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Effect of Waste Plastic Strip on the Cost and Strength of Concrete

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ABSTRACT: This study investigates the impact of incorporating waste plastic strips into concrete mixes on both the economic and mechanical properties of the resulting composite material. The experiment involves varying concentrations of waste plastic strips in concrete mixes, ranging from 0% to 10% by weight. The cost analysis assesses the affordability of incorporating waste plastic strips compared to conventional concrete production methods, considering material procurement, processing, and environmental factors. Concurrently, mechanical testing measures the compressive strength, flexural strength, and durability of the concrete specimens to evaluate any changes induced by the inclusion of waste plastic strips. Initial findings suggest that incorporating waste plastic strips can potentially reduce the overall cost of concrete production while maintaining or even enhancing its mechanical performance. However, further investigation is warranted to optimize the concentration of waste plastic strips for maximal cost-effectiveness and strength improvement without compromising other essential properties of concrete. This research contributes to the sustainable development of construction materials by repurposing waste plastics and offers insights into enhancing both economic and structural aspects of concrete construction.

KEYWORDS: Environmental impact, Recycling, Strength analysis, Cost analysis, Waste plastic, Sustainable construction.

I.INTRODUCTION

The incorporation of waste plastic strips into concrete introduces a novel approach to addressing environmental concerns while potentially enhancing the mechanical properties of concrete structures. Plastic waste, a pervasive environmental issue, can be repurposed as an additive in concrete mixtures, offering an opportunity to divert plastic from landfills and reduce its environmental impact. When waste plastic strips are added to concrete, they interact with the cementitious matrix and aggregates, influencing the material's behavior and performance. One significant aspect of this interaction is its effect on concrete strength. Concrete strength, often assessed through measures such as compressive, tensile, and flexural strength, is critical for ensuring the structural integrity and durability of concrete elements in construction. Research into the effects of waste plastic strips on concrete strength has yielded diverse findings, reflecting the complexity of the interaction between plastic additives and concrete properties. Some studies have indicated potential enhancements in specific strength parameters, such as flexural strength and impact resistance, attributed to the reinforcing nature of embedded plastic fibers or particles.

These findings suggest that waste plastic strips can act as a form of reinforcement within the concrete matrix, improving its resistance to external forces and enhancing its performance in certain applications. However, conflicting results also exist, with some studies reporting reductions in compressive strength associated with the incorporation of waste plastic strips. Challenges such as poor bonding between the plastic and cement matrix or the introduction of voids within the concrete structure can compromise its overall strength. Factors such as plastic type, size, and distribution within the concrete matrix further influence the outcomes, highlighting the complexity of the relationship between waste plastic and concrete strength. Understanding the effects of waste plastic strips on concrete strength is essential for optimizing mix designs, ensuring structural integrity, and advancing sustainable construction practices. It requires careful consideration of various factors, including plastic type and characteristics, dosage, and mixing methods. By addressing these complexities and leveraging the opportunities presented by waste plastic incorporation, the construction industry can move towards more sustainable and resilient concrete solutions while contributing to global efforts to reduce plastic pollution. Plastics have become an inseparable and integral part of our lives. The amount

of plastics consumed annually has been growing steadily. Its low density, strength, user-friendly designs, fabrication capabilities, long life, light weight, and low cost are the factors behind such phenomenal growth. Plastics have been used in packaging, automotive and industrial applications, medical delivery systems, artificial implants, other healthcare applications, water desalination, land/soil conservation, flood prevention, preservation and distribution of food, housing, communication materials, security systems, and other uses. With such large and varying applications, plastics contribute to an ever increasing volume in the solid waste stream. Due to ease of construction, reduced labour and lower cost, macro plastic fibres, such as PP

The global surge in usage of plastic bottles have contributed to an environmental challenge comparable to climate change. It has been reported that the plastic usage has increased by 200 times from 02 million tones/year in 1950 to around 400 million tones/year in 2015 (Geyer et al. 2017). Poly-ethylene terephthalate (PET) bottles contribute significant proportion of plastic with reported production of 300 billion units in 2004, with projection of 583 billion units by 2021 (Ryberg et al., 2019; United Nations 2018). Though PET and high-density polyethylene (HDPE) plastic is recyclable, the recycling rate has been reported to be relatively low, viz., upto 30 % (Mashek, 2017). The chemical recycling of PET bottles contribute towards reduced CO₂ emissions and lower consumption of fossil fuels, due to reduced manufacturing of new PET bottles. However, studies have noted that the chemical recycling itself enhances environmental burden and impacts local environment (Ma et al. 2020). In this context, the application of waste untreated PET bottles in construction industry, can enhance its reutilization and also reduce the negative impact on environment.

II. LITERATURE SURVEY

Research in the field of incorporating waste plastic strips into concrete mixes and its impact on both cost and strength is ongoing. Studies typically examine the mechanical properties, such as compressive and flexural strength, as well as the economic feasibility of using waste plastic in concrete production. These investigations aim to assess how different types and concentrations of waste plastic affect the overall performance and affordability of concrete. Additionally, researchers explore the environmental implications of this approach, considering factors like carbon footprint reduction and sustainability. Case studies provide valuable insights into real-world applications and the practicality of using waste plastic-reinforced concrete in construction projects. Overall, the literature in this area highlights the potential of waste plastic materials to enhance both the cost efficiency and mechanical strength of concrete, contributing to sustainable construction practices.

Effect of Waste Plastic Strip on the Cost and Strength of Concrete", This paper investigates the From a long-term perspective, the authors wish to explore the use of plastic in patterns that are technically efficient, cost effective, and feasible for construction. Preliminary results suggest that a random orientation of plastic yields results comparable to horizontally oriented plastic in terms of improving concrete properties. Thus, the present study shows that the random orientation of plastic fibers is an acceptable arrangement for construction. However, detailed investigation is envisioned to confirm these observations and their likely impact. the Cement is the most widely used construction material in the world and important product in concrete as compared to other. Based on the test results, the compressive strength for 3 days, 7days, 14 days and 28 days of 10% replacement is attained strength by 9.5 N/mm², 15 N/mm², 21 N/mm², 26 N/mm² respectively. Use of recycled plastic in concrete the Polymer concrete using an unsaturated polyester resin based on recycled PET is a feasible and effective material for precast applications. This material can achieve more than 80% of its ultimate strength in 1 day, very significant advantage in many structural applications.

III. PROPOSED METHODOLOGY AND DISCUSSION

Plastic strips, typically sourced from recycled materials, can be incorporated into concrete mixtures to enhance certain properties or address environmental concerns associated with plastic waste. However, the effects of these plastic strips on the strength of concrete are complex and depend on various factors including the type of plastic, its size and distribution in the concrete matrix, and the overall concrete mix design. The incorporation of waste plastic strips into concrete is gaining increasing attention as a potential solution to both environmental challenges posed by plastic waste and the quest for innovative construction materials. With mounting concerns about plastic pollution worldwide, utilizing recycled plastic in concrete mixtures offers a promising avenue to address these issues while potentially enhancing certain properties of concrete. However, the introduction of plastic strips into concrete matrices can significantly influence the material's mechanical characteristics, particularly its strength. This influence is multifaceted and depends on various factors such as the type of plastic used, its size and distribution within the concrete, and the overall mix design. While properly integrated plastic strips may contribute to improved durability by reducing

permeability and increasing resistance to chemical corrosion, improper incorporation or excessive plastic content could weaken the concrete matrix, leading to decreased compressive, tensile, or flexural strength. Moreover, considerations such as workability, cohesion, and the economic feasibility of incorporating waste plastic further complicate the evaluation of its effects on concrete strength. Thus, comprehensive research efforts are essential to understand the intricacies of integrating waste plastic strips into concrete mixtures, ensuring that sustainability goals are met without compromising the structural integrity of concrete in construction applications. For Study of optimum for Addition in concrete casting of 24 Cubes and 8 beams are held in carrying different layers.

The effects of waste plastic strips on concrete strength reveals a nuanced landscape, shaped by a multitude of factors. Studies have showcased a variety of outcomes, with some indicating potential enhancements in specific strength parameters, such as flexural strength and impact resistance, attributed to the reinforcing nature of embedded plastic fibers or particles. However, conflicting findings also exist, suggesting possible reductions in compressive strength due to challenges like inadequate bonding between plastic and cement or the introduction of voids in the concrete structure. These complexities underscore the importance of considering factors such as plastic type, size, and distribution within the concrete matrix. While the prospect of using waste plastic strips to bolster certain concrete properties and address environmental concerns is promising, it necessitates a careful and nuanced approach. Optimizing the incorporation process and balancing structural integrity with sustainability goals are imperative. Further research endeavors are crucial for a deeper understanding of these effects and the development of effective, sustainable strategies for integrating waste plastic into concrete applications.

Methodology:

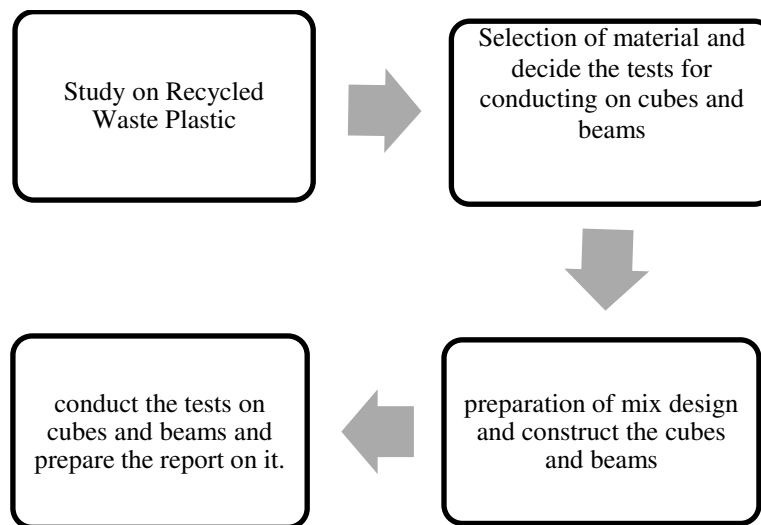


Fig.No.1. Flow Chart

IV.RESULT

The compressive strength test , flexural strength test were conducted on prepared concrete specimens. The specimens were cured for 7 days and 28 days before testing. The results have been tabulated in the table and figure below.

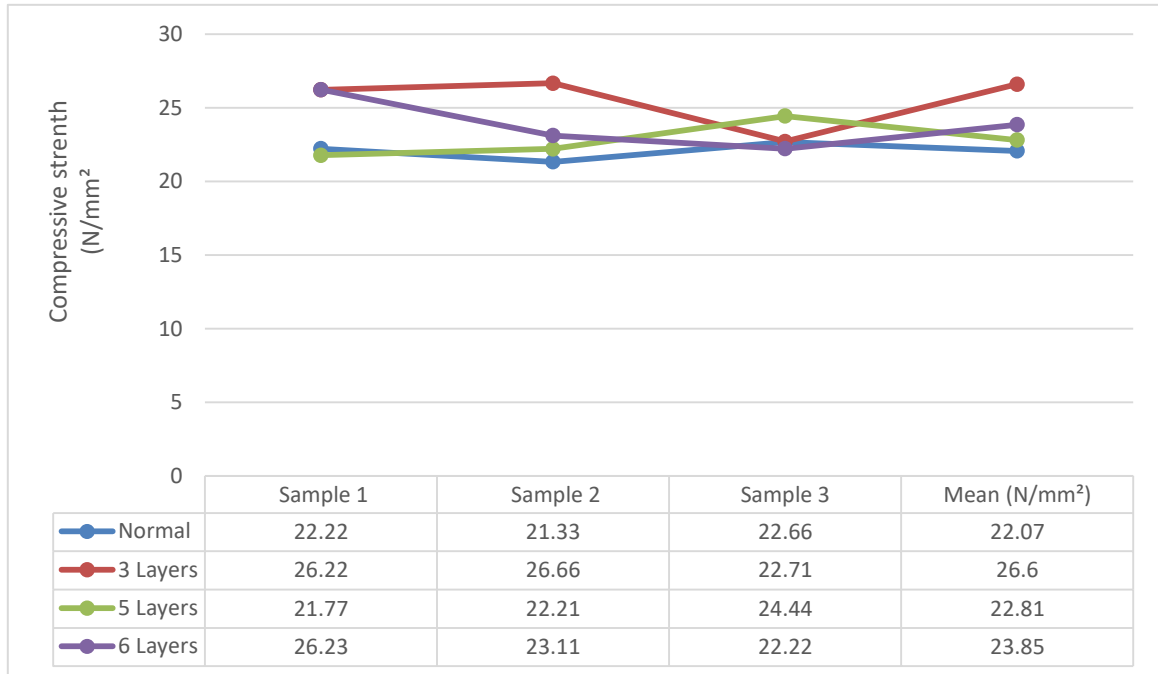


Fig.No.2. Compressive Strength 7 days of M30 Grade Concrete

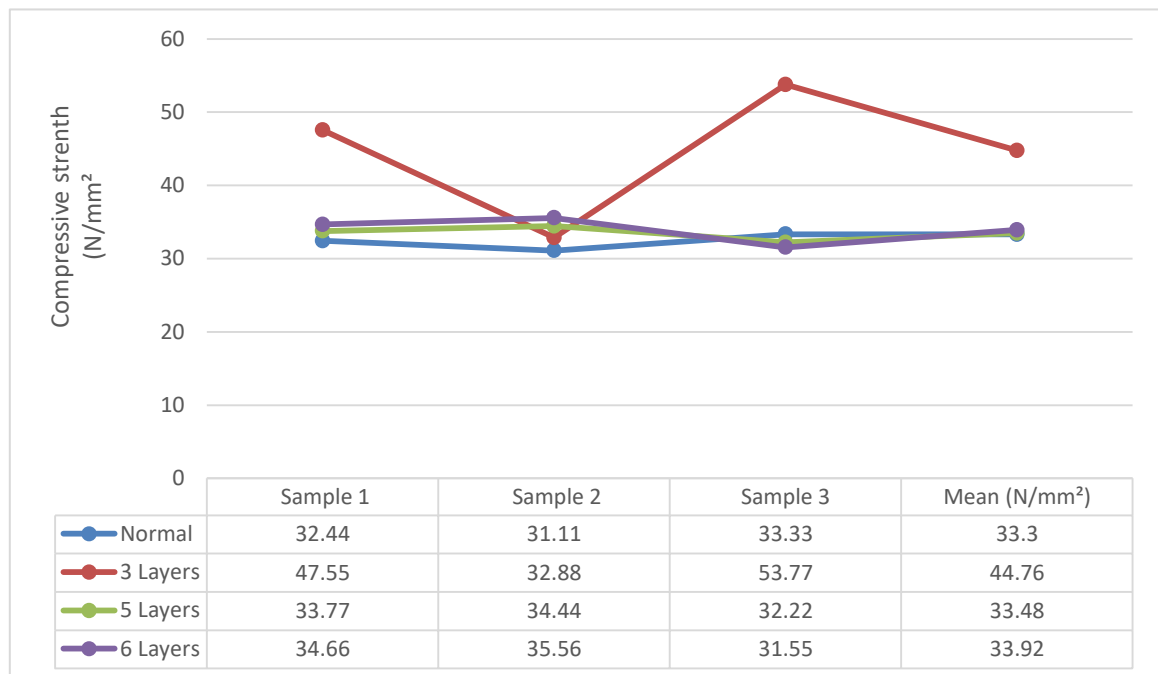


Fig.No.3. Compressive Strength 28 days of M30 Grade Concrete

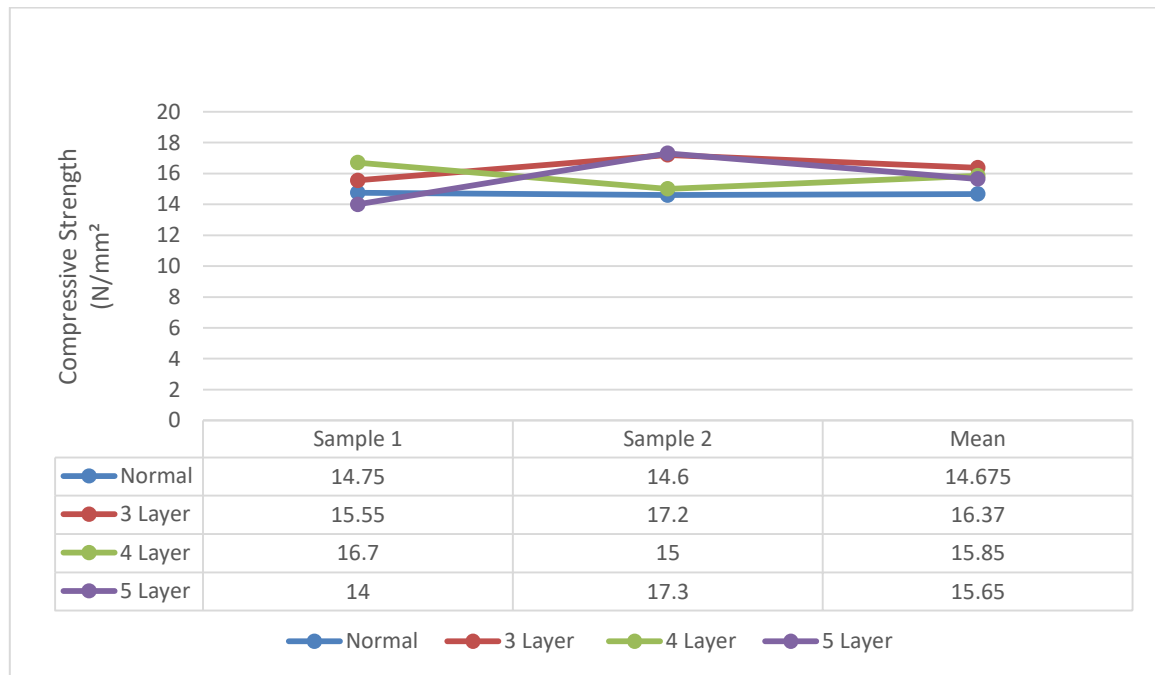


Fig.No.4. Flexural Strength 28 days of M30 Grade Concrete

V. CONCLUSION

the effects of waste plastic strips on the strength of concrete are multifaceted and require careful consideration of various factors. While the incorporation of waste plastic strips holds promise for addressing environmental concerns and potentially enhancing certain properties of concrete, such as flexural strength and impact resistance, it also poses challenges that need to be addressed. Research findings indicate that the addition of waste plastic strips can lead to both positive and negative impacts on concrete strength, depending on factors such as plastic type, size, distribution, and the overall mix design. The effects of waste plastic strips on concrete strength are influenced by various factors including plastic type, size, distribution, and mix design. Incorporating waste plastic strips holds promise for enhancing certain properties of concrete, such as flexural strength and impact resistance.

However, challenges like reduced compressive strength due to poor bonding or void formation need to be addressed. Research findings indicate both positive and negative impacts on concrete strength, highlighting the need for cautious consideration. Further research is necessary to optimize methodologies, refine mix designs, and develop sustainable practices for integrating waste plastic into concrete effectively.

Interdisciplinary collaboration is crucial for advancing this field and unlocking the full potential of waste plastic as a valuable additive in concrete production. By addressing these challenges and harnessing the opportunities presented by waste plastic incorporation, the construction industry can move towards more sustainable and resilient concrete solutions while contributing to the global effort to reduce plastic pollution.

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