

# Development of Stress-Strain Curves for the Conventional Cement Concrete Containing Aluminum Metalized Post Consumer Plastic Waste

D. B. Pansuriya<sup>1</sup> A. C. Bhogayata<sup>2</sup>

<sup>1</sup>PG Student <sup>2</sup>Associate Professor & Head of Department

<sup>2</sup>Department of Civil Engineering

<sup>1</sup>Marwadi Education Foundation, Gujarat, India <sup>2</sup>MEFGI, Rajkot

**Abstract**— The paper reviews the development of stress-strain curves for the conventional cement concrete containing metalized postconsumer plastic waste and the important findings from the experimental works of various researchers. To careful study of various research papers on the topic it was felt by the authors to integrate all the important results for streamlining the potential of this area of research. The paper summarizes conclusions of experiments conducted for the properties like strength, workability and durability. It was observed the improvement in strength, workability and durability properties of the conventional concrete due to the adding of plastic waste and replacement by fine aggregate in different proportions. From the review of past research works it could be concluded that utilizing the plastic waste a great potential towards the development of environment friendly and sustainable conventional concretes.

**Key words:** plastic waste, waste, cement concrete, stress-strain curve, strength, workability, durability, Utilization, Elastic modulus

## I. INTRODUCTION

Generation of plastic waste is one of the fastest growing areas. Every year more than 500 billion plastic bags are used (nearly one million bag per minute).

The biggest component of the plastic waste is polyethylene, followed by polypropylene, polyethylene terephthalate and polystyrene. The disposal of waste plastic is recyclable and non-recyclable of continuous problem for the environment. Disposal of large quantity of plastic bag may cause pollution of land, water bodies and air.

The different, innovative and new research must be required for disposal of plastic waste materials. Post-consumer recycled plastic bags present biggest problems as they are at the present not biodegradable and can resist disposal. Research study will be undertaken concerning the feasibility, environmental suitability and performance of using post-consumer waste plastics in concrete structure.

## II. LITERATURE REVIEW

The literature survey is carried out of various research papers related to adding various types of waste likes as waste PET bottles, waste glass material, and stress-strain curve comparison for normal concrete.

Youssef Ghernouti, Bahia Rabehi, Brahim Safi and Rabah Chaid [1] In this paper plastic bag waste material is used in concrete and then this materials is replaced by fine aggregate by substitution of a variable percentage of sand (10, 20, 30 and 40 %). To check the fresh and hardened states properties of the concrete: workability, bulk density, ultrasonic pulse velocity testing, compressive and flexural strength of the different concretes, has been investigated and analyzed in comparison to the control concrete. The results

is improves the workability and the density, reduces the compressive strength of concrete containing 10 and 20 % of waste by 10 to 24 % respectively.

Ankit Arora and Dr. Urmil V. Dave [2] In this paper e-waste and plastic waste materials use in concrete. A mix design was done for M20 grade of concrete and OPC 43 grade used. This material replaced by 0%, 2%, and 4% of the fine aggregates. To check the Compressive strength and flexural strength and compared with control concrete. There are increase in compressive strength by 5% and reduce cost of concrete production by 7% at optimum percentage of grinded waste.

Raju, Rajiv Chauhan [3] In this paper waste polyethylene material are use in concrete. The waste polyethylene in fiber size 120 mm length and 4 mm width have been replaced by fine aggregate. The fine aggregate was replaced by plastic fiber with 1% by weight. To check the compressive strength and tensile strength of controlled specimen. It was observed the compressive strength was decreased and no significant effect on tensile strength. The compressive strength significantly decreased by 50.42% at 28 days. The tensile strength decreased by 8.52% which is nominal as compare to the compressive strength decrement rate.

Ankur Bhogayata, K. D. Shah, and Dr. N. K. Arora [4] In this paper the plastic waste known as metalized polythene in macro pellet are used in concrete. Water/cement ratio was is 0.45 and plastic pellets were added by 0.5%, 1% and 1.5% by concrete volume. To check the Compressive strength, split tensile strength and surface tensile test. The test results reviled the reduction of strength properties up to 60%.

Lakshmi.R Nagan [5] in this paper E waste are used in concrete. Utilization of E waste particles as coarse aggregates in concrete with a percentage replacement ranging from 0 % to 30%. And M20 grad is used. To observe the Compressive strength, Tensile strength and Flexural strength of Concrete. with and without E waste as aggregates was observed which exhibits a good strength gain. However strength noticeably decreased when the e plastic content was more than 20%.

Srinivasa Reddy V, Rajaratnam V, Seshagiri Rao M V[6] In this paper, to develop a mathematical model for predicting the stress-strain behavior of bacteria induced high strength concrete. And then the stress-strain behavior of controlled and bacterial concrete experimentally, empirical equations are developed to represent uni-axial stress-strain behavior of controlled and bacterial concrete mixes. From these empirical equations, theoretical stresses for controlled and bacterial concrete are calculated and compared with experimental values. The proposed equations have shown good correlation with experimental values validating the mathematical model developed.

V. Bhikshma, R. Kishore [8] In this paper recycled aggregate use in concrete. Recycled aggregate is one such alternative and the present research work is a step forward in developing the design parameters using stress block parameters. To generate stress strain test data of grade of concrete use M15, M20, M25, M30, and M35 and five replacement ratios (0, 0.5, 0.75, 0.85, and 1.0) were considered. The influence of replacement ratio, ( $R_r$ ) the ratio of recycled coarse aggregate to total coarse aggregate ( $R_r = RCA/TCA$ ) on mechanical properties of recycled aggregate concrete was studied. The objective of present research is to develop stress – block parameters for the design of reinforced recycled aggregate concrete members.

T. H. Wee, M. S. Chin and M. A. Mansur [9] In this paper total of 21 normal-weights concrete mixes have been selected. They were divided into five series in accordance with the water-to-binder ratio of the mixes. Water/binder ratio 0.40, 0.35, 0.30, 0.25, 0.20 are used and four different types of cement-replacing admixtures: blast-furnace slag, fly ash, silica fume, and hi-fi, with replacement percentages of 55, 30, 10, and 16.7, respectively. Two additional replacement percentages of 5 and 15% for silica fume and one additional replacement percentage of 70% for slag were used in the series with a water-to-binder ratio of 0.25. To check the compressive strength, strain at peak stress. An experimental investigation was carried out to generate the complete stress-strain curves of concrete in compression with a strength range of 50- 120 MPa. The effects of these parameters on the shape of stress-strain curves are presented and discussed. Based on present test data, a simple model is proposed to generate the complete stress-strain relationships for high-strength concrete. The proposed model has been found to give a good representation of the actual stress-strain response.

Zhao-Hui Lu and Yan-Gang Zhao [10] In this paper the existing empirical models of stress-strain relationships for normal weight HSC can be divided into two categories according to their expressional forms. One category is based on equations suggested by Popovics (1973) and the other category uses a form of equations proposed by Sargin et al. (1971). Based on the investigations, a new empirical model with emphasis on the softening branch is proposed to generate the complete stress-strain relationship for high-strength concrete. An application of the new empirical model to published experimental data on normal weight concretes over a wide strength range demonstrates that the present model gives a good representation of the mean behavior of the actual stress-strain response.

### III. DISCUSSION

Above the literature it is concluded that many researchers have studied different types of waste added in normal concrete. Like as pet bottles, glass waste, plastic waste bag, polyvinyl chloride (PVC), comparisons of stress-strain curve in normal concrete and different equation made of stress-strain curve.

All the literature survey concludes that, fine aggregate replaced by plastic and strength is minor decrease. And the comparison of the development of the stress-strain curve normal concrete and different material added of concrete. Stress-Strain curve are generated the different material adding. Comparison for normal concrete. Different

types of model use in stress-strain curve. Mathematical models are generated in stress-strain curve equation.

### IV. CONCLUSION

Based upon above literature review it could be concluded that all researchers gave their findings with concrete up to 2% replacement of fine aggregate with plastic waste in which compressive and tensile strength is minor decrease. Also workability is decreased with the increase of plastic waste content. But, very few researchers do research work in adding of plastic waste in concrete where to check strength and durability criteria needed to be studied further effectively in future.

### REFERENCES

- [1] Youcef Ghernouti, Bahia Rabehi, Brahim Safi and Rabah Chaid, "Use Of Recycled Plastic Bag Waste In The Concrete", Journal of International Scientific Publications: Materials, Methods and Technologies Volume 8.
- [2] Ankit Arora and Dr. Urmil V. Dave, "Utilization Of E-Waste And Plastic Bottle Waste In Concrete", International Journal of Students Research in Technology & Management Vol 1 (04), August 2013.
- [3] Raju, Rajiv Chauhan, "An Experimental Study on Strength Behaviour of Cement concrete with Use of Plastic Fibre" International Journal of Engineering Research and Applications (IJERA) 29th March 2014
- [4] Ankur Bhogayata, K. D. Shah, Dr. N. K. Arora, "Strength Properties Of Concrete Containing Post Consumer Metalized Plastic Wastes" International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 3, March – 2013.
- [5] Lakshmi.R Nagan, "Studies On Concrete Containing E Plastic Waste", International Journal Of Environmental Sciences, ISSN 0976 – 4402, Volume 1, No 3, 2010.
- [6] Srinivasa Reddy V, Rajaratnam V, Seshagiri Rao M V, Sasikala Ch, "Mathematical Model for Predicting Stress-Strain Behaviour of Bacterial Concrete" International Journal of Engineering Research and Development Volume 5, Issue 11 (February 2013), PP. 21-29
- [7] Zhao-Hui Lu and Yan-Gang Zhao, M.ASCE, "Empirical Stress-Strain Model for Unconfined High-Strength Concrete under Uniaxial Compression" Journal of Materials in Civil Engineering / November 2010
- [8] V. Bhikshma, R. Kishore, "Development of stress-strain curves for recycled aggregate concrete" Asian journal of civil engineering (building and housing) vol. 11, no. 2 (2010)
- [9] Zhao-Hui Lu and Yan-Gang Zhao, "Empirical Stress-Strain Model for Unconfined High-Strength Concrete Uniaxial Compression", Journal of Materials in Civil Engineering / November 2010
- [10] T. H. Wee, M. S. Chin and M. A. Mansur, "Stress-Strain relationship of high-strength concrete in compression" Journal of materials in civil engineering / May 1996