SAERTEX®

COMPOSITE APPLICATIONS IN INFRASTRUCTURE

POSSIBILITIES OF FIBER REINFORCED POLYMERS
FOCUSED ON THE US-MARKET



CONTENTS

INTRODUCTION

WHAT IS A FIBER REINFORCED POLYMER

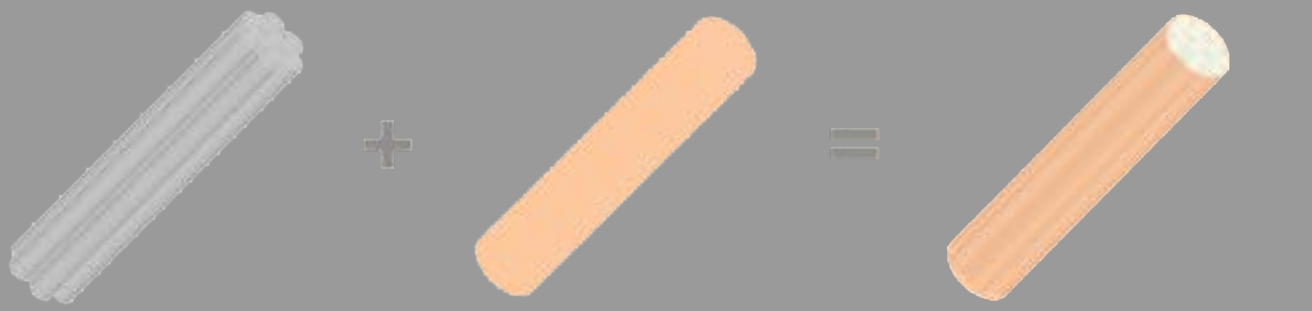
FRP, short for Fiber Reinforced Polymer, represents a class of composite materials that combine two or more distinct elements to yield properties surpassing those of the individual materials.

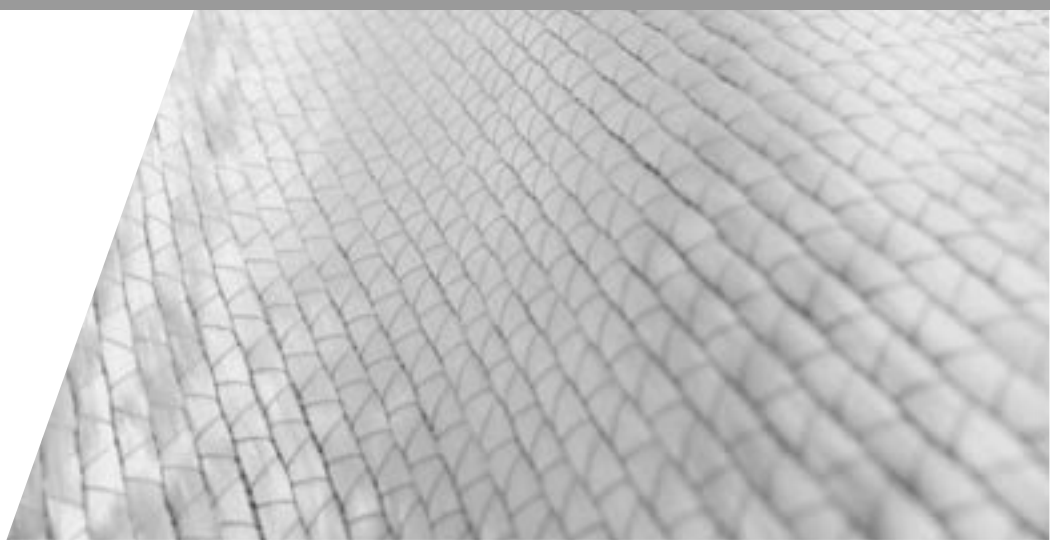
These composites often incorporate continuous or discontinuous strands crafted from organic, inorganic, or synthetic materials. While glass fibers and carbon fibers have traditionally dominated FRP formulations, there is a growing demand for sustainable fibers, aligning with the increased emphasis on reducing carbon footprints.

The versatile applications of composite materials extend across various industries, including aerospace, wind energy, automotive, public transportation, and construction.

Within the construction sector, infrastructure plays a pivotal role, encompassing the planning, development, and construction of vital components such as roadways, bridges, harbors, water/sewer systems, electricity distribution systems, and public transportation.

The significance of infrastructure was underscored in November 2021 with the passing of the Infrastructure Investment and Jobs Act by US lawmakers. This comprehensive legislation aims to channel funds into modernizing, repairing, and fortifying systems crucial for an efficient and sustainable future, presenting a significant growth opportunity for FRP materials.





MAIN MARKETS IN CONSTRUCTION

One specific area where FRP materials are poised for substantial growth is in addressing the challenges posed by the state of the nation's bridges. The American Road and Transportation Builders Association (ARTBA) reported in 2021 that out of the 220,000 bridges in the United States requiring major repair, a staggering 80,000 were in need of full replacement.

Additionally, the Composites in Oil and Gas Industry Market Report by MarketsandMarkets revealed that composites utilized in the oil and gas sector reached USD 1.98 Billion by 2021, with a compound annual growth rate (CAGR) of 5.05%. This further underscores the widespread adoption and economic significance of FRP materials in diverse industries.

Endless possibilities for infrastructure applications

Civil Works

- Singular Civil Works
  - Beacon Towers
  - Dolphins - Caisson for maritime structures
  - Lighthouses
  - Bridges and Pedestrian Bridges
  - Domes
- Repetitive Infrastructures
  - Transportation -> Railway, Road
  - Utilities -> Water (Pipes and Tanks), Oil & Gas, Energy, Telecoms
  - Civil Protection -> Floodgates, Noise, Explosion, Safety Barriers
  - Public, Art and Entertainment -> Stadiums, Concert Halls

Repair, Retrofitting and Reinforcements

- Structural repair and reinforcements
  - Fabrics
  - Rebars
  - Bands
  - CIPP
- Floor and road reinforcements
  - Geo-grids (glass and carbon)
  - Geo-grids (other)
  - Concrete Fillers
- Sealing reinforcements
  - Tanks for liquids
- Facade reinforcements and rehabilitation
- Retrofitting of structures
  - Helicopter bays on roofs
  - Enlargement of highway lanes on a bridge

80,000 US bridges urgently need to be replaced

MATERIALS OF CHOICE FOR INFRASTRUCTURE APPLICATIONS

STEEL

- High compressive strength and good tensile strength
- Fire resistant
- Locally sourced
- High durability
- Cost-effective
- Easy to mold into complex shapes
- Low maintenance
- Water resistant
- User-friendly

CONCRETE

- Cost-effective
- High strength/weight ratio
- Easy to make, fast to install
- High ductility
- Reusable & repairable
- Isotropic properties, predictable material properties
- Good fatigue strength

TIMBER

- Environmental-friendly
- High strength/weight ratio
- Electrical and heat resistant
- Sound absorbent
- Locally sourced
- Short construction times
- Known for centuries

COMPOSITE MATERIALS

- Corrosion resistant
- Durable
- Custom-tailored to add strength in critical areas
- Less maintenance
- Increased lifespan
- Easy and quick installation

BENEFITS OF COMPOSITE MATERIALS

DURABLE AND RESISTANT

FRP materials are naturally **corrosion free** because the polymer matrix system is non-reactive in water, even in saltwater environments. The polymer also protects the fibers from acid rain, acid soil, and harsh fumes. This corrosion-resistant nature translates into virtually **zero maintenance costs**, with the exception of periodic inspections. While FRP solutions in infrastructure markets may entail higher initial costs compared to traditional materials, the long-term savings in maintenance expenses outweigh the upfront investment. When evaluating both upfront costs and subsequent maintenance, the FRP solution proves to be significantly more cost-effective.

STRONG AND LIGHTWEIGHT

One notable advantage of composite materials lies in their **superior strength-to-weight ratio** when contrasted with conventional materials like steel or concrete. The use of lightweight FRP materials in various applications can lead to reduced installation costs by minimizing labor requirements, cutting transportation expenses, and enabling the utilization of equipment with lower lifting capacities.

CUSTOMIZED AND FLEXIBLE

The strategic incorporation of FRP materials in infrastructure design empowers architects and engineers to tailor solutions to specific loads without unnecessary weight or material costs. In contrast to steel, which possesses uniform tensile strength in all directions, FRP materials can be precisely reinforced only where needed. Non-crimp fabrics emerge as the preferred choice for FRP materials, offering optimal **stiffness and design flexibility** when compared to alternative options. Additionally, these non-crimp reinforcement materials can be manufactured in widths ranging from 2” up to 150”.

FRP solutions: Cost-efficient, maintenance-free and customized strength for infrastructure

3 END APPLICATIONS

LIGHT POLE CROSSARM

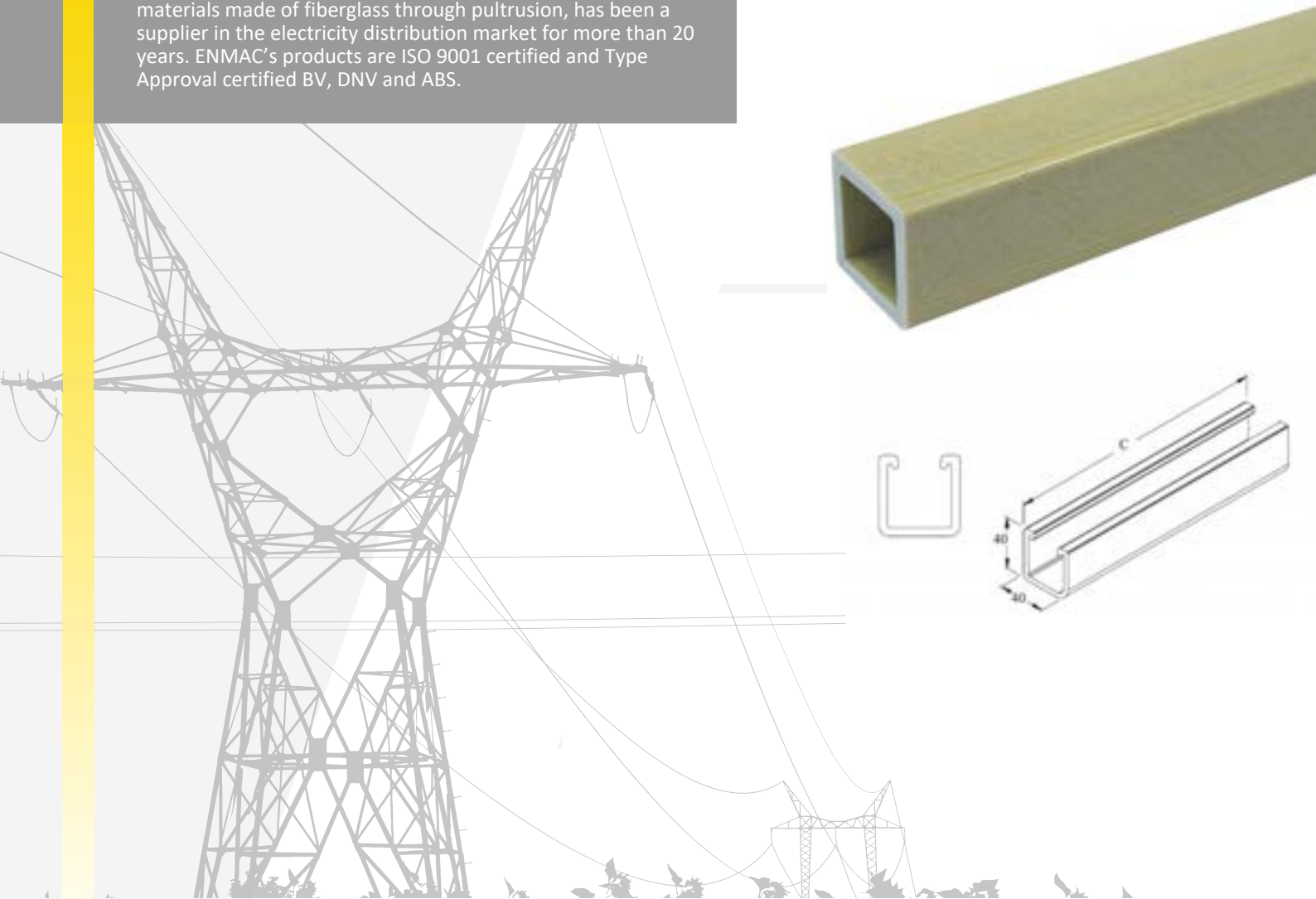
A notable stride in composite solutions within the electricity distribution sector is the introduction of composite crossarms. Positioned at the pinnacle of utility poles where cables are secured, these crossarms undergo a pultrusion process using fiberglass non-crimp fabrics. Their composition, primarily fiberglass, imparts remarkable advantages over traditional materials such as wood or steel.

The lightweight nature of composite crossarms facilitates easy installation, a stark contrast to their metal counterparts. Beyond the convenience of installation, their corrosion-resistant properties contribute to reduced maintenance requirements, thereby extending the service life of utility poles. This longevity stands out in comparison to conventional materials like wood or steel.

Moreover, the non-conductive properties of Fiber Reinforced Polymer (FRP) materials add an extra layer of safety for utility crews, mitigating electrical hazards. The inherent design flexibility of FRP materials allows for the seamless incorporation of various enhancements, including UV-resistant coatings, UV-resistant nonwovens, fiberglass reinforcement, specialized matrices, and closed-cell foams. This adaptability ensures that the material can be fine-tuned to meet all design requirements for light pole crossarm applications, providing a versatile and robust solution in the electricity distribution market.

// REFERENCE

Our customer ENMAC, a Brazilian manufacturer of composite materials made of fiberglass through pultrusion, has been a supplier in the electricity distribution market for more than 20 years. ENMAC's products are ISO 9001 certified and Type Approval certified BV, DNV and ABS.



SHEET PILE REPAIR

Another pioneering approach is the introduction of carbon fiber laminates, which are applied directly to corroded or damaged steel and concrete components. This revolutionary technique not only showcases the versatility of FRP materials but also underscores the strategic use of non-crimp fabrics in their applications.

The inherent design flexibility of non-crimp fabrics enables on-site repair. Through the adept use of coatings, resins, and procedures, the power of non-crimp fabrics is used to swiftly and effectively repair a range of structural components, including piles, walls, columns, and overhead supports. The application of non-crimp fabrics in FRP materials allows for seamless integration, enhancing the ease of manufacturing or repairing in place.

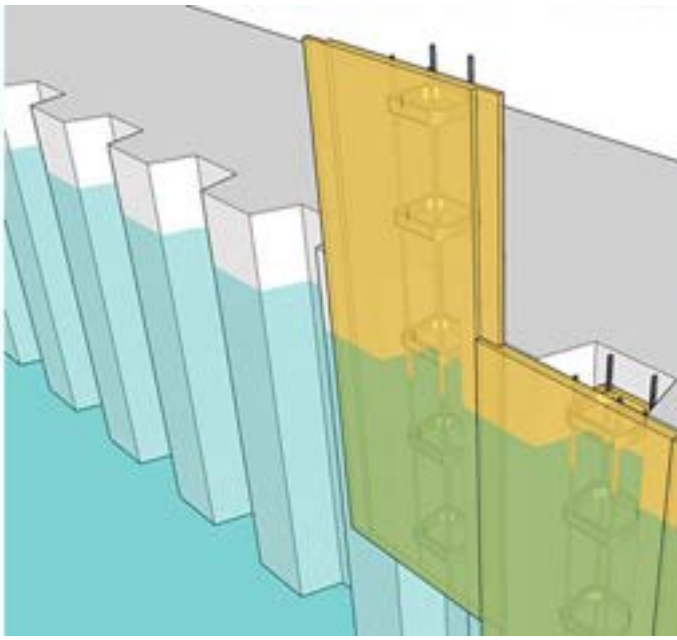
An innovative example of this is the SPiRe (Sheet Pile Repair) system for sea walls. This groundbreaking solution utilizes a resin infusion process to create a composite material with a foam core and fiberglass-reinforced skin layers. The strategic incorporation of non-crimp fabrics ensures optimal design flexibility, making the SPiRe system an efficient and corrosion-resistant retrofitting solution.

These solutions are a testament to the versatility of non-crimp fabrics, transcending geographical boundaries. The SPiRe system exemplifies this adaptability as it is shipped to installation locations, presenting a lightweight alternative to steel. This lightweight attribute ensures a seamless installation process onto existing seawall structures without compromising structural integrity.

In essence, the use of non-crimp fabrics in FRP materials defines the forefront of innovation in infrastructure repair and retrofit. Their strategic approach not only extends the lifespan of structures but also sets a benchmark for sustainable and efficient solutions in the field.

// REFERENCE

Our customer QuakeWrap Inc., established in 1994, stands as the pioneering force in the development and innovation of Fiber Reinforced Polymer (FRP) products tailored for infrastructure repair. With a rich history in the field, QuakeWrap offers a diverse array of composite solutions designed for the infrastructure repair and retrofit market.



COMPOSITE PIPE MANUFACTURING

In the realm of infrastructure, pipe manufacturing experiences a transformative wave. At the heart of the breakthrough lies the design-specific application of non-crimp fabrics combined with epoxy resin in their pipe manufacturing process. The inherent design flexibility of non-crimp fabrics serves as a cornerstone, allowing them to tailor specific aspects to optimize their FRP pipe manufacturing. The strategic use of non-crimp fabrics ensures a seamless integration into their continuous process, setting the stage for groundbreaking advancements in pipe technology.

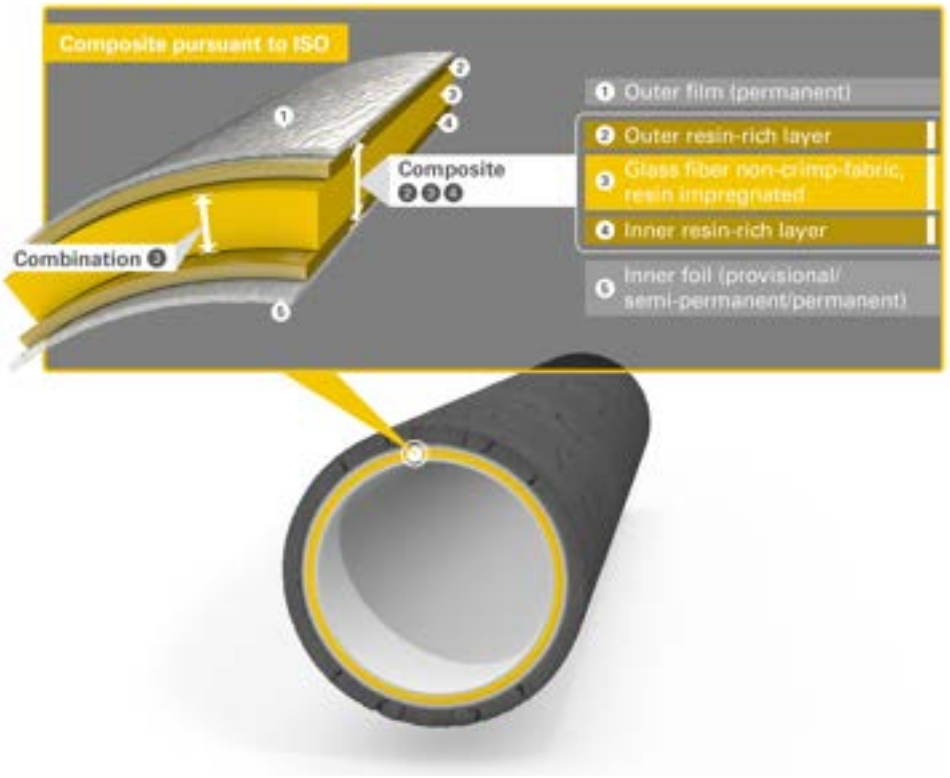
The application of composite materials in the Oil and Gas industry unfolds numerous advantages. Notably, epoxy FRP materials prove to be a game-changer, as they defy the common issue of material degradation over time when exposed to hydrocarbons. The non-reactive nature of the epoxy matrix to most chemicals extends the service life of these pipes, eliminating the need to overbuild with the expectation of performance deterioration. This resilience enhances the reliability of infrastructure, especially in critical sectors like Oil and Gas.

One standout feature of composite pipes is their significantly reduced weight when compared to high-density polyethylene pipes with similar pressure ratings. This weight reduction translates into enhanced efficiency in transportation to the site, reducing logistical complexities. Additionally, the installation process becomes more streamlined, requiring less equipment or smaller machinery.

In essence, the innovative use of non-crimp fabrics and composite materials in pipe manufacturing is heralding a new era in infrastructure development. The strategic approach not only extends the service life of pipes but also revolutionizes transportation efficiency and installation processes, positioning them as leaders in the evolution of pipe technology within the broader landscape of infrastructure innovation.

// REFERENCE

Our customer Big Tuna Pipe is a pioneer in continuous pipe manufacturing, leveraging the benefits of composite materials by placing an emphasis on crimp-free fabrics in their unique manufacturing process.



SAERTEX NCFS FOR INFRASTRUCTURE

In the vast and diverse landscape of the infrastructure market, the adoption of FRP materials stands out as a testament to the best technology available. While recognizing that FRP materials cannot entirely replace every traditional material in the industry, their unparalleled properties make them a compelling choice. Given that public funds often drive infrastructure projects, cost becomes a pivotal factor in the design phase.

Understanding the structure's end-use environment and evaluating the whole life cycle cost present a compelling case for the incorporation of FRP materials in infrastructure applications. The intrinsic value added by FRP materials cannot be overstated, particularly with the corrosion-free, maintenance-free, and lightweight properties that only FRP materials can deliver. In this realm, the choice of non-crimp fabrics as a reinforcement option becomes paramount, offering high design flexibility and optimization essential for various manufacturing methods and applications.

One standout technology within this landscape is the Non-Crimp Fabric (NCF) technology, a game-changer that allows product widths of up to an expansive 150". This technology opens the door to grid structures for road stabilization and multiaxial fabrics for high-strength applications. Notably, NCFs offer the added advantage of incorporating functional layers like backer veils, chop strand mats, fiber print blocker fleeces, enhancing their adaptability and versatility.

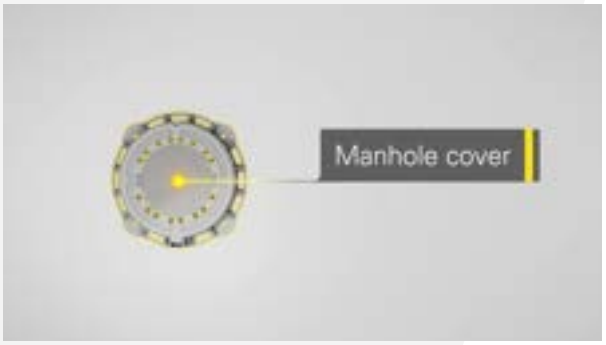
Watch the production of our 150" fabrics!

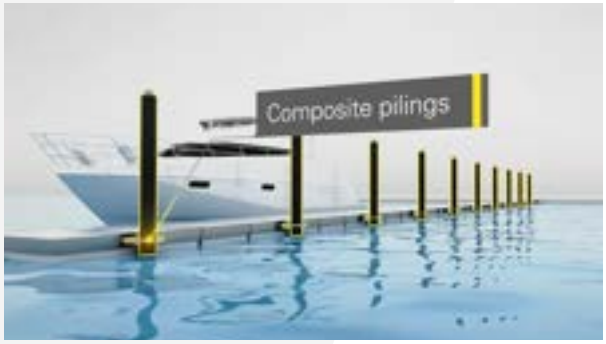
The growing demand for composites in the construction and infrastructure industry underscores the need for experienced experts who can provide design and processing support.

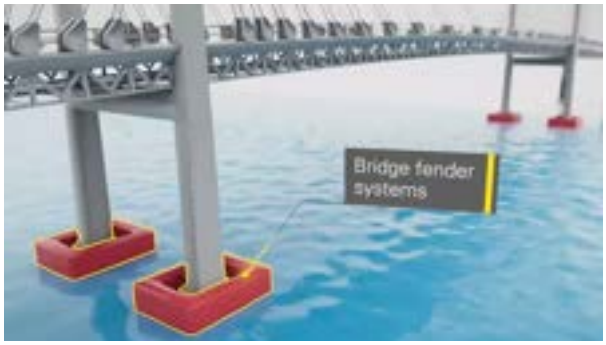
As a positive force in the infrastructure landscape, SAERTEX is poised for further growth, solidifying its position as a key player. The capabilities and competitiveness of composites have been firmly established, showcasing their potential to provide unique solutions for contemporary construction and infrastructure challenges. It is high time that architects and designers in the construction community recognize the transformative potential of composites, positioning them to become a mainstream product that reshapes the future of infrastructure technology.

The infrastructure market is as large as it is varied. It is understood that FRP materials cannot replace every traditional material in the infrastructure industry. Since the industry is often funded, in part, by public funds, cost is a large driver in the design phase. By understanding the structure's end-use environment and evaluating the whole life cycle cost, a strong case can be made for FRP materials in infrastructure applications. Value added by using FRP materials cannot be overlooked in these applications, as most cost saving are realized by the corrosion-free, maintenance-free, and lightweight properties that only FRP materials can provide. Non-crimp fabrics can be one choice of reinforcement for these applications because of the high design flexibility and optimization required by different manufacturing methods and applications.

INFRASTRUCTURE PROJECTS AT SAERTEX







// MULTIAXIALS MADE IN AMERICA

Our Non-crimp fabrics can be your choice of reinforcement for infrastructure applications. Our experienced experts will provide you with individual support for your engineering work - from the idea to the finished innovation. Let's reinforce your ideas together!

YOU WANT TO KNOW MORE?
GET IN CONTACT WITH OUR EXPERTS!

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