IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

# A Comparative Study of Reinforced Cement Concrete Pavement and Polypropylene and Polyester Fiber Concrete Pavement

**Prof. Mr. L.B. Pawar, Shubham Patil, Shubham Sabale**
Department of Civil Engineering
SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad, Nashik, India

**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 termed as pavement quality concrete. Pavement quality concrete is rehabilitation treatment on asphalt concrete. It is defined as Plain Cement Concrete overlay on asphalt concrete. It provides a new innovative method of rehabilitation at a very low cost with very good results and low maintenance cost. This method of rehabilitation/strengthening can be adopted for rural road network and district roads as these roads have low to moderate traffic. Even on the State Highways and some recently declared National Highways, where traffic is moderate, the above method of strengthening has a lot of promise. By adopting proper construction methods, we can rehabilitate large network of roads at reasonable cost and we get additional long life.*

**Keywords:** Rehabilitation, Innovative, Asphalt Pavement, Strengthening

## I. INTRODUCTION

Most of our bituminous pavements today, which are badly suffering fromdistresses like rutting, shoving, cracking etc., are overdue for rehabilitation/strengthening. This will involve huge cost and consumption of scarce physical resources like aggregates and bitumen. Cost effectiveness of PCC overlays (white topping) bituminous overlay, therefore, needs to be examined. White topped roads on average have proved to be quite cost effective besides giving an additional life of 20 to 30 years on average.

Road traffic is increasing steadily over the years. An international forecast predicts that such increase will continue in near future. Even in case of developed countries, there is a shortage of funds required for new infrastructure projects, both for constructing them and more significantly towards their maintenance and repairs. The position in the context of a developing country like India is obviously far worse. As a result, more and more roads are deteriorating and the existing pavement structure as a whole is often found to be inadequate to cope up with the present traffic.

### 1.1 Objectives :

The Main Parameters Study Is Compressive Strength using with polypropylene and Polyester fiber

- To improve the strength of the pavement structure
- To reduce the maintenance cost of pavements.
- To study the effect of fiber in road pavement
- To improve the life span of concrete

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

## II. LITERATURE REVIEW

**In November 2015, Brajesh Mishra**[3], investigated the 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 dueto better reflection of light particularly in city roads. Around 20% of electricity will be saved as compared to flexible pavements. Lower Operational costs and lower absorption of solar energy. Beneficial for environment as concrete roads are much greener and less polluting.

**InOctober 2013, Purvesh Raval**[9], ***et. al***[2], presented an Ultra-thin white topping is relatively new rehabilitation technology applying a 50 to 100 mm (2- to 4-in) thick concrete overlay on top of existing asphalt pavement. Ultra-Thin White Topping (UTWT) i.e. lying of concrete over bituminous pavement with closer joint spacing, thedetails of which are given on IRC: SP 76. UTWT involves the use of High Performance concrete (HPC) as per IRC: SP 70 and Ultra High performance Concrete i.e. HPC contain fibers and special types of aggregates. UTW can be designed for low-speed, low volume traffic areas such as street intersections, aviation taxiways and runways, bus stops and toll booths. For long term performance, the overlay must bond to the underlying asphalt so that the two layers respond in a monolithic manner, thereby reducing load-related stress.

**In January 2012, Ankit Sharma**[2], reviewedThe basic requirement for the design ofUTWT is the bond between the HMA and the PCC which allows the concrete and asphalt to perform as a composite section and causes the layers to act monolithically and share the load with each other and also with the other lower layers. With bonding, the neutral axis in the concrete shifts from the middle to the concrete down towards thebottom of the concrete and brings the stresses into a range the concrete can withstand. For low traffic minimum thickness of existing HMA may be 75 mm and for very heavy traffic, for heavy traffic minimum thickness of HMA may be considered as 100
mm. On certain locations, where some spots of exposed base and sub base course are visible, thesame shall be adequately re-compacted and proper HMA may be re-laid over it. Thegoal is to provide durable HMA to act as part of composite structure. With UTWT, short joint spacing are used so that the energy is absorbed by deflection rather than by bending.

**In April 2012, D. R. Jundhare**[4], ***et al***[2],carried out a comprehensive experimental investigation The increasing truck weights and tare pressures on our pavements in recent years have pushed the demand on the performance of our pavements to a higher level. Many asphalt pavements have experienced rutting while many others have experienced longitudinal cracking. One of the possible solutions to this problem is the use of white topping (WT), which is a cement concrete layer placed over an existing asphalt pavement. White topping is stronger than asphalt overlay, and thus more resistant to rutting and surface initiated cracking. Consequently, white topping pavements pose potential economical and technical benefits. However, they need to be effectively evaluated for feasibility and proper application techniques, suitable for India, so that their use can provide the maximum benefits to the road users in particular and Indian economy at large. Ultra-thin white topping is one of the types of white topping in which a thin layer of concrete varying from 50 to 100mm thick with fibers is placed over a prepared surface of distressed asphalt pavement. In addition to the thickness of the concrete overlay, other factors differentiate UTWT from conventional concrete overlays are: (a) a substantial degree of bond between the concrete overlay and the prepared asphalt surface, and (b) much closer joint spacing

### 2.1 Object of testing

- The main objective of testing was to know the behavior of concrete by using crush sandstandard polypropylene fiber at room temperature.
- The main parameters studied were compressive strength, flexural strength. Thematerials used for casting concrete samples along with tested results are described.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

### 2.2 Cube Casing & Testing

Polypropylene

Polyster

**Compressive Strength (N/mm$^2$) 1% of fibers for 7 Days**

| Fiber's (1%) | Designation | Compressive strength of at 7 days (N/mm^2) | Average (N/mm^2) |
|---|---|---|---|
| Polypropylene | C-1 | 38.42 | 38.30 |
| | C-2 | 38.18 | |
| | C-3 | 38.30 | |
| | C-4 | 38.32 | |
| | C-5 | 38.24 | |
| | C-6 | 38.34 | |
| Polyester | C-1 | 34.44 | 34.28 |
| | C-2 | 34.27 | |
| | C-3 | 34.15 | |
| | C-4 | 34.31 | |
| | C-5 | 34.23 | |
| | C-6 | 34.28 | |
| Polypropylene & polyester | C-1 | 37.56 | 37.46 |
| | C-2 | 37.34 | |
| | C-3 | 37.50 | |
| | C-4 | 37.28 | |
| | C-5 | 37.51 | |
| | C-6 | 37.57 | |

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

**Compressive Strength (N/mm2) 1% of fibers for 28 Days**

| fibers (1%) | Designation | Compressive strength of at 7days (N/mm^2) | Average (N/mm^2) |
|---|---|---|---|
| Polypropylene | C-1 | 59.10 | 58.33 |
| | C-2 | 58.22 | |
| | C-3 | 57.68 | |
| | C-4 | 59.14 | |
| | C-5 | 58.29 | |
| | C-6 | 57.57 | |
| Polyester | C-1 | 48.94 | 49.16 |
| | C-2 | 48.78 | |
| | C-3 | 49.78 | |
| | C-4 | 48.89 | |
| | C-5 | 48.91 | |
| | C-6 | 49.7 | |
| Polypropylene & polyester | C-1 | 51.59 | 51.59 |
| | C-2 | 51.32 | |
| | C-3 | 51.78 | |
| | C-4 | 51.4 | |
| | C-5 | 51.76 | |
| | C-6 | 51.53 | |

## III. CONCLUSION

After carried out of various specimens, i.e. cubes and beams of varying percentage of replacement of river sand to crush sand, following conclusion are drawn.

- Compressive strength of concrete increases by 20.71 %, 20.10 % &19.53. with the increase in sand replacement with different replacement levels of Crush sand. However, at each replacement level of fine aggregate with Crush sand, an increase in strength was observed with the increase in age.
- Pavement strengthening and rehabilitation is a problem of immediate concern and this activity will figure dominantly in the developing plants for the coming year.
- Advantages of concrete overlay included fuel saving , good riding quality hard surfaceno effect of slippage of oil design precision, absence of penetratation of water good reflectivity characteristics, easy available of binder of favorable cost economic.
- From the general behaviour of concrete made with partially replaced natural rivers and and the properties of the rock sand conclusion is herein drawn that CRS is a suitable partial replacement of natural sand.
- The 0 to 70 % CRS resulted in strength values above that of the design (40N/mm2). However the best results were achieved with 50 % crush sand. The replacement of natural river sand can therefore made up to 70%.

## REFERENCES

**[1].** Adams Joe, A. Maria Rajesh,P. Brightson, Mr. Pram Anand (2013), "Experimental Investigation On The Effect Of M-Sand In High Performance Concrete", American journal engineering research,Volume-02, Issue-12,

**[2].** Ankit Sharma (2013), "Guidelines For The Design And Construction Of Ultra Thin White Topping",International Journal of Advanced Engineering Research and StudiesVolume-2,Issue 01.

**[3].** Brajesh Mishra (2015), "A Study On Thin White Topping: An Alternate For Pavement Treatment",International Journal of Advanced Engineering Research and development,Volume11,Issue 11, Pp.07-117.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

**[4].** Dr.T.Ch.Madhavi , L.Swamy Raju , Deepak Mathur (2014), "Polypropylene FiberReinforced Concrete-A Review", ISSN 2250-2459, Iso 9001:2008 Certified Journal,Volume 4, Special Issue

**[5].** Luaay Hussein,Lamya Amleh(2015),"Structural Behavior Of Ultra-High Performance Fiber ReinforcedConcrete Normal Strength Concrete Or High Strength ConcreteComposite Members", Elsevier,Materials 93 (2015) 1105–1116.

**[6].** Vinay H. N., Sunil S (2014), "Rehabilitation Of Low Volume Flexible PavementsBy White Topping-A Case Study", International Journal of Advanced Engineering Research and Studies,Volume: 03 Special Issue: 06 , May-2014