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Study of Canvas Concrete in Civil Engineering Works

(1)Vaseem Akhtar,(2) Amit Tyagi

[1]M.Tech Student ,CE Engg. Department, RIT Roorkee,Uttrakhand, India
[2]M.Tech Student ,CE Engg. Department, RIT Roorkee,Uttrakhand, India

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Abstract— 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.

Key Words: **Concrete Canvas, Cement, Concrete Canvas Shelter, PVC, Ceramic, etcetera**

I. INTRODUCTION

Concrete Cloth is a unique proprietary material because of which its fire and water proof. Concrete Cloth (CC) is a flexible cement impregnated fabric that hardens on hydration to form a thin, durable Water proof and fire proof concrete layer. CC has a number of applications in the c ivil and construction sectors. Other applications for CC include Roofing, Asbestos Containment, Water Tanks, Flood Defenses, Shot Crete Replacement, Tunnel Lining, Retaining Walls, culvert, weed inhabiting, basement lining, Erosion Control, Building Cladding, and Etcetera

CC consists of a 3- dimensional fibre matrix containing a specially formulated dry concrete mix. A PVC backing on one surface of the cloth ensure the material is completely waterproof. The material can be hydrated either by spraying or by fully immersed in water. The hydrophilic fibers on the opposite surface aid hydration by drawing water into the cement. Concrete cloth can be used to rapidly create waterproof, fireproof, fiber-reinforced thin concrete forms across a wide range of applications: rapid track way or landing surfaces, structural reinforcement, ground stabilization, ballistic protection and sterile concrete shelters. It is available in 3- thickness; CC5, CC8 and CC13which are 5, 8 and 13 mm thick respectively.

It comes in a small bag which is easy to carry and it can be easily laid anywhere we want. The main property which gains the most of the attention is that it can be made into home within 24 hours. With just basic three steps that is

- Transport/ delivery.
- Lying as required.
- Curing/ watering

And the structure is ready to use in a minimum time . It is requires minimum labor as well as minimum construction cost and provide the high performance and durability.

1.1. 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. But rapidly it's gaining market and will be one of the major products in the coming time because of its performance.

The British Army just placed a sizeable order for an innovative new material that combines the flexibility of fabric with the structural performance of concrete. Unlike anything else on the market, this revolutionary technology enables the use of concrete in a completely new way. The product, called Concrete Cloth, was developed by a British engineering company called Concrete Canvas. It will soon be used to enhance frontline defenses in Afghanistan.

The story behind its inception is somewhat unusual. Four years ago, we entered a competition run by the British Cement Association. At the time, we had no idea that our entry for a rapidly deployable emergency shelter would result in the launch of our own technology development company. Our research has now included trips to disaster zones around the world, including Uganda and New Orleans.


Figure 2: CC used to sandbag protection in defenses

Four years later, 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, the company relocated to a dedicated production site in South Wales, UK, where we have begun volume production of Concrete Cloth and Concrete Canvas Shelters.

The British Army quickly saw potential uses for this new material and started trials using Concrete Cloth as a method of reinforcing sandbag defenses. This solution, shown in Fig 2, reduces degradation of sandbag walls in harsh environments such as Afghanistan, where the combination of wind, sand, and extreme temperatures mean frequent repairs to frontline defenses. In addition, damage is caused by incoming fire and outgoing muzzle flash. Concrete Cloth is completely fireproof and has performed very well during range trials where it was tested with small-and transported medium-caliber weapons. The material comes in 10 m (33 ft) rolls to eliminate the need for heavy lifting equipment and plant machinery. This is a big advantage when operating in remote areas where most supplies have to be by helicopter. The material is then simply unrolled over the sandbag wall, secured using battens, and sprayed with water. A durable and hard wearing surface is produced within 24 hours. Key to the success of the material is the fibers that form a reinforcing matrix within the Concrete Cloth. These provide a stable failure mode, absorb energy, and help maintain the structural integrity of the concrete when impacted. A ballistic projectile will pass through the cloth, but crack propagation is limited. The sand in the sandbag is therefore retained within the concrete shell. In contrast, standard sandbag cloth will typically tear, and the fill is lost very quickly.

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.

1.2. Storage:

A CC should be stored in dry conditions away from direct sunlight. CC is supplied in rolls packaged in PE sacks. Once the sack has been opened, the cloth must be kept dry and will gradually lose flexibility and performance if exposed to the air for a number of weeks. The rate of degradation is dependent upon humidity levels.

1.3. Cutting:

snap off' type disposable blade is the most suitable tool for cutting CC before it is hydrated or set. When cutting dry CC, a 20mm allowance should be left from the cut edge due to lost fill. This can be avoided by wetting the CC prior to cutting.CC can also be cut using handheld self sharpening powered disc cutters..

1.4. Method of Hydration:

It can be hydrated using saline or non-saline water. The minimum ratio of water to concrete cloth by weight should be 1:2. Concrete cloth cannot be over hydrated so an excess of water is recommended. Concrete cloth should be immersed in water at least 90 seconds.

I.5. MAJOR USES

In Civil Engineering it's mainly used in works like:

1) Construction of temporary structures at relief camps or in temporary shelter house.

2) Lining of canals where water is to be flowed for the fields for uses of construction works.

3) In making the fencings of the house it's used over the barbed wire to provide the additional strength and security.

4) It is use to prevent the soil erosion at slope in hilly areas.

5) It's also used as water proofing agent over the warehouse's roof as well as over the houses in rainy conditions.

In Military works it's used in many operations:

1) It's used to provide a strong layer over the sand bunkers to provide additional strength.

2) In construction of runways and helipads for the fighter planes as well as helicopters.

3) In construction of military camps over the war front.

4) It can be used to repair damaged and unstable gabion walls to provide long-term protection.
5) It's also used in making the flooring for various other purposes.

2. APPLICATIONS

Canvas concrete have many applications in various filed, some of them is given below
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2.1. 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. 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. Concrete Canvas Shelter consist of a revolutionary cement based composite fabric (Concrete Cloth) bonded to the outer surface of a plastic inner which forms a Nissen-Hut shaped structure once inflated

.2.2. Slope Protection:

Slope weather protection is important to control soil erosion down slope as a result of direct rainfall and surface runoff. Protection can be a permanent
Slope covering or a temporary measure until the excavation has been backfilled. Uncovered slopes undergo surface raveling and gull eying, leading to instabilities and safety concerns. Soil erosion is normally prevented by applying a thin concrete skin. However, this is difficult to apply uniformly and often breaks apart. Plastic sheeting covers are disturbed by strong winds, water flows or site damage and meshes do not provide the same level of direct weather protection.
Concrete Cloth (CC) provides a quick means to directly apply a thin, uniform, protective concrete covering to the slope surface and can be applied in all weather conditions. CC is fixed by short nails and provides a strong, waterproof, surface stabilizing covering enhanced by internal reinforcing Fibers. CC can used in conjunction with full length soil nails to increase the stability of slope surfaces by providing similar slope protection measures. CC can also be used to cover landslide scars or cut slopes. Holes can be cut to allow vegetation growth.

2.3. KEY FACTORS

1) Easy To Use: CC is available in man portable rolls for applications with limited access or where heavy plant equipment is not available. There is no need for mixing or measuring, the concrete is premixed and cannot be over hydrated. It will set underwater and in sea water.
2) Rapid: Once hydrated, CC remains workable for 2 hours and hardens to 80% strength within 24 hours.
Accelerated or retarded formulations can be produced to meet specific customer requirements.
3) Flexible: CC has good drape characteristics allowing it to take up the shape of complex surfaces including those with a double curvature.
The unset Cloth can be cut or tailored using basic hand tools
4) Strong: The fiber reinforcement prevents cracking, absorbs energy from impacts and provides a stable failure mode.
5) Durable: CC is chemically resistant, has good weathering performance and will not degrade in UV. They have a design life of more than 10 years in shelters. Each shelter is lined with a flame retardant fiber reinforced polyethylene inner with a B1(DIN 4102-01 05/98)fire rating.
6) Water proof: The PVC backing on one surface ensures that the material is completely water proof and chemical resistant.
7) Fire resistant: It's a ceramic and will not burn.
8) Adaptable: CC is currently supplied on 1.1m wide rolls. There are 3 variants available as standard: CC4, CC8 and CC13, which are 5, 8 and 13mm thick respectively. CC can be manufactured up to 20mm thick.
9) Workable: It can be made into shelter by only 2 people in less than 1 hour and can be made ready for use in just 24 hours. It's a semi-permanent structure without the associated cost and time delays.

3. CONCLUSIONS

The study shows that it's a good material for use at temporary as well as permanent purposes Specially in Tunnel Lining, Defense uses, Water proofing, Fencings, and Construction of military runways, and from cost effective point of view Concrete Canvas/cloth is a competitive alternate product of concrete. Its being ceramic is of great help as because of it its highly fire resistant and because of the three layers present its water proof.

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