International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

ULTRA-THIN WHITETOPPING ON ASPHALT LAYER

Avinash B M[1], Lohith kumar R B[2], Supriya G B[3] , Tejaswini M L[4] , Dr Shivakumara B[5] Poornima K B[6]

[1234] *UG Student, Dept. of civil engineering, S.T.J I.T College, Ranebennur, Karnataka, India.*
[5] *Principal, S.T.J.I.T College, Ranebennur, Karnataka, India.*
[6] *Asst Professor, Dept. of civil engineering, S.T.J.I.T College, Ranebennur, Karnataka, India.*

Abstract - *Ultra-Thin White Topping (UTW) is a technology construct 50-100mm thick cement concrete overlay on distressed asphalt pavement as a improvisation technique. There have been several projects done under this topic. The first UTW project done in India was in Pune, than in New Delhi, Ghaziabad and etc. All projects have shown good and excellent performance. It is also suitable for the Indian climate and traffic condition. This paper includes the details about UTW and its mix design as per IRC code recommendation. There have been several projects done under this topic.*

Key Words: **Ultra-thin white topping, Thin White topping, Pavement quality concrete, Hot mix asphalt, Compression strength, Flexural strength.**

1. INTRODUCTION

In recent years there will be increase in truck weight and tyre pressure on our pavement due to this issue, we pushed the demand on the performance of our pavements to a higher level. Many flexible pavements have experienced rutting while other rigid pavements have experienced longitudinal cracking. One of the possible solution to this problem is the use of white topping (WT), which is a cement layer placed over an existing asphalt layer or pavement.

This UTW has been practiced since from the 1918 in USA. Based on the types of interface, there are 3 types in white topping namely, Ultra Thin White Topping, Thin White Topping, Conventional White Topping.

i. **Conventional White Topping-** which consists of PCC overlay of thickness 200mm or more.

ii. **Thin White Topping-** which consists of PCC overlay of thickness 100-200mm.

iii. **Ultra Thin White Topping-** which consists of PCC overlay of thickness 50-100mm.

1.1 OBJECTIVES:

- To study the present condition of existing pavement and suitability regarding lying of ultra-thin white layer.
- To do various types of testing on existing bitumen pavement to obtain the good design.
- To analysis the load carrying capacity of existing pavement.
- To determine the durability of the pavement surface.

2. MATERIALS AND METHODOLOGY

2.1 Materials

1. Cement
2. Fine aggregate
3. Course aggregate
4. Admixture
5. Water

2.2 METHEDOLOGY:

1. **Repair:** For distressed pavement of HMA, it requires a necessary repairing process before UTWT is applied.

2. **Milling:** This process is used to removal of rutting and to level the surface of the HMA layer from the undulations. This helps to increase the bonding between the new PCC and existing HMA layer.

3. **Cleaning:** After milling processes, the top surface must be cleaned to increase the bonding between the existing HMA and the new PCC overlay.

4. **Mixing and Laying:** Mixing of the materials is based on the grade of the concrete, size of the aggregates, type of the admixture and water cement ratio by IRC code recommendation.

   After the mixing of the cement concrete immediatly we have to deposit it on the bitumen pavement surface, before segregation of the materials takes place. The spreading is done uniformly.

5. **Cutting:** After completion of concrete laying works, groove cutting is require to prevent floor from crack by expansion .

Groove cutting panel size:1.1 to 1.5m.

Depth of groove cutting:1/3rd of the panel thickness.

6. Curing is done to get a desired strength and properties of the cement concrete , by maintaining satisfactory moisture and temperature within a concrete mass as it sets and hardens.

2.3 TESTS:

The tests were conducted are as follows:

a. Compression strength test
b. Split tensile strength test
c. Flexural strength test

a. Compression Strength Test

To determine the ultimate strength of concrete cubes, we have tested 9 numbers of concrete cube specimens (150×150×150mm) were casted and it is allowed for 7, 14 and 28 days curing. Cubes were tested in compression testing machine (CTM),

The compression strength is calculated by using formula:
$C=P/A$……..N/mm^2

Where, P=maximum applied load in N
A= area of specimen in mm^2

Table -1: Compressive strength results

No	7-Days compressive strength (MPa)	14-Days compressive strength(MPa)	28-Days Compressive strength (MPa)
1	49	58.84	60.76
2	50.96	61.74	63.7
3	54.88	53.9	59.78
AVG	51.61	58.16	61.41

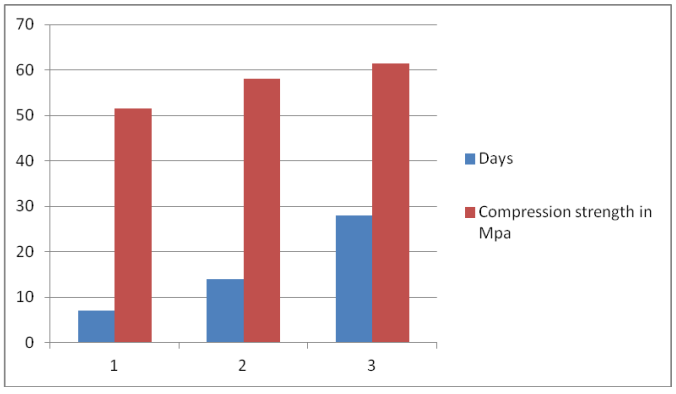

Chart -1:Compression strength v/s Days

b. Flexural Strength Test

To determine the ultimate flexural strength of concrete beams, we have tested 9 number of concrete beam specimens (700×100×100mm) were casted and it is allowed for 7, 14 and 28 days curing. Beams were tested in universal testing machine (UTM)

The flexural strength can be calculated by using the formula:

$f_b= pl/bd^2$

where,

b= width of specimen in mm

d= failure point depth in mm

l= supported length in mm

p= maximum load in Kg

Table no-2: Flexural strength test results

No	7-Days flexural strength (MPa)	14-Days flexural strength(MPa)	28-Days flexural strength (MPa)
1	5.39	5.88	6.56
2	4.99	5.78	6.07
3	5.586	5.88	5.68
AVG	5.322	5.84	6.10

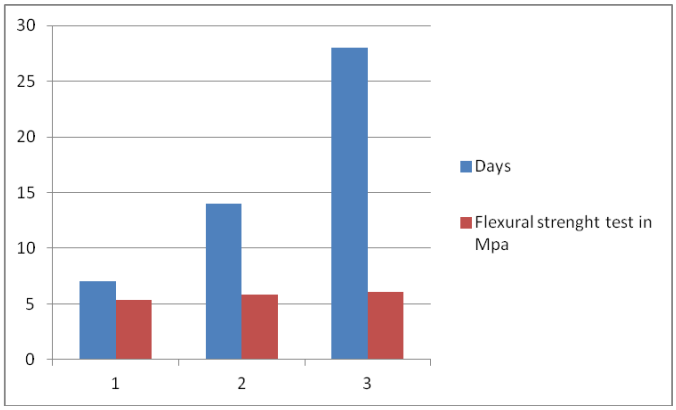

Chart no-2: Flexural strength v/s Days

c. Split Tensile Strength Test

To determine the ultimate tensile strength of concrete cylinders, we have tested 9 number of concrete cylinder specimen (100×100×300mm) were casted and it is allowed for 7, 14 and 28 days curing. Cylinder were tested in compression testing machine (CTM).

By using formula we calculate the tensile strength:

$S=2P/\pi DL$……N/mm^2

Where, P=maximum applied load in N

D=Diameter of the specimen in mm

L=length of the specimen in mm

Table no-3: Split tensile strength test result

No	7-Days split tensile strength (MPa)	14-Days split tensile strength(MPa)	28-Days split tensile strength (MPa)
1	1.862	2.45	2.84
2	2.156	2.25	2.74
3	1.96	2.45	2.94
AVG	1.99	2.38	2.84

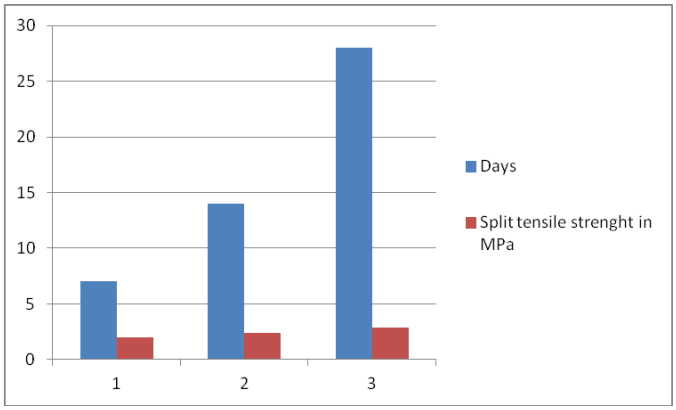

Chart no-3: Split tensile strength v/s Days

3. CONCLUSIONS

Ultra-thin white topping is a concrete pavement overlay option for distressed asphalt concrete pavements. A structural and material design procedure has been proposed based on literature and new research. The failure criteria for the UTW thickness is concrete fatigue cracking at the corner loading position. In India this technology is getting a good scope than any other pavement methods . We are suggesting the thickness of UTW by use of manual design and the ANSYS software.

This UTW pavement is more economic than bitumen pavement. And gives 30-40 years durability with high strength comparing to other pavements.

REFERENCES

1. Brown, D.(1995). "Ultra-thin white topping emerges as Rehab technique" Transportation builder,pp.37-41 V7,No,1.

2. Edward, W.F., and sargand,S.M.(1999). "Response of an ultra-thin white topping pavement to moving wheel loads." Presented at the Accelerated Pavement Testing International Conference, Reno,Nev.,pp,18-20.

3. Balbo, J.T .(1991) , " Applications of high performance concrete for ultra-thin pavement overlays (white topping)", ACI special publication, vol.186, pp., 731-744.

CODE BOOK:

1. IRC:SP:20-2002, Rural Roads Manual.

2. IRC:SP:46-2013, Guidelines For Design And Construction Of Fiber Reinforced Concrete Pavement.

3. IRC:58-2002, Guidelines For The Design Of Plain Jointed Rigid Pavement For Highways.

4. IRC:SP:76-2008, Tentative Guidelines For Conventional, Ultra-Thin, Thin White Topping.