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Use of Rice Husk In Road Construction

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Abstract
The potentiality of rice husk as a good source of high technological materials in road construction is the subject of this research. Every year approximately 600 million tons of paddy (after- M. Ahiduzzaman, *Rice husk Technologies In Bangladesh*) are produced globally. This gives around 120 million tons of rice husk (RH) and 21 million tons of rice husk ash (RHA) annually. Major four uses of rice husk ash are in the steel, cement, refractory bricks and semiconductor industry. Besides these, it can be utilized in several other applications. Emerging trend of using waste material in soil stabilizing or soil strengthening is being working out all over the world in present days. The main reason behind this trend is the excessive production of waste like fly ash, plastics, rice husk ash (RHA) which is not only hazards but also creating deposition problems. Using some of these waste materials in construction practice will reduce the problem in a great extent. This paper will let us study how husk waste can be used in construction of roads. Step by step procedure of various tests conducted on the experimental model section of road block. This project will also conclude about how the use of rice husk in road construction increases the strength, flexibility, durability etc. of the road. Implementation of new innovative technology in construction of roads. (after- *Effect of Rice Husk Ash on Cement Stabilized Laterite*)

Keywords— Rice husk, paddy, hazards, implementation

1. Introduction

Pune is the ninth largest city in India and second largest city in Maharashtra considering the population. The present road network does not satisfy the requirement of traffic in Pune region. Recently Pune Municipal Corporation (PMC) and Pimpri Chinchwad Municipal Corporation (PCMC) has taken up construction of roads in various parts of city and received funds from Central Government under Jawaharlal Nehru National Urban Renewal Mission (JNNURM).To satisfy the present need of transport facilities PMC and PCMC prepared City Development Plan.

Pimpri-Chinchwad Municipal Corporation (PCMC) has taken up construction of roads in various parts of city and received funds from Central Government under Jawaharlal Nehru National Urban Renewal Mission (JNNURM).To satisfy the present need of transport facilities PMC and PCMC prepared City Development Plan. PMC has prepared a City investment plan of 2725 crores for Transport and Traffic Management and PCMC has prepared a plan of 3200 crores. After successful completion of roads network in twin cities Pune and Pimpri Chinchwad the progress and living standards of the cities will get improved. However, the performance of the roads is poor due to the poor quality of road construction at many places. There are potholes on many roads and other defects found on these roads including cracks on road surface, ruts formation and road undulations. Wherever paving blocks are used it is found that at many places the removals of the paving blocks have been observed. The conditions of road are deteriorating over the period of time because of presence of poor quality of materials, improper construction procedure and lack of proper maintenance. The study is limited to Pune region but same may be applicable for other cities.

2. Types of failures in road

Following are the reasons for the failure of road

i) Due to use of improper material
ii) Due to poor drainage conditions of the road
iii) Due to poor procedure followed for the construction of road.

In this paper the failure due to poor drainage of road is focused and the remedial solution in terms of rice husk layer is elaborated.

2.1 *Loss of aggregates Because Of Poor Drainage*

The major failure of road occurs because of the loss of aggregates from the surface which presents a rough appearance. In some portion, the aggregates are intact and at other locations aggregates have been lost as shown in Fig. 1. The reasons of loss of aggregates are:

- Aging and hardening of the binder whereby its adhesive property is lost.
- Insufficient quality of binder for the given size and quality of aggregates used.
- Aggregate having no affinity to the binder because of improper gradation.
- Insufficient rolling of road before opening it for the traffic.
- Use of wet or dusty aggregates.
- Cold spraying of bitumen or delaying the spreading of aggregates over sprayed bitumen.

Figure1: *Loss of Aggregates during rainy season*

Because of loss of aggregates during rainy season the portions from which the aggregates are lost have been filled with water and this causes the main reason for deterioration of road. The water pressure causes the soil and aggregates to move from its place. Passage of traffic again put the water with high pressure inside the pavements and soil particles enter the pavements. Thus the width of pothole goes on increasing. Low content of bitumen causes the accumulation of aggregates on road sides.

This is called as failure due to poor drainage of the roads. The failure pattern is as shown in figure 2 below

Figure 2: *Accumulation of Aggregates on Road Sides*

During rain some amount of water flows away from road surface due to camber provided to it while maximum amount of water is getting accumulated on road surface which further gets percolated through the road surface to the inner layers. This inner water layer can adversely affect the inner portion of road like loosening of aggregates, loss of bond between the aggregates etc which further causes the deterioration of the inner layer results in formation of huge potholes on road surface as shown in figure 3 below.

Figure 3: *Formation of potholes on road due to poor drainage of road surface*

3.Use Of rice husk in road construction

As it was discussed earlier every year approximately 600 million tons of paddy (after- M. Ahiduzzaman, *Rice husk Technologies In Bangladesh*) are produced globally. The research is being done for usage of this rice husk as one of ingradient of road layers. The sub base layer of road can be prepared by using rice husk.

The model view of same is represented in figure 4 below.

Figure 4: *Model showing rice husk layer as sub base*

Basically this concept is initially followed in rigid pavement of M15 grade concrete and the combination of rice husk and fixing agent in proper proportion. The layer is provided below the first layer which absorbs the percolated water through road cracks.

When heavy vehicles passes on this road surface rice husk which under the concrete layer gets compressed and the precipitated water is thrown out which maintains the water level under safe limit or may all water can be expelled out due to the sponging action of rice husk layer. And even after this action the rice husk layer retains it's original position. Hence, it gives a flexible effect.

3.1 *Results and discussion*

In this research project, models were prepared for testing purpose as well as to obtain respective results from the tests. The first layer of 10 cm was of M15 grade concrete mixed with 1:2:4 proportion as well as reinforcement was also provided. Second layer (10 cm) consists of 1 kg of rice husk + 1 kg adhesive. The last layer (10 cm) was again of M15 concrete and reinforcement. Three models were prepared and were kept for different number of days for curing. Following is the table shown for the results for compression test:

TABLE1: COMPRESSIVE STRENGTH FOR VARIOUS CURING PERIODS

PERIOD OF CURING	ULTIMATE LOAD (KN)	ULTIMATE LOAD (TONS)	COMPRESSIVE STRENGTH (N/m^2)	
7 DAYS	1010	102.95	13.46	
14 DAYS	1000	101.936	13.33	
21 DAYS	1050	107.033	14.00	

Average compressive strength=14 N/mm^2

The graphical representation is as follows

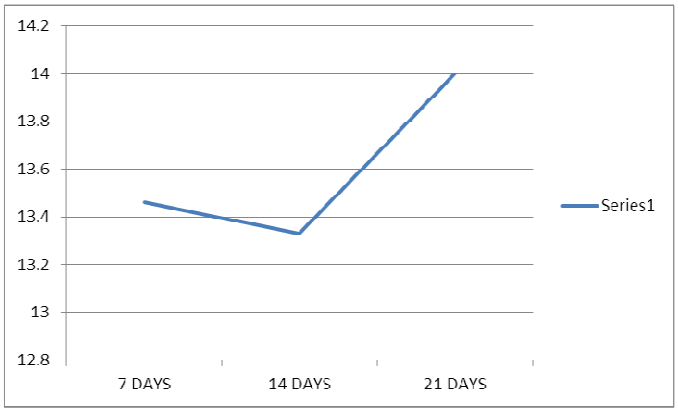

Figure5: *Line graph showing compressive strength*

The following tables show the test results of various periods of curing of model prepared using rice husk.

Table 1: -LOAD CARRIED FOR 21 DAYS CURING

TABEL3 **Crack no.**	**Load resisted**	**Layer affected**
1	200 KN	BOTTOM
2	220 KN	TOP
3	240KN	TOP
ULTIMATE LOAD	1100KN	TOP

Table 1: -LOAD CARRIED FOR 071 DAYS CURING

Crack no.	**Load resisted**	**Layer affected**
1	140KN	TOP
2	200KN	TOP
3	550KN	BOTTOM
ULTIMATE LOAD	1010KN	BOTTOM

Table 1: -LOAD CARRIED FOR 14 DAYS CURING

Crack no.	Load resisted	Layer affected
1	110KN	TOP
2	240KN	TOP
3	300KN	TOP
ULTIMATE LOAD	1000KN	TOP

3.2 *Advantages:*

- Compressive strength is comparatively more than normal rigid pavements.(14 N/mm^2>10 N/mm^2)
- Flexibility is good compared to normal roads.
- Combination of rigid as well as flexible pavement.
- Durability is enough compared to normal roads.
- Material like rice husk is available free of cost. Hence overall cost is reduced.
- Can be implemented in the heavy rainfall areas where rice is a major crop so that the husk production is more and its availability for road construction is more.
- Effective and innovative method which is useful in rainy season.

4. Conclusion:

The rice husk contributes a significant role for processing the main food of the people of the country. The energy is used in a primitive way which causes the wastes of this valuable resource. Therefore the use of rice husk in road construction is an effective method compared to construction method of normal roads. Hence, this will solve many problems like collection of drain water on road surface in rainy season, flexibility of a rigid pavement etc.

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