

# Feasibility of Manufacturing of Concrete canvas in India

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**Abstract** - Concrete is one among the foremost frequently used building materials thanks to its durability but the necessity to enhance its flexibility has always attracted the eye of all civil engineers and researchers. because the country is moving towards the fashionable era it's time to modernize our materials too. Concrete could be a really durable material to serve its purpose in housing industry but in operations repair work, emergency shelters, canal lining, landslides protection in hilly region, it limits the facility of housing industry thanks to its rigid nature. To facilitate economical and quick solutions for these works, concrete canvas is often used thanks to ease in placing. The Indian housing industry is unaware about the fabric thanks to its low availability, high importing cost and limited suppliers. This paper focuses on the feasibility of producing concrete canvas in India as against importing it from foreign manufacturers. Study is completed to ascertain its economical aspect and its various uses.

**KEYWORDS:** Concrete canvas; Concrete Cloth; flexibility; Fire resistant; Shelter; Water Proof

## 1. INTRODUCTION

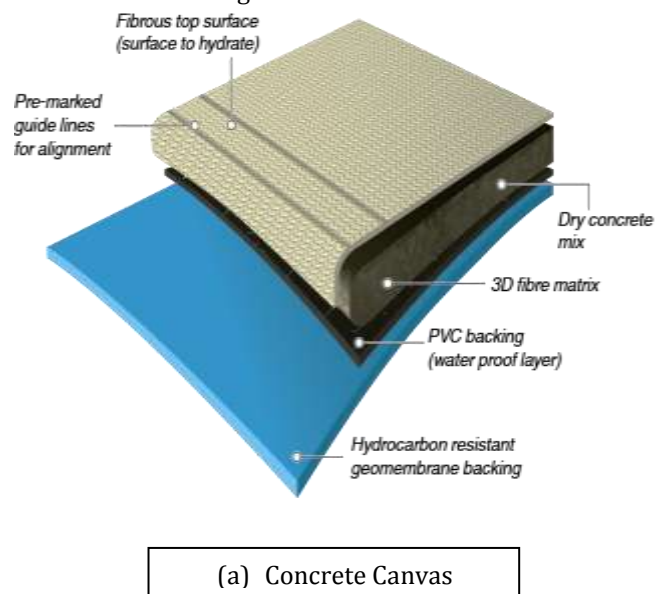
Concrete may be a globally recognized as a construction material possessing a versatility of mechanical properties like good load taking capacity, customizable compressive strength, good impermeability and better durability. Moreover, concrete could also be moulded into a required shape which revolutionized the development industry. the main issue which is usually a priority is concrete's ability to resist tensile stresses. Concrete loses its flexibility, while it's hardened. for creating the concrete flexible the planning philosophy adopted in conventional concrete got to be altered.

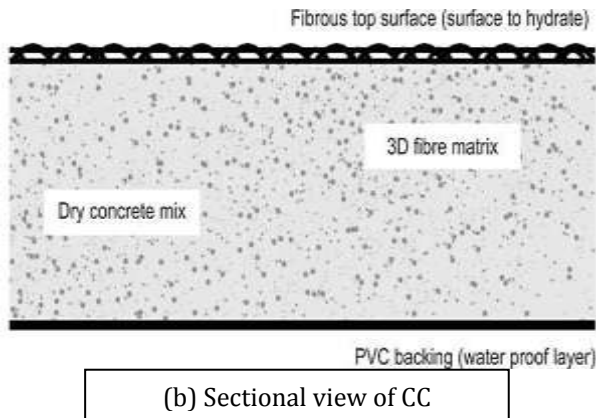


Figure-1: Flexible concrete specimen made by Professor Vector Li

To overcome the pliability issue Professor Victor Li at the University of Michigan developed a replacement material consisting of a special sort of materials which makes it flexible and named it as Engineered Cementitious Composite (ECONCRETE CANVAS) as shown in Figure 1. British Engineering Company introduced a replacement material referred as Concrete canvas or concrete cloth (CONCRETE CANVAS). This material possesses flexibility as compared the traditional concrete. within the flexible concrete, the coarse aggregates are eliminated.

The concrete cloth features a vast scope of application specially in slope protection, construction mining, overlaying on underground pipelines, agriculture, Military application and far more. In the present pandemic situation of COVID -19 the concrete canvas may be a best suited material for construction of emergency shelters. The concrete canvas consists of a three-dimensional fiberglass matrix, containing a dry concrete mix with backing by PVC sheet on one surface of the material to form it waterproof [1]. Fiberglass sheet on the opposite surface support the hydration by drawing water into the cement. The canvas material are often hydrated by spraying or by keeping immersed in water. A typical sectional view of the concrete canvas is shown in Figure 2a-b.





**Figure 2**

As per B.B Jindal, Concrete paper (Concrete Cloth: An Innovative Versatile Construction Material) Cloth (CONCRETE CANVAS) features a completely different preparation process as compared to standard 3D spacer fabric reinforced cementitious composites. Before setting of the cement powder on the surface, concrete cloth which may be a flexible 3D spacer fabric impregnated with cement powder are often placed sort of a soft cloth. Water are often sprayed afterward on the highest surface of fabric for hydration requirement. On getting hardened, a skinny composite layer, that's flexible and sturdy, water-resistant and fire-resistant, forms and covers the structure or element, whatever its shape [2].

Thus concrete cloth are often quickly and effortlessly nailed, stapled through or covered with an honest quality adhesive for efficient connectivity with the surface. The concrete cloth was efficiently used as a structural element to hide prefabricated shelters, the pathway for vehicles or pedestrians and unlimited applications. Once set, this cloth covers the concrete, prevent the crack propagation & imparting a secure plastic failure mode [2].

## 2. MANUFACTURING PROCESS OF CONCRETE CANVAS OF CONCRETE CANVAS

Preparation of Raw materials of Concrete canvas Dry concrete mixture: Dry concrete mixture for concrete canvas is usually prepared by selecting dry cement powder which has got to provide both high mechanical strengths and short setting times. Calcium aluminate cement (CAC), Calcium sulfoaluminate cement (CSA) or combination of both are taken as per the sensible application of CONCRETE CANVAS. Calcium sulfoaluminate cement may be a very suitable binder for concrete cloth thanks to its better mechanical strength, resistance to corrosion, low porosity,

higher resistance to weathering actions, low pH, better dimensional stability and good setting property [2-4].

**Fibreglass matrix:** A three-dimensional fibreglass matrix forms a reinforcing matrix within the Concrete Cloth. On any external impact, the reinforcing property of those fibres helps in absorbing the impact energy, and helps to take care of the structural integrity of the concrete. The fibre matrix reinforces the concrete, preventing crack propagation & providing a secure plastic failure mode.

**Membranes:** An impermeable PVC membrane on one side for creating CONCRETE CANVAS waterproof against any attack by moisture or water from the encompassing. A hydrophilic fibres (Polyethylene and Polypropylene yarns) membrane is attached to the other surface to PVC membrane which helps in hydration process and is employed for drawing water into the mixture [2,5,6].

### 2.1 Preparation of Concrete canvas/Cloth (CONCRETE CANVAS)

As per A.U. Ahmad, P.K. Pasnur paper (Experimental Study of the Mechanical Behaviour of Aluminium Mosquito Sheet on Concrete canvas), a flow chart illustrating the varied steps utilized in the preparation of concrete canvas is shown in Figure 3.

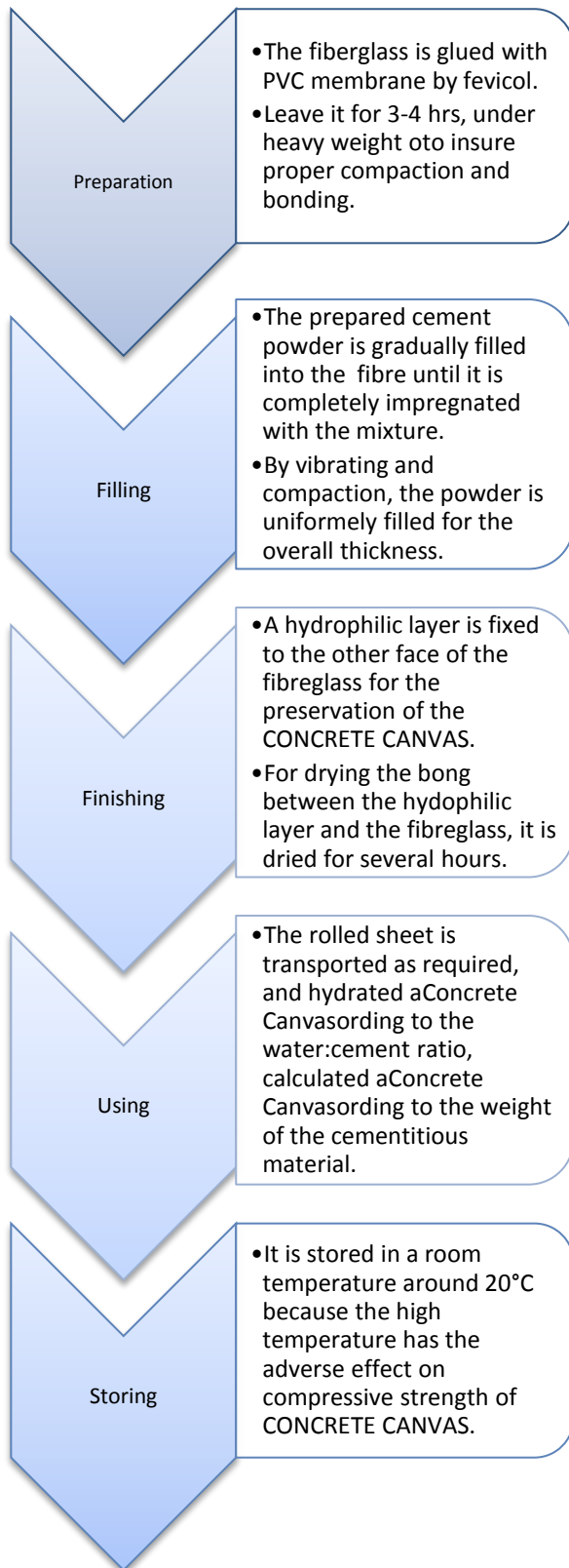


Figure 3: Preparation flow chart of Concrete canvas.

As indicated in Fig 4, CONCRETE CANVAS consists of a 3D spacer fabric and cement powder filled in- between.

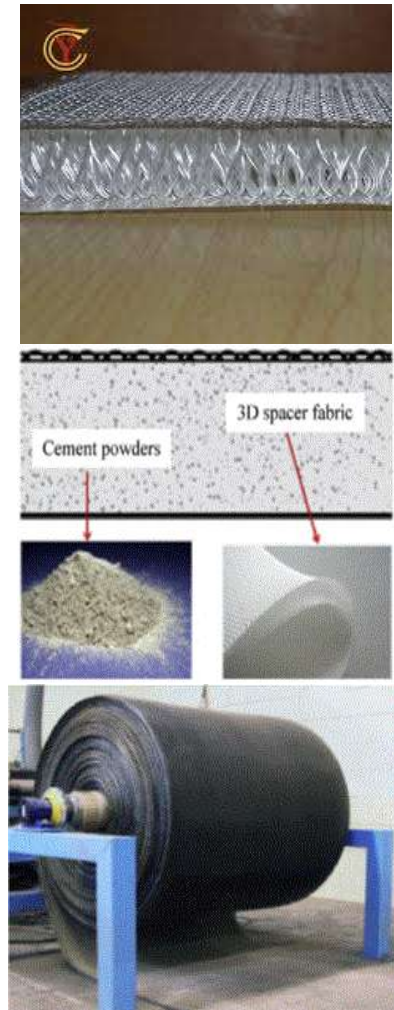


Figure 4: A typical 3D spacer fabric and compositions of concrete canvas

Finally, water is cover the hydrophilic surface for the hydration of CONCRETE CANVAS panels. Once CONCRETE CANVAS panel gets hydrated it's only workable for 2 to 2 and half hours. Spraying of water will immediately stop once the water penetrates alongside the bottommost layer of the CONCRETE CANVAS sample. An excess in water/binder ratio always recommended. Use the spray nozzles for the simplest results don't use high-pressure jet directly on CONCRETE CANVAS specimen as gets disturb the unset CONCRETE CANVAS panels.

No further curing is required for Concrete canvas. Before the addition of water, CONCRETE CANVAS is simply sort of a soft cloth. Once CONCRETE CANVAS gets hydrated by water it becomes solid and to make a thing, strong and waterproof concrete layer.

## 2.2 THE COST of producing THE CONCRETE CANVAS

Basically the concrete canvas is formed from three main materials quick dry cement, spacer fibre and PVC sheet. The approximate cost estimate for the concrete canvas manufactured in India would be as follows

MATERIAL	COST FOR	QUANTITY	RATE	AMOUNT
PVC	PER SQ METER	1sq meter, 0.5mm	RS 190/- per sq. meter	Rs 190/-
QUICK DRY CEMENT	PER KG	5kg approximate	RS 15/- per kg	Rs 55/-
SPACER FIBRE	PER SQ METER	2 sq. meter of 0.5 mm	RS 750/- per sq. meter	Rs 1500/-
LABOUR	WAGES	According to production capacity	Per sq.	Rs 25/-
		<b>TOTAL</b>	<b>AMOUNT</b>	<b>Rs 1770/-</b>

**Table-1:** Cost estimation of concrete canvas

The cost of an imported concrete canvas of thickness 5mm manufactured in UK is approx. Rs 4500/- per sq. meter which is approximate 2.5 times the value mentioned within the above table. Therefore if concrete canvas is manufactured in India it'll reduce the value and make it more feasible to use.

### 2.3 Applications in engineering



**Figure 5:** Ditch Lining

#### Ditch Lining

Concrete canvas are often rapidly unrolled to make ditch or tank lining, it's significantly quicker and fewer expensive to put in than conventional concrete ditch lining and requires no specialist plant equipment. The 30m ditch shown below was lined in 45 min.



#### Slope Protection

Concrete canvas are often used for slope stabilization and other erosion control applications like temporary and permanent slope protection, retaining walls, boulder fences, low level bunds and river bank and dam revetments.



**Figure 7:** Pipeline protection

#### Pipeline Protection

CONCRETE CANVAS are often used as a coating of overland or underwater protection pipeline protection, providing a superior tough rock shield. In remote areas it is often wont to coat steel on site without expensive wet concrete application plants. CONCRETE CANVAS will set under water and supply negative buoyancy.

#### Ground Resurfacing

CONCRETE CANVAS are often secured with ground anchors to rapidly create a concrete surface for flooring, pedestrian walk-ways or dust suppression. CONCRETE CANVAS 8mm and CONCRETE CANVAS 13mm are tested to EN 1991-1-1:2002 (Resistance to Imposed Loads on vehicular traffic Areas)



**Figure 8:** Emergency shelters

### Emergency shelters

Concrete canvas are often used to create thin-walled concrete shelter required only water and air for construction. The concrete canvas use as a shelter is shown in Figure 4(e). Concrete canvas Shelters provide far better environmental protection, increased security and saves effort and price in future as compared to standard tent shelters.

### Mining Applications

CONCRETE CANVAS are often used as an alternate to poured or sprayed concrete or as a fast way of erecting strong permanent or temporary blast and vent structures and spall lining. CONCRETE CANVAS has been successfully tried in Mpumalanga, South Africa.



**Figure 9:** Bund Lining

### Bund Lining

Earth containment bunds are often quickly lined with CONCRETE CANVAS to supply an efficient, chemically resistant alternative to concrete lining.



**Figure 10:** Sandbag Reinforcement

### Sandbag Reinforcement

CONCRETE CANVAS has been proven to stop the degradation of sandbags from sustained incoming fire, outgoing muzzle ash and environmental exposure. A sandbag wall protected by CONCRETE CANVAS withstood 900 rounds of seven .62 NATO, fired by a GPMG LR at a variety of 100m. there's currently over 5500sqm of CONCRETE CANVAS getting used by British army in Afghanistan.

### Gabion Reinforcement/ Capping

CONCRETE CANVAS are often used to cap or repair gabion walls to supply long-term protection and stop FOD (Foreign Object Damage). Covering gabions with CONCRETE CANVAS also prevents water ingress which may cause slump, whilst protecting the geo-textile membrane from the consequences of UV degradation.

### Dust Suppression

CONCRETE CANVAS 5mm was developed as a result of in-theatre feedback, to be used as a dust suppression surface around Helicopter Landing Sites. Benefits include: speed of installation, durability, and good coverage (CONCRETE CANVAS) will conform to the underlying ground conditions).

## 2.4 Advantages of Concrete canvas

### Portable:

They are easy to hold, transport and deployed without specialized equipment.

### Easy to use:

Dry concrete fabric could also be reduced or tailor-made for the usage of straightforward hand tools. It's going to be effortlessly repaired or upgraded for the usage of existing cement products.

### Rapid:

The cloth could also be hydrated with the help of either spraying it or absolutely immersing it in water. Once hydrated, it remains flexible for 2 hours and hardens to 80% of its final power within 4 hours which is far faster than the traditional concrete.

### Flexible:

This can be easily nailed or anchored through before setting.

### Strong:

The fibre reinforcement acts to save lots of the cracking, absorbs energy from affects and affords a solid failure mode

### Waterproof:

The PVC backing on one floor guarantees that concrete cloth is totally waterproof.

### Setting:

The concrete cloth cures within the shape of the below structure on which it's placed and 24 hours later the structure is prepared to use.

Fireproof:

The Concrete cloth may be a ceramic-based material and cannot burn.

### 2.5 Commercial Availability

Concrete canvas is presently available in three variants based upon thickness. These variants vary in thickness, types of their application, properties, and composition are CONCRETE CANVAS5mm, CONCRETE CANVAS8mm, CONCRETE CANVAS13mm of 5, 8 and 13 mm thickness. It is available wrapped in bulk rolls packed in bags which make it very convenient to transport and easy for laying at the site. It requires minimum labour as well very economical for application along with high performance and durability.

### 3. CONCLUSION

The concrete canvas is the latest invention in the construction sector. Concrete canvas owing to its easy manufacturing process, better flexibility properties, a higher degree of waterproofing and easy to customized use can prove a boon for the construction industry. Study shows that it can be helpful in both temporary and well as permanent purpose. In India concrete canvas is imported from foreign countries, so by introducing its benefits and cost analysis to Indian construction industry we can initiate its manufacturing in India.

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