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# High Performance Fibers Applications In Geo Textiles

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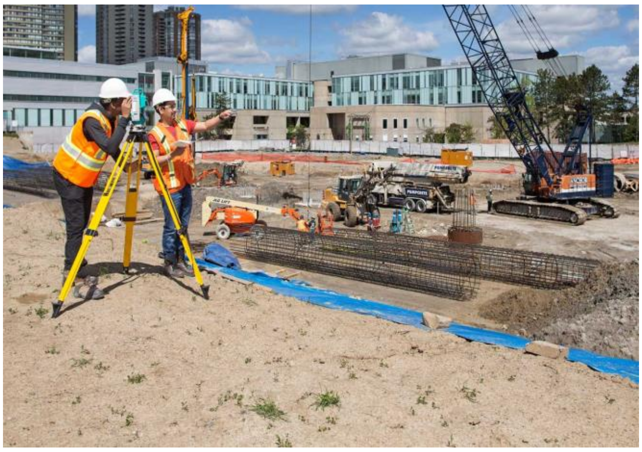
**Abstract:**
This article presents an overview of fiber applications in cementations composites. The socio-economic considerations surrounding materials development in civil engineering in general, and fiber reinforced cementations materials in particular, are described. Current FRC applications are summarized, and the where, how, and why fibers are used in these applications, are documented. An attempt is made to extract common denominators among the widely varied applications. The R&D and industrial trends of applying fibers in enhancing structural performance are depicted. An actual case study involving a tunnel lining constructed in Japan is given to illustrate how a newly proposed structural design guideline takes into account the load carrying contribution of fibers.Composite properties related to structural performance are described for a number of FRCs targeted for use in load carrying structural members. Structural applications of FRCs are currently under rapid development. In coming years, it is envisioned that the ultra-high performance FRC, with ductility matching that of metals, will be commercially exploited in various applications. Highlights of such a material are presented in this article.

**Keywords:** High Performance Fibers, Composite Fibres, Civil Engineering, Properties, Applications, Structural Engineering

## I. Introduction

Civil engineering is a broad field of engineering that deals with the planning, construction, and maintenance of fixed structures, or public works, as they are related to earth, water, or civilization and their processes. Most civil engineering today deals with power plants, bridges, roads, railways, structures, water supply, irrigation, sewer, flood control, transportation, tele communications and traffic. Civil engineering is the broadest of the engineering fields, partly because it is the oldest of all engineering fields. In fact, engineering was once divided into only two fields - military and civil. Civil engineering is still an umbrella term, comprised of many related specialties.



General civil engineering is concerned with the overall interface of human created fixed projects with the greater world. General civil engineers work closely with surveyors and specialized civil engineers to fit and serve fixed projects within their given site, community and terrain by designing grading, drainage (flood control), pavement, water supply, sewer service, electric and communications supply and land (real property) divisions.

In the field of civil engineering, structural engineering is concerned with structural design and structural analysis of structural components of buildings and no building structures. This involves calculating the stresses and forces that affect or arise within a structure. Major design concerns are building structures resistant to wind and seismic forces and seismically retrofitting existing structures.

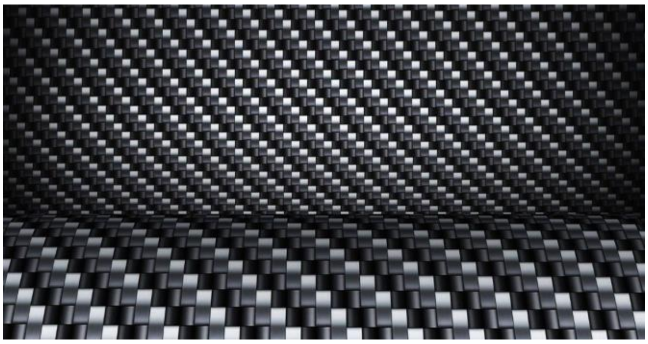
## II. High Performance of Fibres

High-performance fibers are those that are engineered for specific uses that require exceptional strength, stiffness, heat resistance, or chemical resistance. These fibers have generally higher tenacity and higher modulus than typical fibers. High performance fibers are used increasingly for a wide range of applications including geo textiles and geo membranes for construction and civil engineering. High Performance Fibers provides comprehensive coverage of the design and manufacture of high performance fibers and covers their capabilities and applications.

The fiber is an important constituent in composites. A great deal of research and development has been done with the fibers on the effects in the types, volume fraction, architecture, and orientations. The fiber generally occupies 30% - 70% of the matrix volume in the composites. The fibers can be chopped, woven, stitched, and/or braided. They are usually treated with sizing's such as starch, gelatin, oil or wax to improve the bond as well as binders to improve the handling. The most common types of fibers used in advanced composites for structural applications are the fiberglass, aramid, and carbon. The fiberglass is the least expensive and carbon being the most expensive. The cost of aramid fibers is about the same as the lower grades of the carbon fiber. "Other high-strength high-modulus fibers such as boron are at the present time considered to be economically prohibitive"

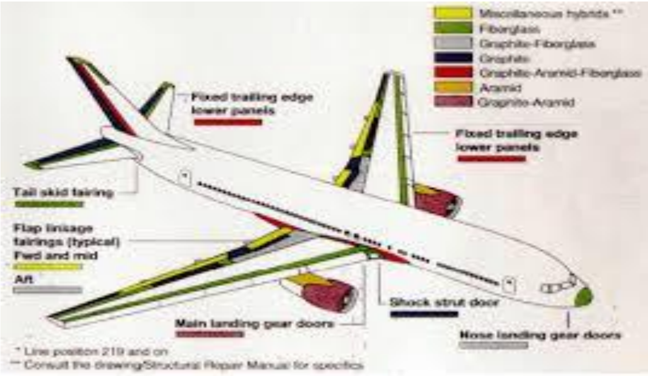
Types of High Performance Fibres :

- Carbon fiber / Graphite fiber
- Kevlar fiber
- Polymeric fibers such as aramid and extended-chain polyethylene
- Fiber glass
- Boron fiber.



**CARBON FIBRE**

**GLASS FIBRE**




**KEVLAR FIBRE USE**

## III.Composites in Civil Engineering

Today high performance fibre reinforced plastics (FRP) are starting to challenge that most ubiquitous material, steel, in everyday applications as diverse as automobile bodies and civil infrastructure .Composite materials are formed by the combination of two or more materials that retain their respective characteristics when combined together to achieve properties (physical, chemical, etc.) that are superior to those of individual constituents. The main components of composites are reinforcing agents and matrix. Fibre reinforced composites can be further divided into those containing discontinuous or continuous fibres. Another commonly practiced classification is by the matrix used: polymer, metallic and ceramic.

Glass fibre is by far the most widely used fibre reinforcement and hence the terms "GRP" (glass reinforced plastic), "Fibreglass" and "FRP" (fibre reinforced plastic) are often used to describe articles fabricated from composites particularly for application in civil engineering. Composites are able to meet diverse design requirements with significant weight savings as well as high strength-to-weight ratio as compared to conventional materials.

Composite for Structural Applications :

Composites have long been used in the construction industry. Applications range from non-structural gratings and claddings to full structural systems for industrial supports, buildings, long span roof structures, tanks, bridge components and complete bridge systems. Their benefits of corrosion resistance and low weight have proven attractive in many low stress applications. An extension to the use of high performance FRP in primary structural applications, however, has been slower to gain acceptance although there is much development activity. Composites present immense opportunities to play increasing role as an alternate material to replace timber, steel, aluminium and concrete in buildings.

## IV.Conclusion

The building and construction industry have very sensitivity to material cost. Introduction of fibers into concrete must therefore bring out significant improvements in structural performance. Synthetic material optimization using minimal amount of expensive material for maximum structures enhancement, rather than empirical trial and error approach, should provide the most direct path to satisfying the required benefit/cost ratio in this industry.

High performance geotextiles is mainly to add additives and modify geotextiles to make up for the performance defects of geotextiles. The geotextiles with excellent properties can be made from high performance fibers, such as glass fibres or basalt fibres, it is possible to design geotextiles with unique and excellent properties by applying nanofibers to geotextiles.

Geosynthetics have superior properties, owing to the synthetic fibres they are made of, and a wider range of applications. Their performance can be further improved using additives during polymer processing. It gives better strength and long life properties.

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