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EXPERIMENTAL STUDY ON SELF-REPAIRING ROAD

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Abstract - *This paper majorly focuses on the application of Self-Repairing Road and its sustainability in "**SRM VALLIAMMAI ENGINEERING COLLEGE**", Chennai, Tamil Nadu. It is built using ultra high strength concrete and special fibers, it is not only cost-effective, but has greater longevity. Unlike the typical Rigid Pavement in which cement is a key component, in self-repairing road it uses 80% Cement And 20% Fly-Ash And 2,3,4%Activated Carbon. These materials on constituent with cement and Activated Carbon makes a normal grade concrete as High Strength and High Performance Concrete. The main content that self heals the road is fibers. The Fibers being used in constructing self-repairing road, should have a epoxy resin and un hydrated cement attracts water in the event of rains. The water then becomes a key component in healing cracks. When a crack appears, this water gives hydration capability to the un-hydrated cement, and produces more silicates, which actually close the crack before they grow larger. The road is about 100mm thick, which makes it 60% less thick than the standard Indian road . This makes the first-time cost of laying out such a road about 30%cheaper.it is important to keep in mind that when cement is used to lay roads It generates green house gases, which negatively affect the environment*

Key Words: Road, Cement, Concrete, Fibers, Fly-Ash, Activated Carbon, Water, Rain, Green House Gas, Environment, Self-Repair

1. INTRODUCTION

Self-healing properties are relatively new to material science. If an object can heal itself, it doesn't need replacing. Product lifetime is a crucial factor that should be maximized, especially in road works. while almost everyone enjoys the opening of a new road that could save a few minutes off their commute, no one likes to repair them. Roads are failing and government cannot keep up with the repairs.

The roads will require less servicing, increasing productivity while decreasing cost. Self-healing roads far outperform conventional roadways, self-healing Rigid Pavement can improve traffic flow, reduce maintenance activity, and can easily extend the life of a road up to 40 years. durability is experiencing a shift from the idea of minimizing damage to the new era of self-healing capabilities.

1.1 OBJECTIVE

1. To test and lay high strength concrete road 2%, 3%, 4% of activated carbon, 20% fly ash and cement content 70-80% .the presence of activated carbon in concrete increases the strength of the road.
2. To give secondary reinforcement for the high strength concrete road with fibers
3. To induce the concept of self-repair when crack are formed with polar substances.
4. To increase the life span of the road and durability when compared to normal asphalt and cement roads.
5. To increase the strength of the rigid pavement by adding Activated Carbon which will increase the strength by 10-25% compared to conventional concrete.
6. To improve the street roads and village roads which have poor maintenance for prolonged period.

1.2 MECHANISM

1. The Activated Carbon in the Concrete will increase the compressive strength evidently and reduce the pores in the rigid pavement. This will significantly resist the road from cracks.
2. The Fiber with Hydrophilic coating have natural tendency to self-repair when cracks are formed.
3. When a crack appears, this water gives hydration capability to the un-hydrated cement, and react with hydrophilic substance, which close the crack before they grow larger.
4. Continued Hydration of anhydrous cement particles with come in contact with water and precipitation of Cement crystals

2. METHODOLOGY

Collection of Raw Materials for Concrete and Collection of Fly Ash and Activated Carbon

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Material Test and their Properties

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Proportioning of concrete with 2-4% Activated Carbon and 20% of Fly Ash.

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Proportioning of Fiber Reinforcement with epoxy resin

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Test for Fresh and Hardened Concrete and compare with Conventional concrete

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Selection of Site and it's Soil Properties

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Laying of Concrete road

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Generation of crack pattern

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Study of Healing of Cracks in addition of Polar substances (microscopic studies)

2.1 MATERIAL COLLECTED

Fig – 1 : Material Collected

2.2 MIX PROPORTION

M30 Design mix

Cement	Fine aggregate	Coarse Aggregate	W/C Ratio
1	1.22	2.52	0.42

Fiber reinforcement with Epoxy Resin are added with 1%,1.5%,2%

Activated Carbon are added as 2%,3%,4% as volume of Cement

Cement as been replaced by 20% of Fly Ash.

2.3 COMPRESSION TEST

Table -1: Compression Test for Hardened Concrete with Activated Carbon

% of Activated Carbon	14 days Compressive strength	28 days Compressive strength
2%	26.32 N/mm²	32.41 N/mm²
3%	27.01 N/mm²	34.52 N/mm²
4%	27.96 N/mm²	36.72 N/mm²

Table – 2 : Compression Test of Hardened Concrete with Fiber Reinforcement

% Fiber Reinforcement	14 days Compressive strength	28 days Compressive strength
1%	27.52 N/mm²	34.81 N/mm²
1.5%	28.91 N/mm²	36.23 N/mm²
2%	29.86 N/mm²	39.32 N/mm²

2.4 SPLIT TENSILE TEST

Table – 3 : Split Tensile Strength of Hardened Concrete with Activated Carbon

% of Activated Carbon	14 days Tensile Strength	28 days Tensile Strength
2%	16.21 N/mm²	22.11 N/mm²
3%	17.01 N/mm²	23.24 N/mm²
4%	18.95 N/mm²	24.42 N/mm²

Table – 4 : Split Tensile Strength of Hardened Concrete with Fiber Reinforcement

% Fiber Reinforcement	14 days Compressive strength	28 days Compressive strength
1%	17.42 N/mm²	24.84 N/mm²
1.5%	18.51 N/mm²	26.27 N/mm²
2%	19.16 N/mm²	27.34 N/mm²

Fig – 2 : Compressive Strength

Fig – 3 : Tensile Strength

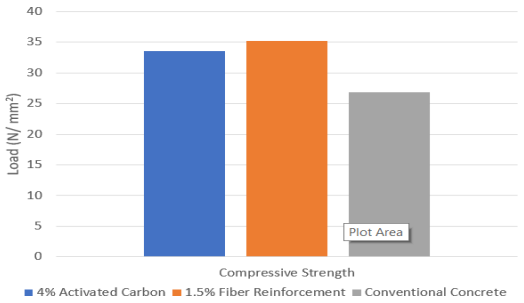

Chart – 1 : Compressive Strength

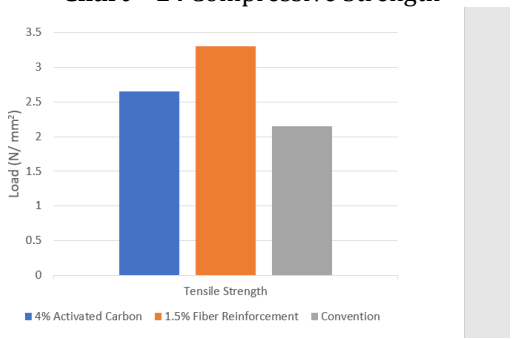

Chart – 2 : Tensile Strength

Hence Activated Carbon Content of 4% has better results Comparatively

2.5 FORMATION OF CRACK AND HEALING

Addition of Epoxy Resin with 5% will induce the self repairing property.

Fig – 4 : Preparation of mould

Fig – 5 : Generation of Crack

Fig – 6 : Self Repair of Crack

2.6 LAYING OF SELF REPAIRING ROAD

Area of Road 1 m x 1.1 m with Depth of 0.1 m

Fig – 7 : Formation of Base Course

Fig – 8 : Laying of Concrete containing Fly Ash and Activated Carbon

This layer is formed at a height of 5 cm from the base course, which increases the strength at the base of road.

Fig – 9 : Laying of Fiber Reinforcement on Top Layer

Fig – 10 : Finishing of Self Repair Road

3. CONCLUSIONS

This project mainly interests the design of rigid pavement as demand for road maintenance increases road contractors and highway engineers need to look widely for ways to improve and maintain the roads. So we hereby concludes that roads with self healing property reduces the cost of maintenance and it believes that with certain natural and synthetic fibres we could done it. On the other hand these road has been laid with high strength concrete containing activated carbon as a main strength improving agent.

Self repairing using natural and synthetic fibers coated with hydrophilic nano coating which has a impaired quality to repair the minute holes and hair pin line cracks which may be a width of about 0.01-2mm,and particularly it is well suited for street roads rather than country roads on increasing its durability to double the span of conventional road.

From this project we have gained practical knowledge towards our project field and the major need of the road maintenance and its solutions which can be given by civil engineers.

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