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Experimental Study on Concrete Canvas

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Abstract – The construction time as well as the cost of construction has always carried attracted attention in Civil Engineering. It has been supplemented by various economical and rapid installation construction techniques and materials. The one of this on which i want to carry my research is Concrete Canvas. Concrete Canvas is a new revolutionary construction material. It is a flexible, cement impregnated material which hardens on hydration to form a thin, durable, retaught, water proof and fire resistant concrete layer. Simply the Concrete Canvas is a flexible concrete in the form like cloth which can very easily positioned and then just add water. After hydration the concrete cloth turns into hard, durable concrete structure within 24 hours.

Key words:- Concrete Canvas, Calcium Aluminate Cement (CAC), Concrete, hydrophilic fiber, PVC sheet.

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INTRODUCTION

Concrete canvas (CC) is a flexible 3D spacer fabric impregnated with calcium aluminate cement (CAC) powder. Like soft cloth, CC can closely cover the arbitrary surface of a structure or element during construction, without the need for mixing equipment. Then, with the addition of water, the solid surface of CC hardens to form a thin, durable, waterproof and fire resistant concrete layer. Its final shape is exactly same as the outer profile of the structure or element covered by the CC. Due to the flexibility and rapid construction of CC, with low labor cost, and the quick setting of CAC, CC have been applied in civil and military engineering. Concrete canvas can be used as a quickly made construction material which is waterproof, fireproof, fiber-reinforced thin concrete layer of cloth which has a wide range of applications: rapid track way or landing surfaces, structural reinforcement, ground stabilization, ballistic protection and sterile concrete shelters. Concrete canvas sheet is a future revolution in the field of civil engineering.

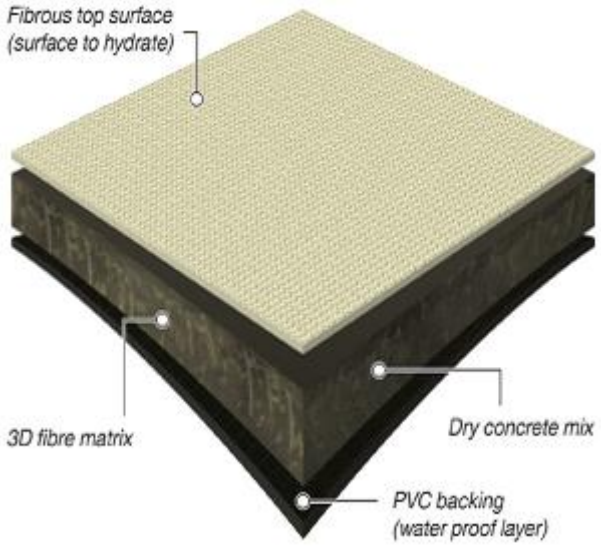


Figure 1:- Cross-section of Concrete Canvas

The material is then performed well in practical situations such as in Ditch lining, slope protection, dust suspension in Helipad, Capping, pipeline protection and several other uses. The various advantages observed include ease of installation, high resistance to chemical attack, abrasion and high speed of work. The Concrete canvas sheet is found in three-thicknesses such as CC5, CC8 & CC13, which can be five, eight & thirteen mm in thickness respectively.

HISTORY

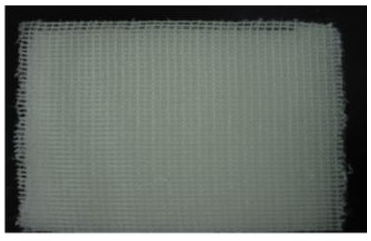
It's a recent innovation in the concrete sector. Even many of the people had not heard about this product and it's also not so famous in the general market because of its short time in the construction field.

Figure 2:- CC as sandbag protection in defenses [Akhtar & Tyagi, 2015].

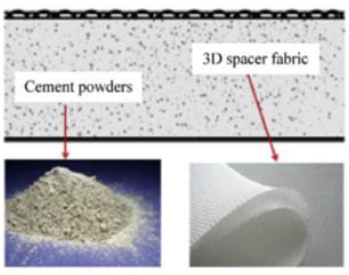
But rapidly it's gaining market and will be one of the major products in the coming time because of its performance. British engineering company named Concrete Canvas was the one who introduces us with the Concrete canvas. The first appearance of Concrete canvas was found in frontline defenses in Afghanistan. The purpose was to improve the strength of sandbag protection in defenses. In January 2008, a small quantity was used on the frontline in Afghanistan to validate its performance in the field. As a result of these trials, the UK Ministry of Defense has just awarded Concrete Canvas a contract to supply 5500 m2 (6600 yd2) to the frontline [Akhtar & Tyagi, 2015].

METHODOLOGY

As indicated in Fig 3, CC is composed of a 3D spacer fabric and cement powder filled in-between.



(a) 3D spacer fabric product



(b) internal structure

(c) final product

Figure 3:- A typical 3D spacer fabric and compositions of concrete canvas [Zhang, et. al., 2016]

The mechanical properties of CC closely depend on the raw materials as well as fabrication process.

LITERATURE REVIEW

Hrishikesh R. Kane, DeveshWarhade, P.S. Randive (2015), since a very long time, Construction has followed conventional methods. And there are no provisions for very rapid and emergency workable concrete installation methods. A private company and its R&D department has taken the initiative to introduce a ground breaking product called as Concrete Cloth. The original idea was to create a rapidly deployable emergency shelter, so as to enter a design competition run by British Cement Association. The product used for making the same has found its varied application in civil engineering works. The designer had no idea that their entry for a rapidly deployable emergency shelter would result in the launch of their own technology development company involving research trips to disaster zones around the world, and the concept has matured into a technology that has applications far beyond emergency shelter. Following development, funded through a combination of private equity investment and grants, and the company is setting up the volume production facility for concrete canvas shelters (CCS) and concrete cloth.

VaseemAkhtar, AmitTyagi (2015) The Cost as well as the time taken by the construction work has always attracted attention of Civil Engineers to be supplemented by some economical and rapid settling construction material. This paper focuses the advantages of using Concrete canvas or Concrete cloth for Rapid and fast construction of structures like canals shelter house and many other which

are made for temporary purpose. This material has a wide range of applications throughout the building and civil engineering industry. In the paper the engineering properties of the material (concrete canvas) is also discussed. This material being ceramic, fire resistant and water proof in nature.

G Anjaneyulu (2017) Concrete cloth or concrete canvas is the most up-to-date fabric material in construction along worldwide. CC is the flexible material due to this advantage, the use of cc is rapidly extended. The speed of work and price to attract the all civil engineers as supplemented by using production cloth in constructions. This cloth is used for transient motive like canal lining and to prevent the soil erosion in hilly regions and so forth. Life span of cc is 15 to 20 years. In this paper to take a look at the applications and engineering properties of concrete cloth. CC is a ceramic nature has fire resistant and water proof.

V. Vedha Narayanan (2015) Worldwide there is increasing demand for construction and construction materials, for that concrete are the most extensively used material in construction. These days concrete is being used for so many purposes in many different adverse conditions. There are many advantages of concrete, but there is one drawback is that, it is not flexible, when it is hardened. To overcome on this drawback of concrete a new construction material is in evolution called concrete cloth.

ADVANTAGES

Rapid:The material can be hydrated either by being sprayed or by being fully immersed in water. Once the Concrete canvas gets hydrated, it remains workable for two and half hours and hardens to 80% strength within 24 hours. This time can be reduced by adding accelerants into the dry mix at the time of manufacture.

Easy to use: Concrete canvas is available in rolls which can easily handle by man in their applications with limited access or where heavy plant equipment is not available, there is no need for mixing or measuring.Dry concrete cloth can be cut or tailored busing simple hand tools such as Stanley knives. The PVC side can be supplied with an adhesive backing and the fibrous side bonds well to concrete or brick surfaces when set. It can be easily prepared or upgraded using existing cement products.

Flexible: As the key property of concrete canvas that it is flexible, it can easily molded in any difficult shape provided before hydration.

Waterproof: As the PVC backing is provided at the bottom layer which brings it waterproof material.

Hydration: The 54m2 shelter is then sprayed with water (with smaller variants, hydration takes place by filling the sack with water. The volume of the sack controls the water: cement ratio). Hydration is aided by the fiber matrix, which wicks water into the cement.

LIMITATIONS

- The over hydration of concrete canvas should be avoid and an excess of water is always recommended.
- Avoid the jet high pressure water directly onto the Concrete cloth as this may wash a channel in the material.
- The Working time of Concrete cloth has is about 1-2 hours after hydration. So do not move CC once it has begun to set.
- In hot climates the Working time will be reduced.
- If Concrete cloth wasn't the fully saturated, the final sheet of Concrete canvas may be delayed and strength reduced.

APPLICATIONS

Concrete Canvas Shelters:

Concrete Canvas Shelter is one of the major uses of concrete cloth. They are rapidly deployable and require only water and air for construction. Concrete Canvas Shelters (CCS) are more operational and financial then conventional tented shelter. They provide a hardened structure from the very first day of operation.

Figure 4:- Concrete Canvas Shelters [8]

They provide much better environmental protection, security and very improved medical capability. They have a design life of over 10 years, whereas tents get worn out very rapidly and have to be removed at a very short time period. Concrete Canvas Shelters Save effort and cost. The key to Concrete Canvas Shelter is the use of inflation to create a surface that is optimized for compressive loading. This allows thin

walled concrete structures to be formed which are both robust and lightweight.

Ditch lining: Concrete canvas can be quickly unrolled to use in ditch or canal lining.

Figure 5:- Ditch lining [9]

It is considerably faster and cheap to install than conventional concrete ditch lining and without any need of special labors, techniques and equipment's.

Pipeline Protection: Concrete cloth can be used as a coating for overland or underwater pipeline protection, providing a superior tough rock shield. In remote areas it can be used to coat steel pipe on site without expensive wet concrete application plants.it will set underwater and provide negative-buoyancy.

Figure 6:- Pipeline Protection[9]

CONCLUSIONS

- Concrete cloth is the latest and extremely useful innovation in field of concrete, which can change the perspectives about construction materials and methods.
- Installation and application of the CC has drastically reduced the manpower and mechanical power consumption. It is one of the most economical and advanced techniques in construction.
- From point of effective cost Concrete Canvas sheet is a competitive alternate product of concrete.
- The study shows that it's a good material for use at temporary as well as permanent purposes Especially in Tunnel Lining, Defense uses, Water proofing, Fencings, and Construction of military runways.
- Furnished outlook, high durability and low maintenance makes it's a reliable product.
- Maximizing the use can optimize the economy, and save time. Overall, this innovative project can change the ways of construction.

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