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PLASTIC MIX CONCRETE BY USING WASTE PLASTIC POWDER AND PLASTIC GRANULES WITH WORKABILITY TEST

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Abstract:

Plastic mix concrete is an eco friendly concrete which is more effective used in sanitation which can reduces the bacterial effects and increases the ground water level. One of the waste materials used in this concrete mix is 'Plastic'. The plastic materials used for concrete mix are waste plastic powder and plastic granules. The main aim of the study is to investigate the change in mechanical properties of concrete with addition of plastics in concrete. Usually, M20 concrete is used for most of the constructional works, hence in this project M20 concrete is taken and waste plastics is used as a modifier. Modifier was added in percentage such as 3%, 5%, 10%, 15% in order to replace the same amount of cement and fine aggregates. Tests were conducted on coarse aggregates, fine aggregates, cement and modifiers (waste plastics) to determine their physical properties. These tests were conducted at room temperature and these tests include performing slump, fresh density, dry density, compressive strength. Cubes were casted and tested for 7 & 28 day's strength.

Key Words: Plastic Powder, Workability Test, Plastic Granules, Polymer, Density, Compressive Strength & Cubes

Introduction:

A plastic material is an organic solid, essentially a polymer or combination of polymers of high molecular mass. A polymer is a chain of several thousand of repeating molecular units of monomers. The monomers of plastic are either natural or synthetic organic compounds. The term resin is sometimes used as synonym of a commercial polymer. Plastics can be classified by chemical structure, i.e. by the main monomer of the polymer's backbone and side chains. Conduction of workability by slump, compaction factor and vee Bee consistomer is described. The test result so obtained is tabulated in an appropriate manner. Graphs are plotted for each test against the percentage of fibers by weight of matrix. The content of additives in plastic varies widely from less than 1% in PET bottles and up to 50-60% in hard PVC, striking often a balance between technical properties and economics, as some additives are considerably more expensive than the main polymers, Stabilizers (acids, oxidation, biodegradation, heat, UV, etc), Flame retardants, Plasticizer, Colorants, Antifogging and antistatic agents, Optical brighteners, fluorescent whitening agents, Impact modifiers, Lubricants, Nucleating agents.

Objectives:

- ✓ To determine the effect of the water-to-cementations-material ratio on workability test.
- ✓ To determine the effect of plastic replacement level on workability test.
- ✓ To determine the effect of curing on workability test.

Future Scope:

- ✓ The use of waste plastics in concrete is relatively a new development in the world of concrete technology and lot of research must go in before this material is actively used in concrete construction.
- ✓ The use of plastics in concrete lowered the strength of resultant concrete, therefore, the research must be oriented towards ternary systems that helps in overcoming this drawback of use of plastics in concrete.
- ✓ Estimation of the types, quantity and useful components present in the waste plastic materials in the city and surrounding areas.
- ✓ Methodology for collection and sorting out the useful components of the plastic waste.
- ✓ Carrying out further laboratory investigations, construction of some test tracks and field studies on the performance of concrete using the modified concrete.
- ✓ Working out relative economics of using the modified concrete mixes in road construction works, considering the improved performance and increased service life of the pavement.
- ✓ Preparation of specifications and standards for the construction industry.

Observations and Results:

Slump Test:

To determine the consistency of concrete mix of given propositions by the slump test. Slump test is most commonly used method of measuring consistency of concrete which can be employed in laboratory or at

site of work. It is not a suitable method for very wet or very dry concrete. It does not measure all factors contributing to workability, nor is it always representative of the placability of concrete. However, it is used conveniently as a control test and given an indication of the uniformity of concrete from batch to batch.

Table 1: The Recommended Slump Values for Concrete for Various Jobs

S.No	Name of Work	SLUMP, mm	Water-Cement Ratio
1	Concrete for roads and mass concrete	25 to 50	0.70
2	Concrete for RCC beams and slabs	50 to 100	0.55
3	Columns and retaining walls	75 to 125	0.45
4	Mass concrete in foundation	25 to 50	0.70

Table 2: Slump Values Recorded for Different Percentage of Waste Plastic

S.No	% of Waste Plastic	SLUMP (mm)
1	0	135
2	3	130
3	5	120
4	10	115
5	15	110

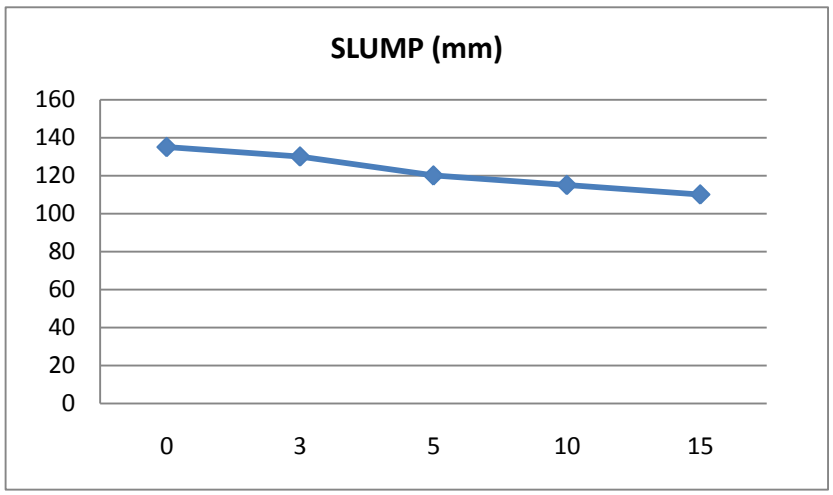

Figure 1: Workability Graph (slump in mm)

Compaction Factor Test:

To determine the workability of concrete mix of given proportions by the compaction factor test. The compaction factor test is designed primarily for use in the laboratory but it can also be used in the field. It is more precise and sensitive than the slump test and is particularly useful for concrete mixes of very low workability as are normally used when concrete is to be compacted by vibration.

Table 3: Relationship between degree of workability and C.F and recommended values for various types of concrete

Degree of Work Ability	Slump, mm	Compaction Factor	Use for Which Concrete is Suitable
Very Low	0 to 25	0.78	Road vibrated by power operated machines
Low	25 to 50	0.85	Roads vibrated by hand operated machines, Mass foundations without vibrations or lightly reinforced section with vibrations.
Medium	50 to 100	0.92	Less workability, flat slab, manually compacted reinforced concrete
High	100 to 180	0.95	For section with congested reinforcement. Not suitable for vibrations

Compacting factor of fresh concrete is done to determine the workability of fresh concrete by compacting factor test as Per IS: 1199 – 1959. The apparatus used is compacting factor apparatus.

Procedure to Determine Workability of Fresh Concrete by Compacting Factor Test:

- ✓ The sample of concrete is placed in the upper hopper up to the brim.
- ✓ The trap –door is opened so that the concrete falls into the lower hopper.
- ✓ The trap – door of the lower hopper is opened and the concrete is allowed to fall into the cylinder
- ✓ The excess concrete remaining above the top level of the cylinder is then cut off with the help of plane blades.
- ✓ The concrete in the cylinder is weighed. This is known as weight of partially compacted concrete.

- ✓ The cylinder is filled with a fresh sample of concrete and vibrated to obtain full compaction. The concrete in the cylinder is weighed again. This weight is known as the weight of fully compacted concrete.
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Compacting factor = (Weight of partially compacted concrete) / (weight of fully compacted concrete)

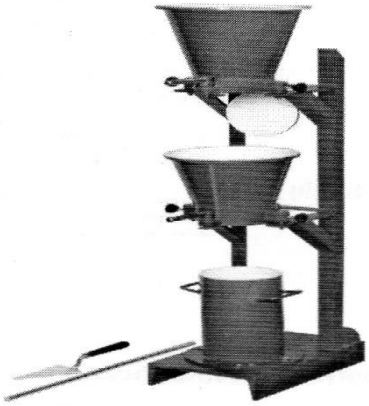

Figure: Compacting factor apparatus

Table 4: Compaction factor values recorded for different percent of Waste plastic

S.No	% of Waste Plastic	Compaction Factor
1	0	0.93
2	3	0.92
3	5	0.916
4	10	0.90
5	15	0.88

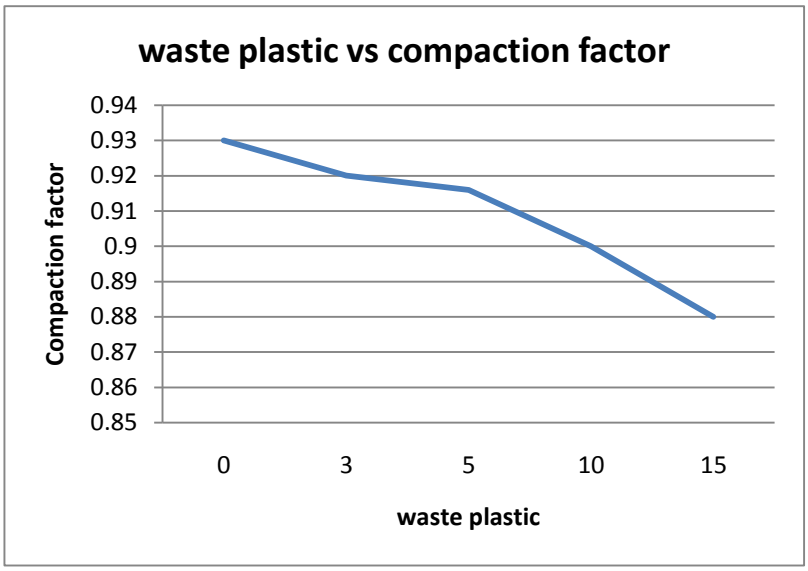

Figure 3: Showing compaction factor values for different percentage of plastic

Work Ability by Vee – Bee Consistometer:

Procedure to determine workability of fresh concrete by Vee- Bee consistometer.

- ✓ A Conventional slump test is performed, placing the slump cone inside the cylindrical part of the consistometer.
- ✓ The glass disc attached to the swivel arm is turned and placed on the top of the concrete in the pot.
- ✓ The electrical vibrator is switched on and a stop – watch is started, simultaneously.
- ✓ Vibration is continued till the conical shape of the concrete disappears and the concrete assumes a cylindrical shape.
- ✓ When the concrete fully assumes a cylindrical shape, the stop – watch is swiched off immediately. The time is noted. The consistency of the concrete should be expressed in VB – degrees, which is equal to the time in seconds recorded above.

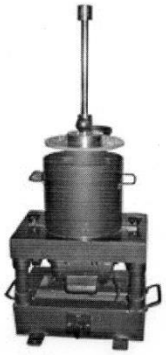

Figure 4: Vee – Bee Consist Meter

Table 5: Standard Vee – Bee values

Workability Description	Vee- Bee time, seconds
Extremely Dry	32 – 18
Very stiff	18-10
Stiff	10-5
Stiff Plastic	5-3
Plastic 3-0	
Flowing	-

Table 6: Vee-Bee Values recorded for different percent of waste plastic

S.No	% Waste Plastic	Vee – Bee (See)
1	0%	10
2	3%	35
3	5%	51
4	10%	55
5	15%	68

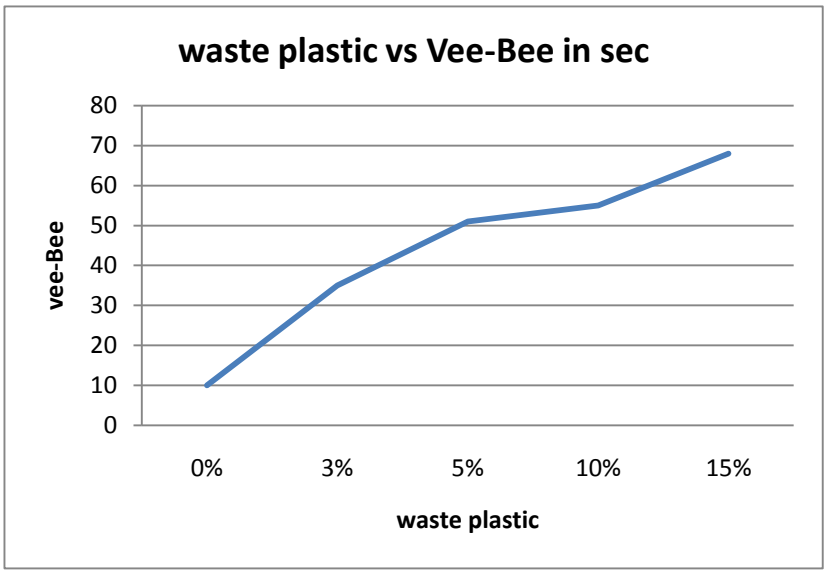

Figure 5: Vee-Bee timing in seconds for different percentage of waste plastic

Conclusion:

- ✓ By observing the test results, we can say that the compressive strength of plastic concrete has slightly decreased when compared to ordinary concrete.
- ✓ By comparing waste NYLON 06 & NYLON 09 granules compressive strength results, we can say that the compressive strength of waste Nylon is greater than Nylon granules.
- ✓ It also helps to avoid the general disposal technique of waste plastic like land filling and incineration.
- ✓ When this modifier used in the rigid pavements it can carry the more load then it can used in construction of small drainage works.

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