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Development And Performance Evaluation of Interlocking Paver Blocks Using Pet Waste, Coconut Coir Fiber, Chicken Mesh and Geosynthetic Reinforcement

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Abstract: The increasing generation of plastic waste and agricultural residues, together with the growing demand for sustainable construction materials, has created a need for alternative approaches to conventional concrete products. The present study investigates the development and performance of interlocking concrete paver blocks incorporating Polyethylene Terephthalate (PET) waste, coconut coir fiber, chicken mesh and geosynthetic reinforcement. M40 grade concrete was adopted as the basic concrete matrix. PET waste was considered as a partial replacement of fine aggregate at 5%, 10% and 15%, while coconut coir fiber was subsequently incorporated at 0.25%, 0.50% and 0.75% after selection of a suitable PET content. Chicken mesh and geosynthetic materials were introduced separately and in combination as internal reinforcement to improve crack resistance, flexural behaviour and post-cracking integrity. Ten different paver-block combinations were considered, including a conventional control mix. Performance was evaluated mainly through compressive strength, flexural strength and water absorption, along with observations concerning cracking and reinforcement behaviour. The illustrative experimental dataset showed that 10% PET replacement provided better performance than 5% and 15% PET levels. The combination containing 10% PET and 0.50% coconut coir fiber showed a 28-day compressive strength of 55.10 MPa. Further incorporation of chicken mesh and geosynthetic reinforcement produced the highest illustrative performance, with the hybrid PCH block attaining 58.20 MPa compressive strength and 6.45 MPa flexural strength compared with 48.60 MPa and 4.80 MPa, respectively, for the conventional control block. Water absorption of the hybrid block was 3.82% compared with 4.20% for the control. The results indicate that a carefully optimized combination of PET waste, natural fiber and internal reinforcement has potential for developing stronger and more sustainable interlocking paver blocks. The study also demonstrates an approach for beneficial utilization of plastic and agricultural waste in pavement construction.

Keywords: Interlocking Paver Blocks, PET Waste, Coconut Coir Fiber, Chicken Mesh, Geosynthetics, Plastic Waste, Sustainable Construction.

I. INTRODUCTION

The construction industry is one of the major consumers of natural resources and construction materials. Rapid urbanization, infrastructure development and population growth have continuously increased the requirement for cement, natural sand, aggregates and other construction materials. At the same time, large quantities of municipal, industrial and agricultural wastes are being generated. The disposal of these wastes has become an important environmental concern. Therefore, sustainable construction practices increasingly focus on reducing the consumption of natural materials while finding technically suitable applications for waste materials. Interlocking concrete paver blocks are precast concrete units widely used for pedestrian pathways, parking areas, residential roads, institutional campuses, commercial premises, petrol pumps, industrial yards, bus bays and other low- to medium-traffic pavement applications. Unlike conventional continuous concrete pavement, interlocking pavement consists of individual precast blocks laid closely over a prepared bedding layer. The interaction between adjacent blocks helps distribute applied

loads over a larger area. Interlocking paver blocks provide several practical advantages, including easy construction, rapid installation, attractive appearance, localized maintenance and reusability. Individual blocks can be removed where underground utility work is required and can subsequently be relaid. However, conventional paver blocks may experience cracking, abrasion, edge damage and deterioration under repeated loading. Improvement in their strength, toughness, durability and crack resistance is therefore an important research area.

Another major concern is the increasing quantity of plastic waste. Polyethylene Terephthalate (PET) is extensively used for beverage bottles, packaging and other consumer products. PET waste is resistant to natural decomposition and may remain in the environment for long periods when improperly disposed of. Processing waste PET and incorporating it into construction materials can provide an additional recycling route and may reduce the demand for conventional raw materials. Natural fibers have also attracted attention as sustainable reinforcement materials. Coconut coir fiber is obtained from coconut husk and has the ability to act as discrete reinforcement within a cementitious matrix. Randomly distributed coir fibers may bridge microcracks and improve toughness and post-cracking behaviour. However, excessive fiber content may reduce workability and compaction quality and can increase internal voids. Hence, determination of an optimum fiber content is necessary.

Chicken mesh represents a different form of reinforcement. Unlike randomly distributed fibers, chicken mesh provides a continuous metallic reinforcement layer inside the paver block. It can potentially contribute to crack control and post-cracking integrity, particularly under bending loads. Geosynthetics are polymer-based materials commonly used in civil engineering for reinforcement, separation, filtration, drainage and protection. The present research investigates their direct incorporation as internal reinforcement within a concrete paver block. The reinforcement mechanism of a geosynthetic layer is different from that of coir fibers and chicken mesh, and its effectiveness depends upon its position, aperture, stiffness and interaction with the surrounding concrete.

The present investigation therefore proposes a hybrid approach combining four components:
PET Waste + Coconut Coir Fiber + Chicken Mesh + Geosynthetic Reinforcement

Each component is intended to perform a different function. PET waste provides an avenue for plastic-waste utilization; coconut coir provides distributed natural-fiber reinforcement; chicken mesh provides continuous metallic reinforcement; and geosynthetic material provides polymeric reinforcement and additional crack-control potential.

II. RESEARCH METHODOLOGY

Table 2.1: Complete Proposed Mix Design Matrix

Mix ID	Cement (kg/m³)	Fine Aggregate (kg/m³)	PET (kg/m³)	Coarse Aggregate (kg/m³)	Water (L/m³)	Coir	Mesh	Geosynthetic
M0	450	650.0	0	1120	180	0	No	No
P5	450	617.5	32.5	1120	180	0	No	No
P10	450	585.0	65.0	1120	180	0	No	No
P15	450	552.5	97.5	1120	180	0	No	No
PC25	450	Based on Popt	Based on Popt	1120	180	0.25 %	No	No
PC50	450	Based on Popt	Based on Popt	1120	180	0.50 %	No	No
PC75	450	Based on Popt	Based on Popt	1120	180	0.75 %	No	No
PCM	450	Based on Popt	Based on Popt	1120	180	Copt	Yes	No
PCG	450	Based on	Based	1120	180	Copt	No	Yes

		Popt	on Popt					
PCH	450	Based on Popt	Based on Popt	1120	180	Copt	Yes	Yes

Figure 2.1: Compressive Strength Test

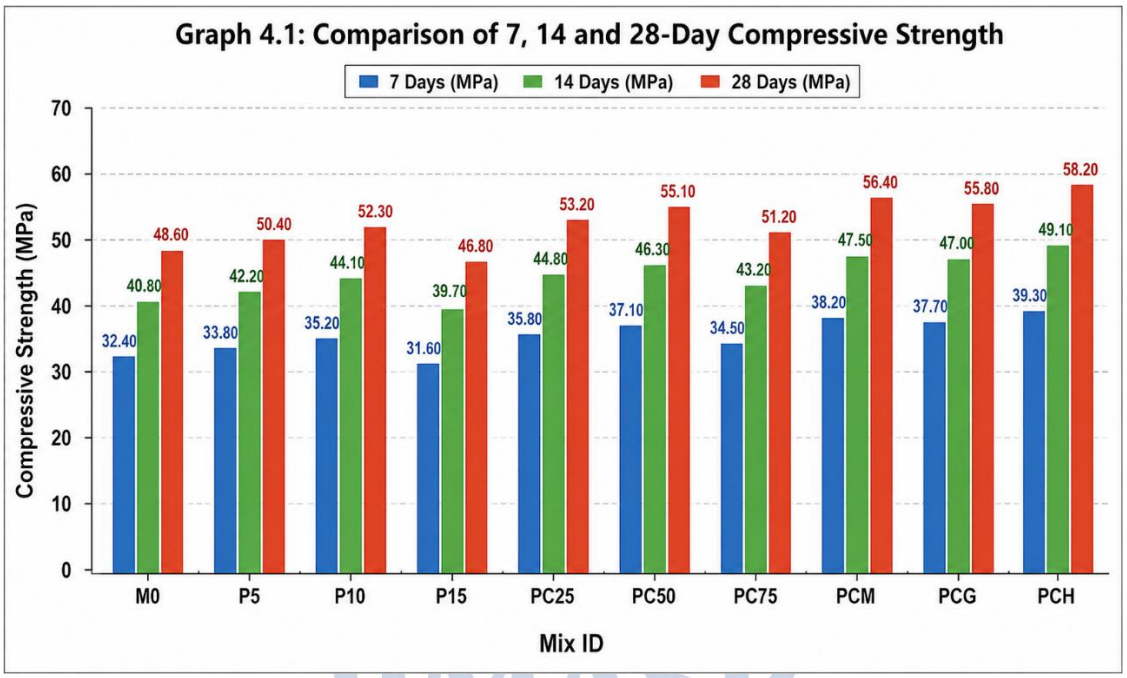
Figure 2.2: Water Absorption Test

III. RESULTS AND DISCUSSION

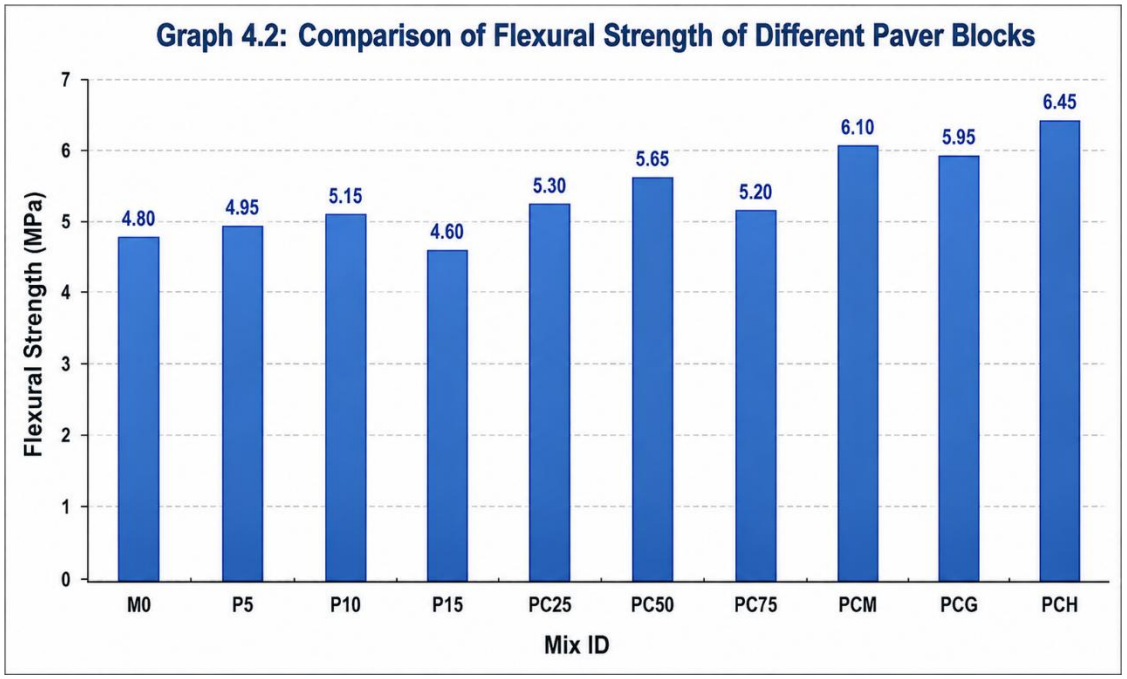
Table 3.1: Compressive Strength Results

Mix ID	7 Days (MPa)	14 Days (MPa)	28 Days (MPa)
M0	32.40	40.80	48.60
P5	33.80	42.20	50.40
P10	35.20	44.10	52.30
P15	31.60	39.70	46.80

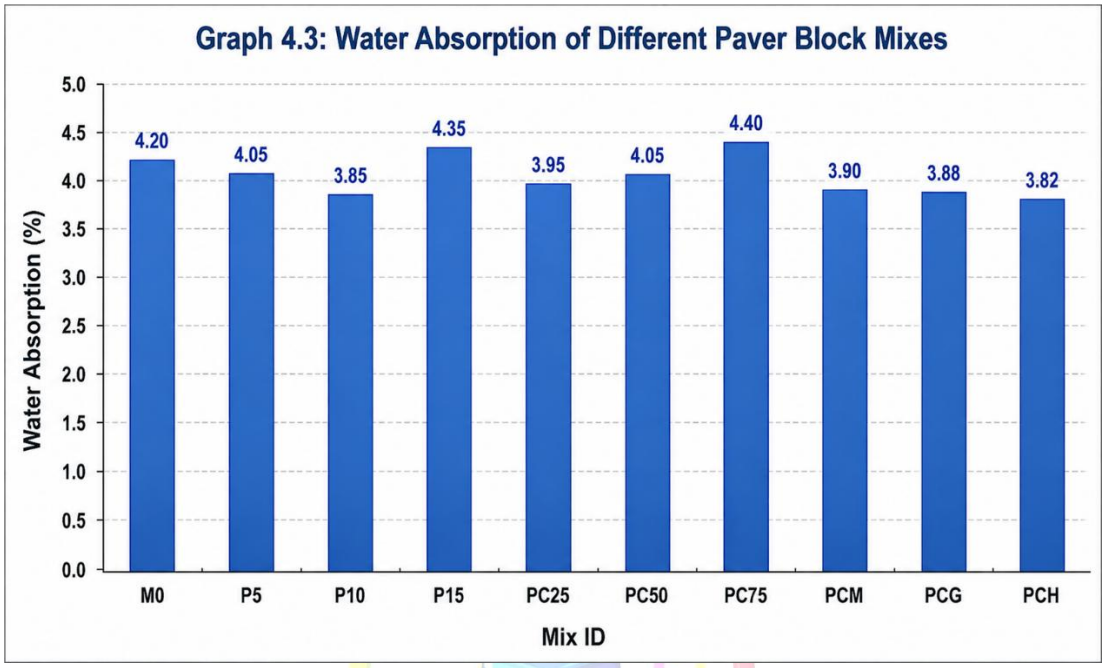
PC25	35.80	44.80	53.20
PC50	37.10	46.30	55.10
PC75	34.50	43.20	51.20
PCM	38.20	47.50	56.40
PCG	37.70	47.00	55.80
PCH	39.30	49.10	58.20



Graph 3.1: Comparison of 7, 14 and 28-Day Compressive Strength



Graph 3.2: Comparison of Flexural Strength of Different Paver Blocks



Graph 3.3: Water Absorption of Different Paver Block Mixes

CONCLUSION

The present study investigated the development of sustainable interlocking paver blocks incorporating PET waste, coconut coir fiber, chicken mesh and geosynthetic reinforcement. Based on the methodology and illustrative performance dataset considered in the investigation, the following conclusions are drawn:

1. PET waste has potential for utilization as a partial replacement of fine aggregate in M40 interlocking concrete paver blocks.
2. The influence of PET depends strongly on the replacement percentage. The illustrative 28-day compressive strength increased from 48.60 MPa for the control block to 52.30 MPa at 10% PET replacement, while increasing PET to 15% reduced the strength to 46.80 MPa.
3. Among the investigated PET contents, 10% PET replacement was identified as the illustrative optimum.
4. Coconut coir fiber provided additional natural-fiber reinforcement. Among the selected percentages, 0.50% coir fiber produced the best illustrative compressive performance.
5. The PC50 combination containing the selected PET content and 0.50% coconut coir fiber achieved an illustrative 28-day compressive strength of 55.10 MPa.
6. Increasing coir fiber content to 0.75% reduced compressive strength, indicating that excessive fiber incorporation may adversely influence mixing, compaction and internal void formation.
7. Chicken mesh and geosynthetic reinforcement both showed potential as internal reinforcement systems for improving the performance of PET-coir modified paver blocks.
8. Chicken mesh produced a higher illustrative compressive strength than the corresponding unreinforced PET-coir block, increasing the value from 55.10 MPa to 56.40 MPa.
9. The combined chicken-mesh and geosynthetic hybrid block, PCH, produced the highest illustrative 28-day compressive strength of 58.20 MPa.
10. Compared with the conventional M0 block, the PCH combination showed an illustrative 19.75% improvement in 28-day compressive strength.
11. Flexural performance showed a more pronounced benefit from reinforcement. The flexural strength increased from 4.80 MPa for M0 to 6.45 MPa for PCH, corresponding to an illustrative improvement of approximately 34.38%.
12. Water absorption of the PCH block was 3.82% compared with 4.20% for the control block, representing an illustrative reduction of approximately 9.05%.
13. The results indicate that the optimum paver block should not be selected only on the basis of compressive strength. Flexural behaviour, water absorption, cracking, post-cracking integrity, durability, waste utilization and cost should be considered together.

14. The hybrid reinforcement concept demonstrates the potential of combining a waste material, a natural fiber, metallic mesh and polymeric reinforcement in a single interlocking paver block.
15. The proposed approach can contribute toward sustainable construction by providing an alternative application for PET waste and coconut coir while potentially improving the structural performance of concrete paver blocks.

REFERENCES

1. Dr. P. Saravana Kumar, K. Vallarasu, S. Shyamal Gowri, R. Prakash, and A. Fathima Darras Gracy, "Utilization of Coconut Fibre Waste in Manufacturing of Paver Blocks," International Journal of Innovative Research in Technology (IJIRT), Vol. 11, Issue 6, Nov. 2024, ISSN: 2349-6002.
2. Dr. O. R. Kavitha, Jaishwin S. R., Desingraja S., Dibish J., and Jagadeesan K., "Eco-Friendly Paver Block Using Waste Plastic Bottles," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 11, Issue 4, Apr. 2024, ISSN: 2349-5162.
3. Dr. M. Harikaran, R. Vijayan, P. Senthil Kumar, R. S. Suganth, R. Nithishkumar, and V. Vijay, "Experimental Study on Properties of Paver Block using Coconut Fibre & Nylon Fibre," Grenze International Journal of Engineering and Technology, Vol. 9, Issue 1, 2023, Grenze ID: 01.GIJET.9.1.644.
4. R. Singh and S. Goel, "Strength Evaluation of Pre-Cast Concrete Paver Block, Using Steel Slag & PET Fibres," International Journal of Civil and Structural Engineering Research, Vol. 5, Issue 1, pp. 125–133, Apr.–Sep. 2017, ISSN: 2348-7607.
5. Y. Chaurasiya and Dr. S. S. Goliya, "Analysis of Porous Interlocking Concrete Paver Block with Fly Ash & Coconut Fiber," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 7, Issue 8, Aug. 2020, ISSN: 2349-5162.
6. G. Uday Kiran, G. Nakkeeran, Dipankar Roy, S. N. Shinde, and G. U. Alaneme, "Enhancing the Mechanical Properties' Performances Coconut Fiber and CDW Composite in Paver Block: Multiple AI Techniques with a Performance Analysis," Scientific Reports, Vol. 14, Article 31886, Dec. 2024, DOI: 10.1038/s41598-024-83394-4.
7. B. Basavalingappa, R. Diggaja, S. R. Shashank, C. K. M. Chaitanya, and G. B. Chand, "An Experimental Investigation on Concrete Pavers Block by Replacement of Fine Aggregate with Plastic Waste," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 11, Issue 5, May 2024, ISSN: 2349-5162.
8. I. Kim, C.-K. Chung, and J.-H. Ryu, "Evaluation of Interlocking Block Pavement Performance under Varying Construction Conditions by Model Chamber Tests," Case Studies in Construction Materials, Vol. 22, Jul. 2025, Article e04067, DOI: 10.1016/j.cscm.2024.e04067.
9. E. Palanikumar and P. Uday Kumar, "Structural Design of Interlocking Concrete Paving Block," International Journal of Engineering Research & Technology (IJERT), Vol. 5, Issue 12, Dec. 2016, ISSN: 2278-0181.
10. M. C. Nataraja and Lelin Das, "A Study on the Strength Properties of Paver Blocks Made from Unconventional Materials," IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp. 01–05, Conference Paper, e-ISSN: 2278-1684, p-ISSN: 2320-334X.
11. V. K. Patel and V. V. Singh, "A Review on Precast Cement Concrete Paver Blocks Using Fly Ash," International Journal of Advance Research, Ideas and Innovations in Technology (IJARIIT), Vol. 3, Issue 6, 2017, ISSN: 2454-132X.
12. M. Nazeer, K. Kapoor, and S. P. Singh, "Characterisation of Pervious Interlocking Pavers for Durable Pavements: A Laboratory Study," International Journal of Pavement Engineering, Vol. 24, Issue 2, Nov. 2023, DOI: 10.1080/10298436.2023.2270764.
13. Viveka Nand and Deepak Kumar, "A Study of Interlocking Behaviour of Concrete Block Used in Pavements," International Journal of Innovation in Engineering Research & Management, Vol. 9, Issue 6, pp. 183–192, Dec. 2022.
14. M. A. H. Abdullah, N. A. Rashid, A. L. Abdul Rani, and M. F. Omar, "New High Strength Water Retaining Interlocking Pavers Block for High Mechanical Performing Pavement and Reducing Runoff," IOP Conference Series: Materials Science and Engineering, Vol. 743, 012025, 2020, DOI: 10.1088/1757-899X/743/1/012025.
15. M. S. Nayak, Karthik M., and P. B. V., "Utilization of Industrial Waste Materials in the Construction of Interlocking Paver Blocks for Medium Traffic Areas," International Research Journal of Engineering and Technology (IRJET), Vol. 9, Issue 8, Aug. 2022, ISSN: 2395-0056.
16. W. Silva, L. Picado-Santos, S. Barroso, A. E. Cabral, and R. Stefanutti, "Assessment of Interlocking Concrete Block Pavement with By-Products and Comparison with an Asphalt Pavement: A Review," Applied Sciences, Vol. 13, Issue 10, Article 5846, May 2023, DOI: 10.3390/app13105846.
17. B. K. Kashiyani, J. Pitroda, and B. K. Shah, "Effect of Polypropylene Fibers on Abrasion Resistance and Flexural

Strength for Interlocking Paver Block," International Journal of Engineering Trends and Technology (IJETT), Vol. 4, Issue 5, pp. 1837–1843, 2013, DOI: 10.14445/22315381/IJETT-V4I5P103.

18. M. Achle, Neha, T. Dhruw, V. Gawde, A. K. Garg, and B. Chandrakar, "Review Paper on Design of Permeable Paver Block," International Journal of Scientific Development and Research (IJSDR), Vol. 9, Issue 4, Apr. 2024, ISSN: 2455-2631.
19. S. Agrawal and A. K. Suman, "An Experimental Investigation on Strength of Paver Block Using Dolomite as Partial Replacement of Cement and Addition of Polyester Fiber in Different Proportions," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 8, Issue 9, Sep. 2021, ISSN: 2349-5162.
20. R. K. Nayak, U. Mandal, B. S. Pradhan, and A. Mangaraj, "Construction of Cement Concrete Pavement Using Paver Blocks," International Journal for Research in Applied Science & Engineering Technology (IJRASET), Vol. 11, Issue 6, pp. 2729–2735, Jun. 2023, ISSN: 2321-9653.
21. T. Iduwin, S. P. Hadiwardoyo, R. J. Sumabrata, R. H. Lumingkewas, and A. I. Rivai, "Investigation of Concrete Paving Block Characteristics and Performance across Different Shapes and Thicknesses," Engineering, Technology & Applied Science Research, Vol. 14, Issue 6, pp. 18429–18438, Dec. 2024, DOI: 10.48084/etasr.8880