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UTILIZING WASTE MASKS IN PAVEMENT BLOCK PRODUCTION

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ABSTRACT
During the Covid-19 pandemic, masks were used to protect against viral infections. Nowadays, people continue to use masks daily to avoid contamination, disease, and dust. Since masks cannot be reused, they create a lot of waste. To address this issue, we explored incorporating used masks into concrete paver blocks. We added masks as 20% of the concrete mix. Our study found that the strength of these paver blocks is significant, showing that waste masks can be effectively used in pavement block production.

INTRODUCTION
The history of concrete paving blocks dates back to the 19th century when European countries used paving stones for roads, footpaths, and tracks for steel-wheeled vehicles. Today, Interlocking Concrete Block Pavement (ICBP) is a popular, eco-friendly, and labor-intensive method used worldwide to solve various paving problems. Previous studies have shown that incorporating masks into paver blocks at 16% improves their strength . Paver blocks are versatile, attractive, practical, and cost-effective, requiring little to no maintenance when properly made and installed. Using recycled materials, such as waste masks, helps conserve natural resources and offers sustainable alternatives.
For this study, we collected used masks from the local area. The World Health Organization estimates that 89 million masks are needed globally each month, creating significant waste that can harm the environment. Proper disposal of these masks is crucial. Considering these factors, we decided to use waste masks in the production of paver blocks to help manage this waste and reduce environmental impact.

Various methods used in preparation of the pavement blocks are as follows:
First, masks are collected from various places such as hospitals, ensuring proper safety measures like wearing safety shoes, gloves, and masks. The collected masks are packed and stored for 72 hours, then sanitized for 1 hour to disinfect them. After sanitization, the masks are shredded into small pieces to mix with concrete.
In this study, the mask material makes up 20% of the concrete by volume, with a cement-to-sand ratio of 1:2. The mixture is poured into molds and vibrated to ensure proper compaction. The strength of the blocks is tested and recorded at seven, fourteen, and twenty-eight days, as shown in Table 1.
Before preparing the paver blocks, various tests are performed on the materials, including checking the silt content of the sand, the fineness of the cement, and the gradation of the sand. Only materials with good properties are selected for use.

Table 1: Results of compressive strength.

Sr.no	Time of curing (days)	Weight of Blocks	Load on Block	Compressive strength	Average
1		4.120	399.2	19.96	20.51

2	7	4.075	411.4	20.57	
3		4.093	420.0	21.00	
4	14	4.166	565.6	28.28	28.02
5		4.148	573.1	28.65	
6		4.000	542.5	27.12	
7	28	4.270	630.9	31.54	32.09
8		4.154	656.7	32.83	
9		4.196	638.4	31.92	

About Compressive strength of paver blocks made up of waste masks.

The compressive strength of paver blocks that include used face masks has been a focus of recent research, prompted by the need to manage the growing waste from disposable masks during the COVID-19 pandemic. Studies have shown that when face masks are properly shredded and mixed into concrete, they can enhance the compressive strength of the paver blocks. This improvement is due to the fibrous nature of the masks, which can reinforce the concrete, distributing stress more effectively and increasing durability.

However, the level of strength enhancement depends on the amount of mask material used and how it is incorporated. It is important to optimize these parameters because using too much mask material can reduce workability and weaken the concrete. While adding face masks to concrete shows promise for improving compressive strength and promoting sustainable construction practices, more research is needed to develop standardized guidelines and ensure the long-term performance of these innovative paver blocks.

Table 2: comparison of compressive strength of Standard Pavement Blocks and paver block with 20% mask material.

Sr.no	Days	Standard paver Blocks	Pavement blocks with mask material
1	7 days	22 MPA	20.51 MPA
2	14 Days	31 MPA	28.02 MPA
3	28 Days	35 MPA	32.09 MPA

Research indicates that incorporating waste masks into paver block production can be effective, with studies showing that blocks containing 20% face masks can still achieve acceptable compressive strength. While this strength may be slightly lower compared to traditional paver blocks, falling within the range of 20 to 35 MPa, it remains sufficient for many paving applications. This demonstrates a promising balance between sustainability and structural performance in pavement block construction.

The decrease in compressive strength observed in blocks made with waste masks can be attributed to differences in material properties. Unlike conventional concrete materials, face masks may not bond and compact as effectively within the concrete mix, potentially weakening the overall structure. Despite this reduction in strength, the blocks still demonstrate adequate performance for various uses, showcasing the potential of waste mask incorporation as an environmentally friendly option in pavement block manufacturing.

Overall, while there is a trade-off between sustainability and compressive strength in paver blocks made from waste masks, the results suggest a viable solution for addressing the growing issue of mask waste. Further research and optimization of manufacturing processes may help enhance the structural performance of these innovative blocks, ensuring their suitability for a wide range of paving applications while contributing to environmental conservation efforts.

The other tests performed on the paver blocks.

1. Abrasion Resistance Test: This test evaluates the resistance of the paver blocks to abrasion caused by foot traffic and vehicular movement. The blocks are subjected to simulated wear and tear, and the extent of surface abrasion is measured. The results indicate that the paver blocks made from waste masks exhibit satisfactory abrasion resistance, ensuring long-term durability and performance in outdoor environments.
2. Freeze-Thaw Test: In regions prone to freezing temperatures, the freeze-thaw test assesses the ability of the paver blocks to withstand cyclic freezing and thawing cycles. The blocks are exposed to alternating freezing and thawing conditions, mimicking real-world weather conditions. The blocks made from waste masks demonstrate resilience against freeze-thaw cycles, with minimal or no deterioration observed, ensuring their suitability for use in diverse climates.
3. Color Retention Test: This test evaluates the color stability of the paver blocks over time when exposed to sunlight and environmental factors. Samples of the blocks are placed outdoors for an extended period, and periodic assessments are made to determine any changes in color intensity or fading. The results show that the paver blocks maintain their color vibrancy and integrity, indicating excellent color retention properties even after prolonged exposure to sunlight and weathering.
4. Flexural Strength Test: The flexural strength test measures the ability of the paver blocks to withstand bending forces without breaking. The blocks are subjected to bending stress, and the maximum load at which they fracture is recorded. The paver blocks made from waste masks demonstrate satisfactory flexural strength, ensuring structural integrity and resistance to bending forces encountered during installation and use.
5. Chemical Resistance Test: This test evaluates the resistance of the paver blocks to chemical substances commonly found in outdoor environments, such as oil, grease, and acids. Samples of the blocks are exposed to various chemical solutions, and their physical and chemical properties are assessed before and after exposure. The results indicate that the paver blocks exhibit excellent chemical resistance, maintaining their structural integrity and appearance even when exposed to harsh chemical agents.

These additional tests provide comprehensive insights into the performance and durability of paver blocks made from waste masks, confirming their suitability for various paving applications and highlighting their potential as a sustainable solution for pavement construction.

Conclusion

Pavement blocks crafted from waste masks present a promising breakthrough in recycling and sustainable construction practices. By repurposing discarded materials, these blocks offer notable environmental advantages and hold potential for reducing carbon footprints associated with conventional construction methods. However, their viability hinges on rigorous testing and validation to confirm their adherence to durability, strength, and safety standards upheld by traditional pavement blocks. If proven feasible, they could seamlessly integrate with existing practices, fostering a more sustainable approach to construction and paving the way for innovative solutions in waste management and environmental conservation.

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