

# EXPERIMENTAL INVESTIGATION ON PERFORMANCE OF WHITE TOPPING OVER FLEXIBLE PAVEMENTS

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**Abstract** - The main focus of the present era is to construct a long-lasting and better performing pavement. Usually, with respect to the rehabilitation of the pavement, the construction agencies go with the bituminous overlays as their first priority without considering the condition of the existing pavement structure. But Cement Concrete (CC) pavements have proved that they perform better and are long-lasting as new pavement as well as when used for rehabilitation of the existing pavement.

Hence it is the era, White Topping methods are gaining their popularity. White topping 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.

This study presents a methodology to adopt white topping as rehabilitation treatment and cost-effective rehabilitation alternative for preserving bituminous pavements on long-term basis and to compare & conclude which type of road is feasible and is good to have on a particular situation. The comparison of the study shows that the white topping of both types of roads improves the life span of the road & its withstanding capability.

**Keywords:-** White Topping, Potholes, Compressive Strength, Split Tensile Strength, Flexural Strength.

## 1. INTRODUCTION

India has the second largest road network in the world spanning about 4.69 million km comprising different categories of roads. Only half of the total road network is paved and of the paved roads, 90% of them are bituminous pavements. Pavement design is the

process of developing the most economical combination of pavement layers to suit the soil foundation and the cumulative traffic to be carried during the design life. Highway pavement is deteriorating fast due to lack of timely maintenance. Thus, timely maintenance of the highway pavement is essential. Road maintenance is one of the important components of the entire road system. Right maintenance treatment is to be given to the right place at the right time. Highway engineering is an engineering discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of roads, bridges, and tunnels to ensure safe and effective transportation of people and goods. Some considerations are the adverse effects on the environment, such as noise pollution, air pollution, water pollution, and other ecological impacts. A flexible pavement failure is defined by formation of potholes, ruts, cracks, localized depressions, settlements, etc.

The Portland Cement Concrete (PCC) overlay on an existing bituminous pavement is termed as White topping. The main goal of concrete overlay is to maximize the strength of the existing asphalt structure by rebuilding it. While achieving this aim, the overlay also brings back the riding-quality of the existing structure which had undergone deformations like rutting. At present, the concrete technology and its applications have developed in a rapid rate and hence the concrete overlay has become a non-renewable option.

## 2. OBJECTIVES OF THE STUDY

- [1] To evaluate the design and methodologies for repairing potholes by white topping layers.
- [2] To compare the Performance of potholes repaired using white topping layers and bituminous concrete mix.

## 3. METHODOLOGY

To achieve the objectives stated above, an efficient working procedure has to be followed. Initially

the required materials for white topping are selected and basic tests are conducted, then mix proportion of M40 grade is designed as per IS: 10262 and IS: 456 code specifications. By the obtained mix proportion moulds are prepared to test the properties of concrete such as compressive strength test, split tensile strength test and flexural strength test. When after reach the target strength the same proportion of mix is prepared to fill the potholes of known stretch of 50 meter road. Simultaneously bitumen mix is also prepared and filled in the same stretch of other potholes. Comparison is to be made after certain time and the conclusions are obtained.

**4. MATERIALS USED**

Fig: 1 Particle Size Distribution

The materials used in experimental investigation are Cement, Fine aggregates, coarse aggregates and Water.

**4.1 Cement**

The Portland Pozzolana Cement (PPC) is a kind of Blended Cement which is produced by either inter-grinding of Ordinary Portland Cement (OPC) clinker along with gypsum and pozzolanic materials in certain proportions or grinding the OPC clinker, gypsum and Pozzolanic materials separately and thoroughly blending them in certain proportions and tests results are tabulated as shown in Table 1.

**Table: 1** Basic Laboratory Tests on Cement

SL No	Tests on Cement	Test Results
1	Initial setting time Final setting time	240 min.. 300 min..
2	Normal Consistency	34%
3	Fineness of cement	2.83%
4	specific gravity of cement	3.0

**4.2 Coarse Aggregate**

20 mm and down size angular aggregates are used for experimental investigation and tests results are tabulated as shown in Table 2.

**Table: 2** Basic Laboratory Tests on Coarse Aggregates

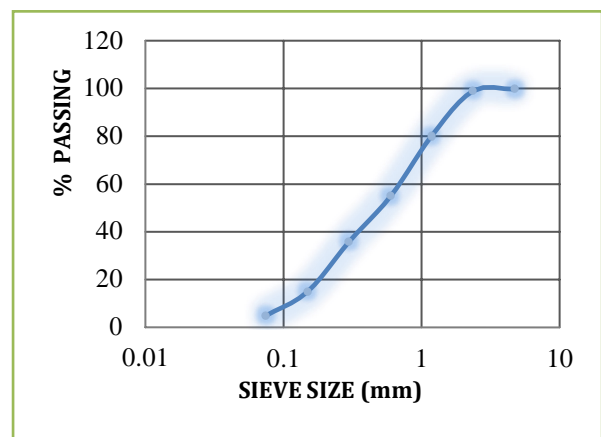
SL No	Tests on Coarse Aggregates	Test Results
1	Impact test	22.17%
2	Crushing test	27.45%
3	Abrasion test	32%
4	Soundness test	2.04%
5	Specific gravity and water absorption	2.50 and 0.5%

**4.3 Fine Aggregate / Sand**

Zone-2 aggregates are used for experimental investigation and tests results are tabulated as below Table 3 and the particle size distribution is as shown in Fig-1.

**Table: 3** Basic Laboratory Tests on Fine Aggregates

SL No	Tests on Fine Aggregates	Test Results
1	Specific gravity	2.60
2	Sieve analysis	Well Graded



**Fig: 1** Particle Size Distribution

**4.4 Water**

Locally available potable water used for mixing and curing was clean and free from injurious amounts of oils, acids, alkalis, salts and sugar, organic materials or other substances that may be deleterious to concrete.

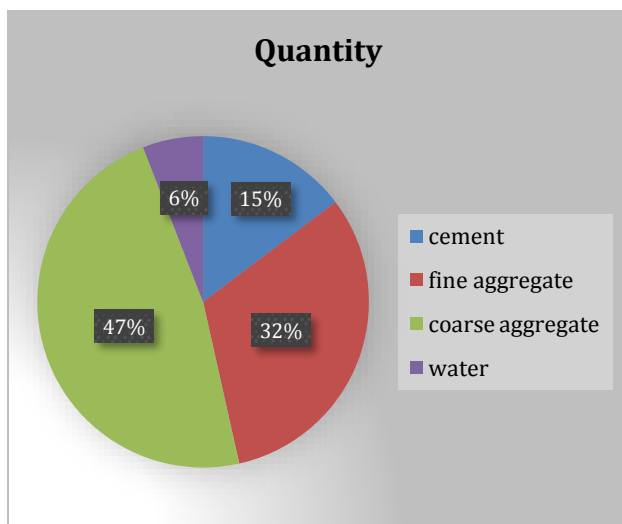
### 5. MIX DESIGN

From the results of materials basic tests, Mix design were conducted for M40 grade concrete mix using IS10262 and IS 456:2000 codal provisions. The mix design ratio among cement, fine aggregate, coarse aggregate and water were originated as shown in Table 4 and percentage of proportions were shown in Fig 2.

**Table: 4** Mix Proportions per Cubic Meter

Cement	Fine Aggregate	Coarse Aggregate	Water
894kg\m <sup>3</sup>	850kg	1274kg	157.6kg
1	2.15	3.23	0.4

**Fig-2:** Mix Proportion



### 6. CASTING AND CURING

A total 9 cubes, 9 cylinders and 9 beams were cast for the compressive strength test, split tensile strength test and flexural strength test respectively. The appropriate mix proportion was maintained during the construction. After 24 hours of casting, the specimens were de-moulded and submerged under the water for curing which is shown in Fig 3.



**Fig-3:** Concrete Specimens after De-moulding

### 7. RESULTS AND DISCUSSIONS

The casted specimens are subjected to check the target strength for 3 days, 14 days and 28 days respectively.

**7.1 Compressive Strength Test:** The cubes were tested for compressive strength with respective ages of curing as 7, 14 and 28 days. A compressive strength test helps to determine concrete grading as shown in Fig-4.



**Fig-4:** Compressive Strength Test of Cubes

The compressive strength test results are tabulated as shown in Table: 5

**Table: 5** Results of Compressive Strength Test

SL No	No of Days	Results
1	3	8.93
2	14	16.79
3	28	40.23







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