EXPREMENTAL STUDY ON PARTIAL REPLACEMENT OF SAND BY SAWDUST IN PAVER BLOCKS

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Abstract :

This study investigates between normal paver block and partially replacement of sand by using sawdust. Today the construction field lags down due to various reason. Among that, important one is lack of sand. To solve this problem we replaced the sand by sawdust for making paver blocks. Sawdust can easily available at low cost. It is environmental ecofriendly material. The development of sawdust concrete is suitable for the production of lightweight load bearing blocks (Outdoor Purpose), where the ingredients used in the mixing are cement, aggregates, water and sawdust. The physical and mechanical properties of sawdust concrete not only depends on the amount of sawdust used but also on the chemical and physical characteristics of the sawdust. In this project, the mix proportion is taken as M_{30} (1:2.2:2) and replacing sand volume 10%, 15%, 20% of sawdust. Here we conduct Compressive strength over the saw dust paver block to determine their properties and strength.

1. Introduction

Sawdust is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood with a saw or other tool; it is composed of fine particles of wood. Certain animals, birds and insects which live in wood, such as the carpenter ant are also responsible for producing the saw dust. Sawdust has a variety of other practical uses, including serving as mulch, as an alternative to clay cat litter, or as a fuel. Until the advent of refrigeration, it was often used in icehouses to keep ice frozen during the summer. It has been used in artistic displays, and as scatter. It is also sometimes used to soak up liquid spills, allowing the spill to be easily collected or swept aside. As such, it was formerly common on barroom floors. Mixed with water and frozen, it forms pyrite, a slow-melting, much stronger form of ice. Sawdust can be used as alternative substitute for fine aggregate in concrete production. Before using the saw dust it should be washed and cleaned. Concrete obtained from sawdust is a mixture of sawdust, gravel with certain percentage of water to entrance the workability and full hydration of the cement which provide great in bonding of the concrete. Sawdust concrete is light in weight and it has satisfactory heat insulation and fire resisting values. Nails can be driven and firmly hold in sawdust concrete compare to other lightweight concrete which nail can also easily drive in but fail to hold construction community might well be aware of, incorporating organic materials into solid concrete is not such a good idea to begin with. First of all, its loose molecular structure would cause the structure to fail at a certain stage and second, it would compete and retard the hydration process of cement. Also, presumptions indicate that if each sawdust particle took up enough water during hydration, they could aid the hydration process especially in the center parts of concrete that is impossible to cure with water thus eliminating the need of curing because water deposited in sawdust particles are being harvested by cement particles. The most important aspect and main target of the experiment are proving that sawdust-cement-gravel mixtures can prove to be more lightweight and cost efficient. Since sawdust is already waste then the cost would go down as well as weight cause of its extremely light unit weight. Sawdust is used in concrete more than 40 years.

Table.1. Chemical Characteristics of Saw Dust

S.NO.	Constituents	Percentage (by weight)
1.	Sio_2	87
2.	Al_2O_3	2.5
3.	Fe_2O_3	2.0
4.	MgO	0.24
5.	CaO	3.50
6.	Loss of ignition	4.74

2. Materials used

Saw dust: Sawdust is also known as wood dust. It is the by-product of cutting, drilling wood with a saw or any other tool; it is composed of fine particles of wood. Certain animals, birds and insects which live in wood, such as the carpenter ant are also responsible for producing the saw dust. Sawdust's are produced as a small discontinuous chips or small fragments of wood during sawing of logs of timber into different sizes. The chips flow from the cutting edges of the saw blade to the floor during sawing operation.

Fig.1. Saw Dust

Cement: Cement used in the experiment work is Ordinary Portland Cement conforming to IS: 8042-1989.

Fine Aggregates: Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone III as per the specifications of IS 383:1970.

a) Specific gravity = 2.68

b) Fineness modulus = 2.71

Coarse Aggregates: Crushed granite of 10 mm maximum size has been used as coarse aggregate. The sieve analysis of combined aggregates confirms to the specifications of IS 383: 1970 for graded aggregates.

a) Specific gravity =2.8

Water: Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water.

3. Mix design for M-30 Grade Concrete

Design Stipulations

Characteristic Compressive Strength required at the end of 28 days: 30 N/mm^2

Maximum size of Aggregate:10mm

Type of Exposure: Moderate

Degree of Quality Control: Good

Test Data for Materials

Specific Gravity of Cement: 3.15

Specific Gravity of Coarse Aggregate: 2.8

Specific Gravity of Fine Aggregate: 2.68

Target Mean Strength of Concrete

For a tolerance factor of 1.65, the obtained target mean strength for the given grade of concrete = 38.25 N/mm^2

Selection of Water Cement Ratio

The free water cement ratio for the obtained target mean strength is 0.50.This is equal to the value prescribed for Moderate conditions in IS 456.

Table.2. The mix proportions

Water	Cement	Fine aggregate	Coarse aggregate
0.50	1	2.2	2
210 kg	1.146 kg	2.424 kg	2.203 kg

Note-In this experiment, we prepared test specimens of control concrete & 10%, 15%, & 20% fine aggregate replaced by saw dust by volume each.

Table.3. Compressive Strength at 7, 14 and 28 days with respect to % replacement of Saw Dust Pavers.

Paver Block	Compressive strength (N/mm^2)		
	7 days	**14 days**	**28 days**
Conventional	27.17	30.96	34.61
Ratio 1 (10%)	27.19	28.23	32.32
Ratio 2 (15%)	27.97	29.2	33.32
Ratio 3 (20%)	29.09	30.87	34.44

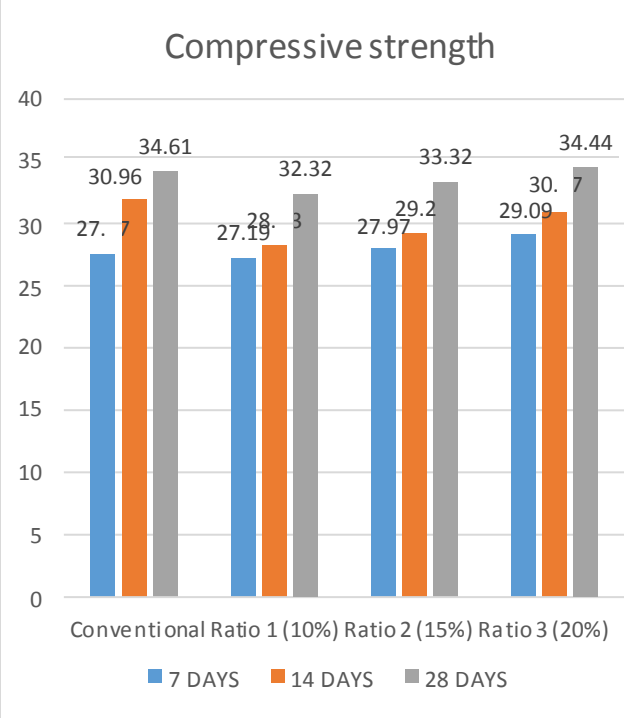

Fig.2. Percentage of Saw Dust v/s Compressive strength.

Conclusions:

In our project from the results an conclusion could be drawn,

- ✓ Concrete becomes less workable as the proportion of sawdust increases at a constant water cement ratio.
- ✓ This pavers could not be attributed to the high water because of using water proofing agent.
- ✓ The compressive strength of paver block decreases with increases in certain amount of sawdust. This was exhibited by the 28 days strength.
- ✓ The light weight material can be replaced by volume basis only for a good bonding.
- ✓ Using light weight material (sawdust), we are designed M_{30} grade to achieve the heavy load bearing capacity of paver.
- ✓ Sawdust paver exhibits early development of strength compared to conventional pavers.
- ✓ The design purpose of paver for car parking areas and petrol bunks.
- ✓ From the results 20 % replacement of sand by sawdust to achieve maximum compressive strength in our project.
- ✓ And finally, from our project, wastage of sawdust is minimized and it can be recycled for construction work.
- ✓ Further studies may be carried out for getting more information regarding to ultimate utilization of sawdust in different innovative approaches.

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