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High Strength Concrete Interlocking Pavement Blocks for Heavy Loading Vehicles

Mohammad Adnan Adil, Nomaan Sheikh, Enamul Hauque, Sujin George
Department of Civil Engineering, Rashtrasant Tukadoji Maharaj Nagpur University/ Anjuman College of Engineering and Technology, Nagpur, Maharashtra, India

ABSTRACT

The rapid development in concrete material technology, leads to revolutionary development in the construction of major structure. Such development requires special concrete which have to accomplish multiple demands such as high strength, workability, ductility under overload and earthquake. High performance concrete are specially designed to meet the requirement of such major structure. Revolutionary development in Indian construction industry has raised the use of interlocking concrete pavement block in different areas where conventional Construction of pavement is not feasible. Recent studies show that in modern construction practices, the industrial chemical waste or by products are used in concrete. The industrial waste which can be easily procured and have possibility to be used in concrete effectively is used engine oil. This work aims to investigate the effect of used engine oil on the performance of fresh and hardened properties of high strength ICPB.

Keywords: used engine oil, interlocking concrete pavement block, high strength concrete, ductility, workability.

I. INTRODUCTION

This investigation aim to examine the performance and alteration in fresh and hardened properties of high strength interlocking concrete pavement block of M60 grade by using mineral admixture, over the years the application of high strength concrete has taken its due place in Indian construction scenario. The application of high strength concrete is found to be common in many different countries. High strength concrete ranging from 40 MPA to 80 MPA has been used in India for various different heavy structures. The most important aspect of high strength concrete is mix design. According to IS the mix design is defined as “the process of selecting suitable ingredient of concrete and determining their relative proportion with the objects of producing concrete of certain minimum strength and durability as economical as possible. The capital aim of mix design is to accomplish the minimum stipulated strength and durability of concrete in most economical manner. For proportioning in connection with a concrete mixes the four major factor are 1.Water cement ratio 2. Cement content 3. Gradation of aggregate 4.Consistency. With the advent of special additive, it has been feasible to produce the concrete of higher strength as compared to normal one. These special additives may be in the forms of chemical and mineral admixture. latest research suggest that there is a

worldwide trend to investigate the practical and serviceable implementation of processed and unprocessed municipal or industrial product or by product as raw or additive ingredient in concrete. The object of such investigation is two fold. The first objective is to conserve the environment from the ill effect of such waste by reusing it in another form. The second objective is reducing the cost of concrete by replacing waste material with original material or substituting the waste material as additives, this will also help in reducing the cost of treatment and disposal of waste many of non-recyclable waste can be used as mineral additive and admixture which can improve the fresh and hardened property of concrete. Latest survey report that more than 55% of used engine oil is thrown away by users in the environment without any treatment. The UEO is a lubricant which separates the different part of machine and reduce the friction. ICPB technique is extensively used in heavy traffic and very heavy traffic areas in many part of worlds. Now a days in India there is a trend of using high strength IPCB in highway pavement or in terminal area, where other method of construction is not feasible.

II. LITERATURE SURVEY

Md. Ashraful Alam and B. Hidayah carried out the research on used cooking oil (UCO) as mineral admixture in concrete. They investigated the compressive strength and slump value property. It was noted that the compressive strength increases with the increment of UCO up to 2%, and the slump value also increases with the increment of dosage of UCO.

Sanjay Srivastava and Dr S.S Jain carried out the investigation on high strength concrete of M60 grade for high pavement for heavy vehicle. They develop high strength concrete of M60 grade by using fly ash. They examine the different properties of concrete. They concluded that 11% fly ash by weight of cement can be effectively used to produce high strength concrete, which results in greater saving in cement and reduction in heat.

III. RESEARCH OBJECTIVES

1. An attempt to improve the quality of concrete by reusing different waste materials as additive.
2. To design the high strength concrete in economical manner.
3. To develop the concept of recycling the waste material in construction sector, which helps in reducing the cost of building materials and it also saves environment.

IV. EXPERIMENTAL EXAMINATION

1. Cement

The main function of cement is to bind all ingredients of concrete. Ordinary Portland cement of ACC Company, grade-53 confirming to IS 8112-1989 was used throughout the experimental work. Generally 53 grade of cement is used for superior quality of works. The following table shows the physical properties of cement used in this project work.

Table 1

S.no	Properties	Results	IS standard range
1.	Specific gravity	3.01	3-3.15
2.	Fineness	5.34%	Not Less than 10%
3.	Std. consistency	30%	No standard range
4.	Setting time		

	i. initial	30min.	Not less than 30 min.
	ii final	560 min.	Not greater than 600 min.

2. Coarse aggregate

The aggregate comprise of approximately 75-80% volume of mass concrete. The locally available crushed aggregate of size ranging from 10-20mm confirming to IS 383- 1987 is used. Table shows the properties of coarse aggregate.

Table 2

S.no	Properties	Results	IS standard range
1.	Specific gravity	2.756	2.5-3.0
2.	Water absorption	0.443%	0.1%-2%
3.	Impact value	20%	Not more than 30%
4.	Crushing value	19%	Not more than 30%

3. Fine aggregate

Natural river sand passing from 4.75mm IS sieve confirming to IS 383-1987 is used. Table shows the properties of fine aggregate.

Table 4

S.no	Properties	Results	IS standard range
1.	Specific gravity	2.56	2.4-3.0
2.	Water absorption	1.002%	0.1%-2%
3.	Fine modulus	2.60	2.5-3

4. Admixtures

A] Polycarboxylate ether

The superplasticizer admixture named polycarboxylate ether is used. It is high range water reducer's chemical admixture which allows reduction in water content; generally it is used for making superior grade of concrete, high performance concrete and self-compacting concrete. The specific gravity of P.C.E is 2.

B] Used engine oil

Used engine oil is a lubricant or any petroleum based product which got contaminated and cannot be used further, due to loss of its original properties. U.E.O is used as mineral admixture in this experimental investigation

V. EXPERIMENTAL PROGRAMME

Results obtained during investigation on fresh and hardened concrete are discussed in following charts.

Results of fresh concrete

A] Slump value

The chart -1 shows the variation of slump [mm] of concrete with varying dosage of different admixture. [C.M- control/reference mix, P.C.E- Polycarboxylate ether, U.E.O-used engine oil]

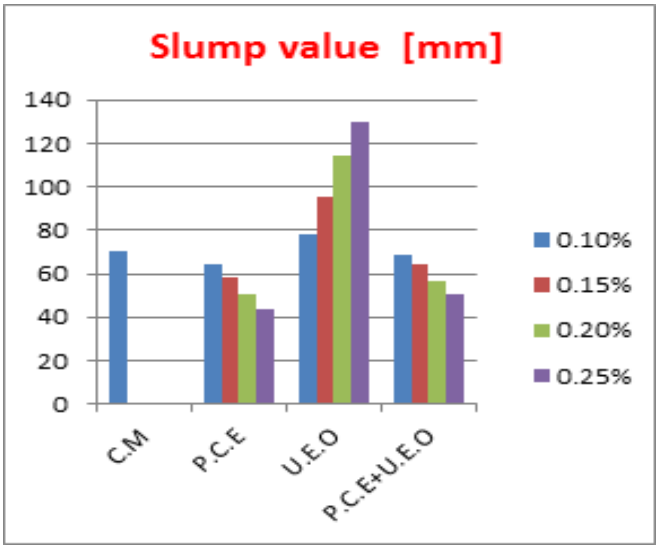

Chart 1

B] Initial setting time

Chart-2 shows the variation in initial setting time of different mixes made with different admixture of varying dosage.

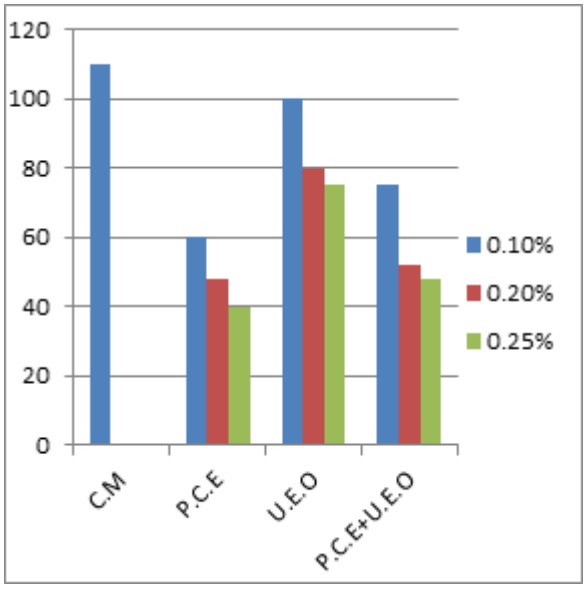

Chart 2

Results of hardened concrete

A] Compressive strength

The following charts show the variation in compressive strength of concrete for different mix at different ages – 3days, 14days, and 28days. It can be seen that with increase in P.C.E content, the concrete gains the high early strength. There was decrease in strength value with increasing content of U.E.O, from 0.1 to 0.25% content, it shows the positive growth in the strength, further increment shows the decrease in strength.

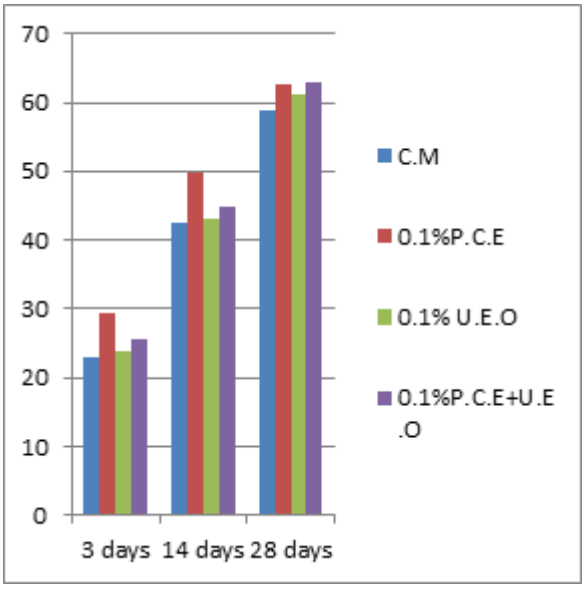

Chart 3. concrete compressive strength at different ages with 0.1% dosage of different admixture

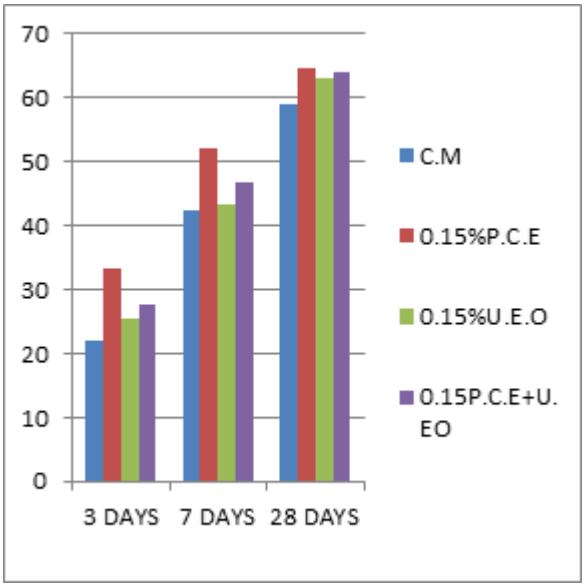

Chart 4. concrete compressive strength at different ages with 0.15% dosage of different admixture

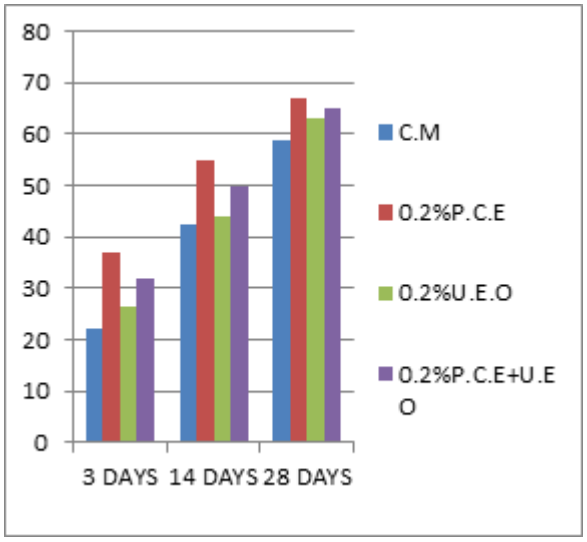

Chart 5. concrete compressive strength at different ages with 0.2% dosage of different admixture

VI. VI. CONCLUSION

Based on the above experimentation, the conclusions made were

1. The utilization of used engine oil as a mineral admixture is a good alternative, as it improves the performance of concrete, and did not show negative effect on the fresh and hardened properties of concrete if mixed in proper proportion as well as it reduces the environmental problems and concrete cost too.
2. It was observed that, as the content of used engine oil increases, it will eventually lead to fluidity loss due to which setting decreases.
3. The desired strength and performance was observed with the addition of superplasticizer, there is no negative effect on the strength parameter with the increasing content of superplasticizer in concrete, but the setting time decreases drastically.
4. Early high strength can be easily gained with the use polycarboxylate ether, as reduction in water cement ratio leads to increase in strength.
5. Gradation of aggregate and fineness modulus plays a significant role in development of high strength concrete.

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