	40922
11-12	29.564	53.147	0.56	94249
Less than 11	28.025	53.147	0.53	217067

V. CONCLUSION

By using polypropylene fibre, the flexural strength of M40 concrete for a curing period of 3days is calculated by conducting third point load test as 15.65 kg/cm^2.
By using polypropylene fibre, the flexural strength of M40 concrete for a curing period of 7 days is calculated by conducting third point load test as 41.25 kg/cm^2.
By using polypropylene fibre, the flexural strength of M40 concrete for a curing period of 15 days is calculated by conducting third point load test as 53.147 kg/cm^2.
The commercial vehicles per day from Jakat naka to MIDC square are 208 cvpd.
For UTWT pavement the square panel of size 1m x 1m has been provided.
The stress ratio for 100 mm thick UTWT pavement is 0.875 i.e, 87.5 %

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VI. FUTURE SCOPE

Design of UTWT can be provided for Bus stand, parking yards, small airports.
The ultra-thin white topping can be provided as a pavement rehabilitation techniques for high traffic volume road.
Design of UTWT based on finite element analysis software can give the accurate results and economy can be achieved.
The design of UTWT overlay concrete mix by using admixtures can be used in a such a way that the required strength of concrete is achieve within 2-3 days which allow early opening to traffic.
Use of plastic sheet in UTWT overlay as a material in intermediate joint can be used so as to avoid joint cutting.
Fatigue data are needed for some of the concrete resurfacing systems, IRC: SP:76- 2008 especially for bonded resurfacings, and for some of the newer or less used resurfacing types, such as fibrous, pozzolona admixed, self-compacted and prestressed concrete. Such data would permit these resurfacing systems and materials to be incorporated into existing or proposed analyses with more confidence.

REFERENCES

1. D. R. Jundhare, K. C. Khare, R.K. Jain, “Ultra-Thin White Topping in India: State of Practice”. ACEE international journal on transportation and urban development, Vol.2, No 1 April 2017.
2. Haifang Wen, PhD, P.E., Xiaojun Li, Wilfung Martono, "Assessment of Wisconsin’s white topping and ultra-thin white topping project".
3. Dave Amos, Intermediate Research Assistant, Missouri Department of transportation, “Pavement Rehabilitation Through Ultra-Thin White topping (UTW) Overlays".
4. D. R. Jundhare, Dr. K. C. Khare; and Dr. R. K. Jain, “Performance Evaluation of Ultra-Thin White topping in India by BBD Test". International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 1 Issue 4, June - 2012
5. Mitesh D. Patel, Prof. P. S. Ramanuj, Bhavin Parmar, Akash Parmar, “White Topping as A Rehabilitation Method: A Case Study of Budhel- Ghogha Road”, International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974.
6. Ashish P. Alapure, Shishir S. Ganjale, Shrikant . Kulkarni, Utkarsha B. Ingle, Yogesh Y. Gore, Yogita B. Dahatonde, “Pavement Rehabilitation Using Thin White Topping”. IOSR Journal of mechanical and civil engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN:2320-334X.
7. Brajesh Mishra, “A Study on Thin White Topping: An Alternate for Pavement Treatment”, International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, Volume 11, Issue 11 (November 2015), PP.07-11
8. Prof. Shrikant Harle, Prof. Prakash S. Pajgade, “White Topping in Roads: Review”.
9. Journal of structural and transportation studies, Volume 1 Issue 3.
10. “Ultra White Thin Topping”, Alapure Ashish P., Dahatonde Yogita B., Ganjale Shishir S., Gore Yogesh Y., Ingale Utkarsha B., Kulkarni Shrikant S., S. P Shinde, IOSR Journal of mechanical and civil engineering (IOSR-JMCE) e-ISSN: 2278-1684,
11. -ISSN:2320-334X, PP 123-132,2015
12. 10) Mr. Mehul J. Patel, Mrs. S. M. Kulkarni, “Effect of Polypropylene fiber on the high strength concrete”, Journal of Information Knowledge and Research In Civil Engineering.
13. U. Sivaramakrishna, Dr. C. N. Satishkumar, “A study on design concepts of ultra- thin white topping on village roads in India”, ELK Asia Pacific Journals- Special Issue ISBN: 978-81-930411-5-4.
14. J. Roesler, “Fatigue Resistance of Concrete PavemEnts”.6th International DUT-
15. workshop on fundamental modelling of design and performance of concrete pavement, Belgium, September 2006.
16. IRC: SP-76 (2008). “Tentative Guidelines for Conventional, Thin and Ultra-Thin White topping." Indian Road Congress, New Delhi, 2008
17. IRC: 58 – 2002 “Guidelines for the design of rigid pavement for highways,” Indian Road Congress, New Delhi, 2002
18. IRC: 15 – 2002 “Standard specifications and code of practice for construction of concrete roads.” Indian Road Congress, New Delhi, 2002
19. IRC: 44-2008. “Guidelines for Cement Concrete Mix Design for Pavements (Second Revision)” Indian Road Congress, New Delhi, 2008
20. IS: 516-1959, “Methods of Tests for Strength of Concrete” Indian Standard, 1959 20] IS: 456-2000, “Plain and Reinforced Concrete- Code of Practice”, Indian Standard, 2000

Impact Factor
7.54

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

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