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MECHANICAL PROPERTIES OF CONCRETE CLOTH USING 3D FIBER MASH

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Abstract: This paper explores the development and mechanical properties of Concrete Cloth, a unique material formed using a three-dimensional fiber mesh. Concrete Cloth is a composite material that combines the structural strength of concrete with the flexibility and ease of deployment of fabric. The fiber mesh serves as a reinforcement network within the concrete matrix, enhancing its tensile strength and ductility. This study investigates the manufacturing process of Concrete Cloth, including the selection of fibers, weaving techniques, and impregnation methods. Mechanical testing is conducted to evaluate the material's performance under various loading conditions, including tensile, compressive, and flexural tests. The results demonstrate the effectiveness of the fiber 3D mesh in improving the mechanical properties of Concrete Cloth, including its resistance to cracking, deformation, and abrasion.

Keywords: Cement, Concrete Cloth, Defense, PVC Sheets, 3D Fiber Matrix.

I. INTRODUCTION

Concrete Cloth, an innovative construction material, has gained prominence for its unique composition comprising concrete embedded within a three-dimensional fiber mesh. This amalgamation offers a novel approach to reinforcing concrete structures, enhancing their mechanical properties while maintaining flexibility and ease of installation. The utilization of fiber 3D mesh technology represents a significant advancement in construction materials, providing improved structural integrity and performance compared to traditional methods of reinforcement. This paper aims to explore the manufacturing process, mechanical characteristics, and potential applications of Concrete Cloth utilizing fiber 3D mesh reinforcement.

The technology of concrete cloth was found for the use of emergency shelters. This technology wasn't commercialized for other works. Later researches were made on concrete cloth and incredible product was introduced to construction field. The concept of concrete cloth was first proposed by Brewen and Crawford in 2005. Later the research was conducted and the British Engineering Company found the Revolutionary material called as Concrete Cloth or Concrete Canvas. It is a new era product in the field of construction.

The integration of fibers into concrete matrices has been extensively studied to enhance the material's tensile strength, crack resistance, and overall durability. Traditional methods, such as steel rebars and

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synthetic fibers, have demonstrated efficacy but often entail complexities in installation and handling. The advent of fiber 3D mesh technology has revolutionized these processes by offering a more integrated and efficient means of reinforcement. Concrete Cloth emerges as a pioneering solution that capitalizes on this technology, offering a versatile material with superior mechanical properties.

This study will delve into the manufacturing intricacies of Concrete Cloth, encompassing aspects such as fiber selection, weaving techniques, and impregnation methods to ensure optimal bonding between fibers and the concrete matrix. Additionally, mechanical testing will be conducted to evaluate the material's performance under various loading conditions, including tension, compression, and flexure. These tests will provide valuable insights into Concrete Cloth's structural integrity, durability, and resilience compared to conventional concrete materials.

Furthermore, this paper will discuss the potential applications of Concrete Cloth across diverse sectors, including civil engineering, construction, environmental remediation, and disaster relief. By elucidating its advantages in terms of cost-effectiveness, sustainability, and rapid deployment, Concrete Cloth presents a compelling alternative to conventional construction materials.

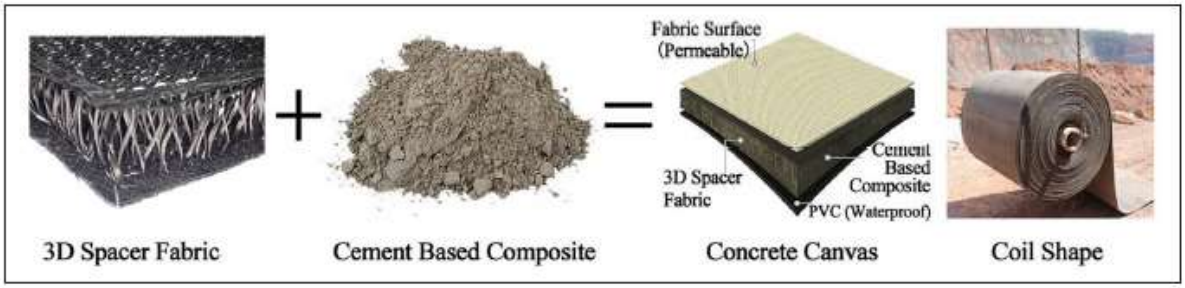

Fig.1. Concrete Cloth

Concrete Cloth consist 3-Dimensional fiber matrix linking two faces one of them is porous face and another impervious face. The fiber matrix act like reinforcement and make it strong. It can be used within 24 hours. After transport or delivery of concrete cloth bag just spread it on the required surface or ground and apply curing .Within 24 hours it gets hard and become ready to use. No need of more labour and precision. It gives high performance and durability with high efficiency.

Concrete Cloth is available in 3 thicknesses: CC5, CC8 and CC13, which are 5, 8 and 13mm thick respectively. Compared to traditional concrete solutions, Concrete Cloth is faster, easier and, more cost effective to install and has the additional benefit of reducing the environmental impact of concreting works by up to 95% so it is eco-friendly construction material. Concrete Cloth Hydro is a revolutionary new containment product from Concrete Canvas Ltd. It combines the company’s concrete impregnated fabric technology with a high impermeability, chemically resistant geomembrane backing.

Ingredients and Mix Proportions:

- **Cement**: Portland cement is commonly used as the binder in Concrete Cloth. It reacts with water to form a paste that binds the aggregates and fibers together.
- **Aggregates**: Fine aggregates such as sand are mixed with cement to form the concrete matrix. Aggregates provide bulk and strength to the material.

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- **Fibers**: 3d Fiber mash added to improve the tensile strength, toughness, and durability of Concrete Cloth. These fibers help to prevent cracking and enhance the material's ability to withstand bending and flexing.
- **Water**: Water is necessary for the hydration of cement, which initiates the chemical reactions that bind the ingredients together and form the hardened concrete. Water will be added after the concrete cloth is transported and placed to desire location.
- **Additives**: Additives such as accelerators – calcium Chloride included in the mix to modify the setting time at 2% cementitious material.

Mechanical Properties

Compressive Strength

Compression testing for concrete cloth involves determining its compressive strength, which is essential for assessing its performance and suitability for various applications. Here's a general procedure for conducting compression testing on concrete cloth:

- Cut specimens of Concrete Cloth to the desired dimensions. For flexural testing, these are typically rectangular beams.
- Set up the compression testing machine according to the manufacturer's instructions and applicable standards. Place the concrete cloth specimen on the lower platen of the compression testing machine.
- Center the specimen on the loading axis to ensure uniform loading.
- Apply load gradually and continuously until failure occurs. The loading rate should be within the range specified by the relevant standards or project specifications.

Table:1 – Compressive Strength of Concrete Cloth

Days	Mix -1 (Without fiber) Strength (N/mm^2)	Mix -1 (With fiber) Strength (N/mm^2)
3	17.43	19.90
7	27.28	29.85
28	35.78	38.27

Flexural Strength

Testing the flexural strength of Concrete Cloth, also known as Concrete Canvas, involves subjecting samples to a bending load to determine their resistance to bending or flexure.

- Cut specimens of Concrete Cloth to the desired dimensions of 100 mm X 500 mm x 13 mm. For flexural testing, these are typically rectangular beams.
- Support the Concrete Cloth specimen on two spaced supports (often referred to as "simple supports") that are placed a specific distance apart, typically specified in testing standards. Start applying a load to the center of the Concrete Cloth specimen at a constant rate.
- The rate of loading should typically conform to relevant testing standards or specifications of ASTM C1609/C1609M - 20.
- ASTM standards provide specific formulas for calculating flexural strength based on the geometry of the specimen and the applied load.

Table:2 – Flexural Strength of Concrete Cloth

Days	Mix -1 (Without fiber)	Mix -1 (With fiber)

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	Strength (N/mm^2)	**Strength (N/mm^2)**
3	2.55	4.31
7	4.85	6.63
28	6.23	8.29

Tensile Strength

Testing the tensile strength of Concrete Cloth, also known as Concrete Canvas, involves subjecting samples to controlled tension until they break. Here's a general outline of how you can perform this test:

- Cut specimens of Concrete Cloth to the 100 mm X 500 mm dimensions. Typically, these are rectangular strips. Ensure that the specimens are free of any defects or irregularities that could affect the test results.
- Grip each end of the Concrete Cloth specimen securely using appropriate clamps or grips that won't damage the material. Make sure the grips are attached to a testing machine that can apply a controlled and uniform tension to the specimen.
- Start applying tension to the Concrete Cloth specimen at a constant rate. The rate of loading should typically conform to relevant testing standards or specifications. Continuously monitor and record the load applied and the corresponding elongation of the specimen. This data helps in constructing a stress-strain curve, which provides insights into the material's behavior under tension.
- The tensile strength of Concrete Cloth can be calculated by dividing the maximum load at failure by the cross-sectional area of the specimen.

Table:3 – Tensile Strength of Concrete Cloth

Days	**Mix -1 (Without fiber) Strength (N/mm^2)**	**Mix -1 (With fiber) Strength (N/mm^2)**
3	0.58	1.01
7	0.67	1.48
28	0.98	1.82

CONCLUSION:

In conclusion, Concrete Cloth, reinforced with fiber 3D mesh, represents a promising advancement in construction materials, offering a unique combination of structural strength, flexibility, and ease of deployment. Through the integration of a three-dimensional fiber mesh into the concrete matrix, Concrete Cloth demonstrates enhanced mechanical properties, including improved tensile strength, crack resistance, and durability. The manufacturing process, encompassing fiber selection, weaving techniques, and impregnation methods, ensures optimal bonding between fibers and the concrete matrix, resulting in a robust and versatile material. As per the results of different tests, there is minor increment in Compressive strength but in case of Flexural and tensile strength major increment is there due to the presence of 3d Fiber mash.

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