

Comparison in Strength of Pervious Concrete Block by using Natural Course Aggregates and Plastic Coated Course Aggregates

Jichkar R. R, Bharambe A. S, Hande P. R

Abstract: This paper presents comparison in strength of pervious concrete block by using Natural course aggregate (NCA) and plastic coated course aggregate (PCCA). Pervious concrete is a concrete which consists of course aggregate and cement paste. In this paper concrete made by NCA and PCCA. Previous studies indicate that pervious concrete has lower compressive strength capabilities than conventional concrete. This work investigated prior studies on the compressive strength on pervious concrete as it relates to water cement ratio, aggregate size and compaction and compare those results with results obtained in laboratory experiments conducted on sample of pervious concrete block made by NCA and PCCA. The present study investigated the use of waste plastic for the modification of properties of aggregate and compressive strength of PCCA pervious concrete. The plastic waste thoroughly mixes with heated aggregates forming a layer on the surface of the Natural aggregates. This PCCA aggregate tested for impact test, crushing value, specific gravity and water absorption. It has been found that there is significantly improvement in the properties of plastic coated aggregate and the compressive strength of PCA cubes is slightly less than the NCA cubes.

Index Terms: Plastic Waste, Natural Course Aggregate (NCA), Plastic Coated Course Aggregate (PCCA).

I. INTRODUCTION

Pervious concrete is a composite material consisting of course aggregate, Cement and water. In this work Pervious concrete made by using NCA and PCCA. It is different from conventional concrete in that it contains no fines in the initial mixture, recognizing however, that fines are introduced during the compaction process. The aggregates usually consist of a single size and are bonded together at its points of contact by a paste formed by the cement and water. NCA and PCCA pervious concrete characteristics differ from conventional concrete. Aggregates from the major portion of pavement structure and these are prime material used in the construction of various layers of pavement and other construction site. The aggregates are bound together either

cement or bituminous material. The utilization of waste plastic in the construction of pervious concrete is new concept. The quantity of waste plastic in the municipal solid waste is increasing day by day due to increase in population, pollution, development activities and urbanization. The disposal of this waste plastic has become a serious problem because of the non- biodegradability. This waste plastic can be used in the construction of pervious concrete by coating a natural aggregate. This work was carried out by mixing waste plastic with heated aggregates by dry process. This paper investigate the use of plastic waste for the improvement of the desirable properties of aggregate like impact value, crushing value, specific gravity, water absorption and comparison of PCCA and NCA. For this, laboratory test are conducted on the NCA and PCCA with 0.3% of plastic waste to the total weight of aggregate.

II. LITERATURE REVIEW

The use of plastic waste in pervious concrete would open up a solution for the disposal issue regarding plastic wastes. There is no work have been done in the area of use of plastic waste in pervious concrete construction.

- **V.M. Malhotra (1976)** discussed about pervious concrete as it relates to applications and properties. He provided details on such properties as consistency, proportions of materials, unit weight, compatibility, and curing in an attempt to maximize permeability.
- **Raji (2007)** investigated the “utilization of marginal materials as an ingredient in bituminous mixes”. They concluded that plastic wastes can be used as additives on bituminous pavements. Hence in their study, the properties of bituminous mix when modified with shredded syringe plastic waste were investigated. The work was carried out by mixing shredded autoclaved plastic syringes with heated aggregates by dry process.
- **Dr. R. Vasudevan (2007)** investigated that the coating of plastics reduces the porosity, absorption of moisture and improves soundness. The polymer coated aggregates bitumen mix forms better material for flexible pavement construction as the mix. Hence the use of waste plastics for flexible pavement is one of the best methods for easy disposal of waste plastics. Use of plastic bags in road help in many ways like Easy disposal of waste, better road and prevention of pollution.

Manuscript published on 30 April 2018.

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- **Dr. R. Vasudevan and S. Rajasekaran, (2007)** stated that the polymer bitumen blend is a better binder compared to plain bitumen. Blend has increased Softening point and decreased Penetration value.
- **Pratiksha Singh Rajput, R. K. Yadav (2014)-IJIRST** Effect of Plastic Waste on Properties of Road aggregates – These plastic waste coated aggregates are tested for impact value, crushing value, specific gravity and water absorption. It has been found that there is significantly improvement in the properties of plastic coated aggregates.
- **Gawande (2012)**, Summarized an overview on waste plastic utilization in asphaltting of roads. They reviewed techniques to use plastic waste for construction purpose of roads and flexible pavements.
- **Dr. Bhageerathy (2014)** investigated the use of biomedical plastic waste in bituminous road construction. They concluded that the Marshall Stability value of plastic modified mix was found to be 51 percent more than that for the normal mix which indicates an increase in load carrying capacity.

III. METHODOLOGY

The following tests were conducted on the natural course aggregate and plastic coated course aggregate with 0.3% amount of plastic waste by weight of total aggregate

- Water absorption test
- Impact value
- Crushing value
- Los Angeles test
- Specific gravity test

And the Compressive strength tests were conducted on NCA pervious concrete and PCCA pervious concrete.

IV. ANALYSIS AND RESULTS

Table 1. Properties of Aggregate

Test Conducted	Natural Aggregates	Plastic Coated Aggregates	IRC Specification
Water absorption test	1%	0%	< 2
Impact value	24.60%	6.25%	< 30
Crushing value	22.60%	14.46%	< 30
Los Angeles test	26.20%	17.56%	< 35
Specific gravity test	2.54	2.66	2.5-3.0

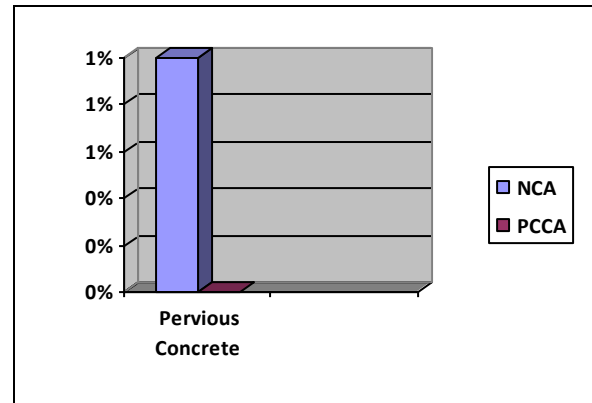


Figure 1: Water Absorption Test

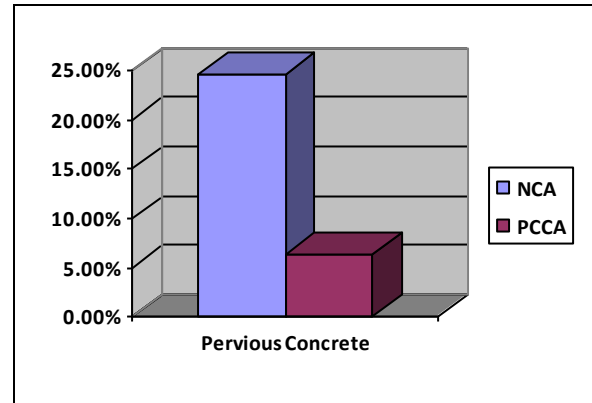


Figure 2: Aggregate Impact Value

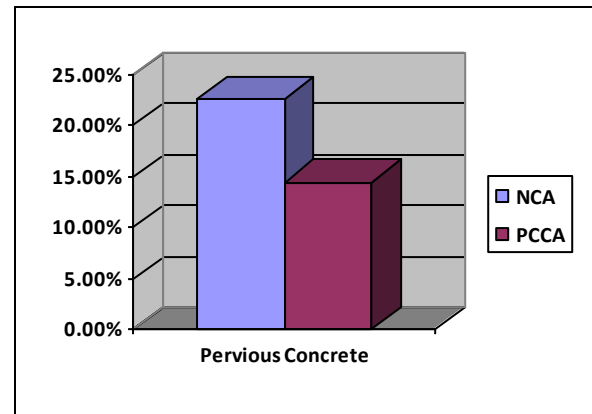


Figure 3: Aggregate Crushing Value

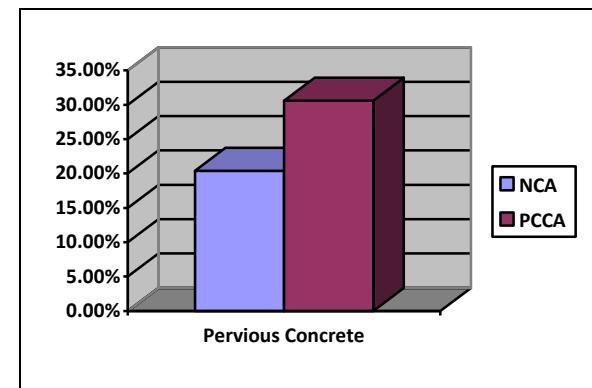


Figure 4: Aggregate Los-Angeles test

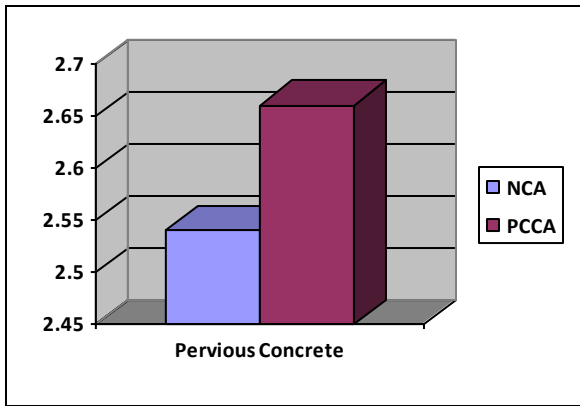


Figure 5: Specific Gravity

Table 2. Results of Compressive Test on NCA or PCCA Pervious Concrete

Sr no	Cubes	W/C ratio	C/A ratio	Average Compressive strength (N/mm ²)		
				7days	14days	28days
1	NCA	0.40	1:4.5	6.81	7.52	8.21
2		0.35		7.05	10.18	11.18
3	PCCA	0.40	1:4.5	6.89	9.48	9.80
4		0.35		4.67	7.21	7.54

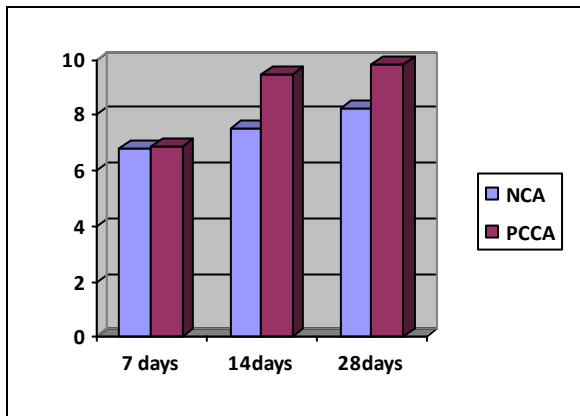


Figure 6: Compressive Strength 0.40w/c

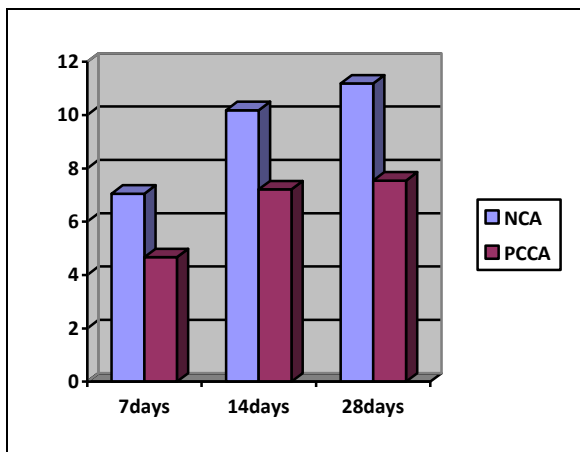


Figure 7: Compressive Strength 0.35 w/c

V. CONCLUSION

The use of plastic waste in the construction of pervious concrete block is one of the best methods for the safe disposal and better performance of the pervious concrete if the plastic are used. The following conclusions are drawn from the study:

- The coating of aggregates with plastic reduces the absorption of moisture.
- There is decrease in the PCCA impact value as compared to NCA without plastic. This means that the plastic coated aggregate have better impact resistance.
- It was observed that PCCA crushing value was reduces as Compared to NCA. This implies that the crushed fraction will be lower when the PCCA are subjected to loads.
- Los angles abrasion value of PCCA was found to reduce as compared to NCA indicating that these aggregate have superior abrasion resistance compared to NCA.
- There is small increase in specific gravity value of PCCA as compared to NCA.
- It was observed that for w/c 0.4, Compressive strength of NCA for 28 days is 8.21 N/mm² and PCCA for 9.80 N/mm² i.e. increase in strength of PCCA pervious concrete as compared to NCA pervious concrete
- It was observed that for w/c 0.35, Compressive strength of NCA for 28 days is 11.18 N/mm² and PCCA for 7.54 N/mm² i.e. reduces in strength of PCCA pervious concrete as compared to NCA pervious concrete

On the basis of the experiments result obtained, it is found that mixes prepared with plastic waste has shown better properties as compared natural course aggregate and The compressive strength of PCCA pervious concrete cubes for 0.40 W/c gives good strength as compared to NCA pervious concrete cubes. Hence it is one of the best method for disposal of plastic waste by using it in construction material.

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