DEVELOPMENT OF FIBRE REINFORCED PAVING BLOCK FOR OUTDOOR SPORTS SURFACES

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Synthetic fibre blended fabric offcuts generated from textile industry are considered as waste and currently incinerated in cement kilns. Utilisation of textile waste in development of cement based product was focused in this study. Behaviour of fabric pieces in cement matrix indicates its reinforcing effect with proper bonding characteristics while changing its failure pattern from brittle mode to more ductile pattern. Experimental investigation was carried out to identify the optimum size of shredded fabric pieces and its content which can be incorporated into cement matrix to achieve the highest flexural strength of the fabric-cement composite. Optimum fabric content was found to be 26% by volume and most suitable size range of shredded fabric pieces was identified as 0 to 10 mm. Superplasticiser was used to improve the workability of mixture at low w/c ratios and viscosity modifier was used to improve the homogeneity. Paving block was developed with the use of shredded form of polyester spandex fabric, manufactured sand, cement and admixtures. Developed block complies with the requirements specified for paving blocks in SLS 1425 and BS EN 1338 standards. Fiber reinforced paving block has a compressive strength of 18 MPa and tensile splitting strength of 5.4 MPa. Under compression type load, the block is initially subjected to elastic deformation and then plastic deformation. Failure pattern changing point from elastic deformation region to plastic deformation region was considered as failure point of that block to estimate its compressive strength. The developed paving block has an abrasion resistance of 17 mm and a skid resistance of 80 USRV. Elasticity effect of polyester spandex fabric leads to improve the shock absorption characteristics of fibre reinforced paving block. The shock absorption capability of this paving block was measured using a test apparatus that was fabricated in accordance with the BS EN 14808 standard, which specifies the determination of shock absorption characteristics of sports surfaces. The shock absorption capability of this block is 21%, which meets the requirement specified in the BS EN 15330-1 standard for tennis court surfaces. Incorporation of fabric pieces into cement matrix leads to create a porous structure while improving water infiltration capability. Permeability of the paving block was measured in terms of its infiltrated water volume at constant time intervals under constant pressure head. This paving block has a water percolation capability of 200 litres/m^2 per hour, which means it can absorb up to 100 litres of water per square meter in 30 minutes under a pressure head of 1.1 bar. This helps to reduce surface runoff of rainwater. Deterioration of fabric fibres in an alkaline environment was evaluated as per ISO 8336 standard while subjecting fibre reinforced paving blocks to 50 numbers of soak–dry cycles and soak-dry performance criteria was estimated as 0.8 which satisfies the ISO 8336 standard requirement. Developed paving block satisfies the requirements specified for paving blocks in SLS and BS EN standards. The novel paving block has improved shock absorption and water infiltration characteristics, as well as satisfactory durability. It is suitable for outdoor sports surfaces, as it provides better foot comfort and slip resistance.

Keywords: Paving block, Polyester spandex, Shock absorption, Permeability, Sports surfaces

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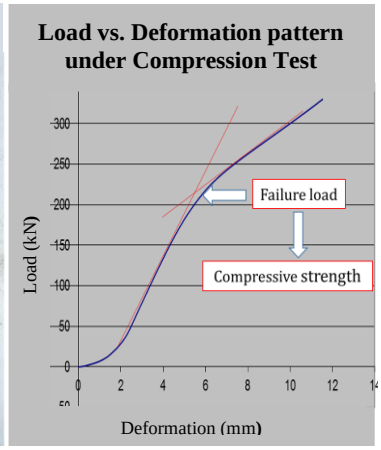
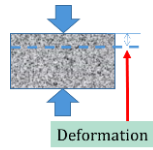
Surface Texture of Fabric Embedded Paving Blocks

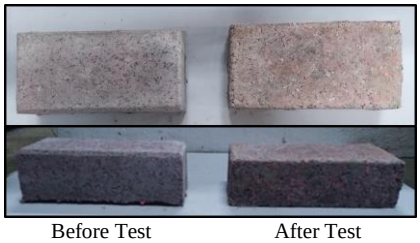
Load vs. Deformation pattern under Compression Test





Abrasion Resistance Tested Specimen

Failure Pattern under Compression Test

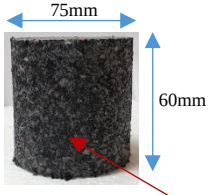


Before Test

After Test

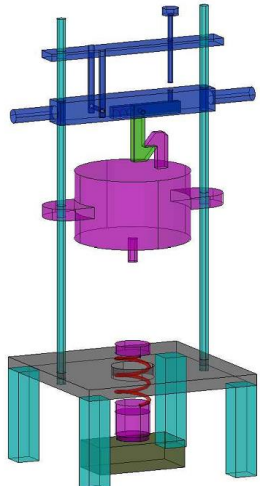
Failure Pattern of Specimen under Tensile Splitting Strength Test

Constant Head Permeability Test



Test Specimen

Shock Absorption Test Apparatus



Fibre Reinforced Paving Blocks Laid Jogging Track at SLLI Panagoda

Product Performance

Property	Test Result	Specified Standard Requirement
Compressive Strength	18 N/mm^2	≥ 15 N/mm^2 (SLS 1425)
Tensile Splitting Strength	5.4 N/mm^2	≥3.6 N/mm^2 (BS EN 1338)
Abrasion Resistance	17 mm	≤ 20 mm
Skid Resistance	80 USRV	≥ 55 USRV
Permeability	100 litres/mm^2 (30 mins)	-
Shock Absorption	21%	15% - 24% (BS EN 15330-1)
Durability	0.80	≥ 0.75 (ISO 10904)