FIBERGLASS REINFORCEMENT

MAKING CONSTRUCTION EASIER

A Non Corrosive Alternative in Concrete Reinforcement

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Composites' Development

1940s – First structural applications of modern composites in naval and aerospace industries

1950s – Introduction of composites in automotive and oil industries

1960s – Development of advanced composites (defence industries) and first applications in construction industry

1970-1990s:

Technological development of manufacturing processes
Requirement of increasing construction speed
Demand for electrically nonconductive material (MRI medical equipment)

Up to mid-1990s the Japanese had the most FRP reinforcement applications

In the 2000s China became the largest user of composites with their applications from bridge decks to underground works

Current leaders in composite use – USA and Canada

Worldwide applications

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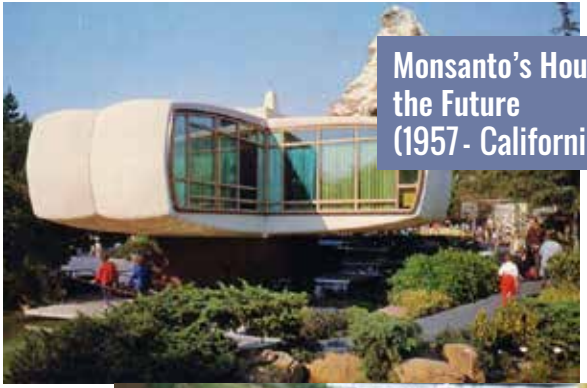
Samples of world applications:

- Potter County Bridge and Bettendorf Bridge (USA)
- National Institute of Health (Betesda, USA)
- Manitoba Bridge, Saint-Francois Bridge (Canada)
- Hospital in Isedzaki City (Guama Prefecture, Japan)
- Underground subway in Fuxing and railway stations in Yishan, Shanghai (China)
- Railway tunnel under the Thames river (London, England)
- Runway strip at Zurich airport (Switzerland)



Monsanto's House of the Future (1957 - California, USA)

Highway 401, Toronto, Canada

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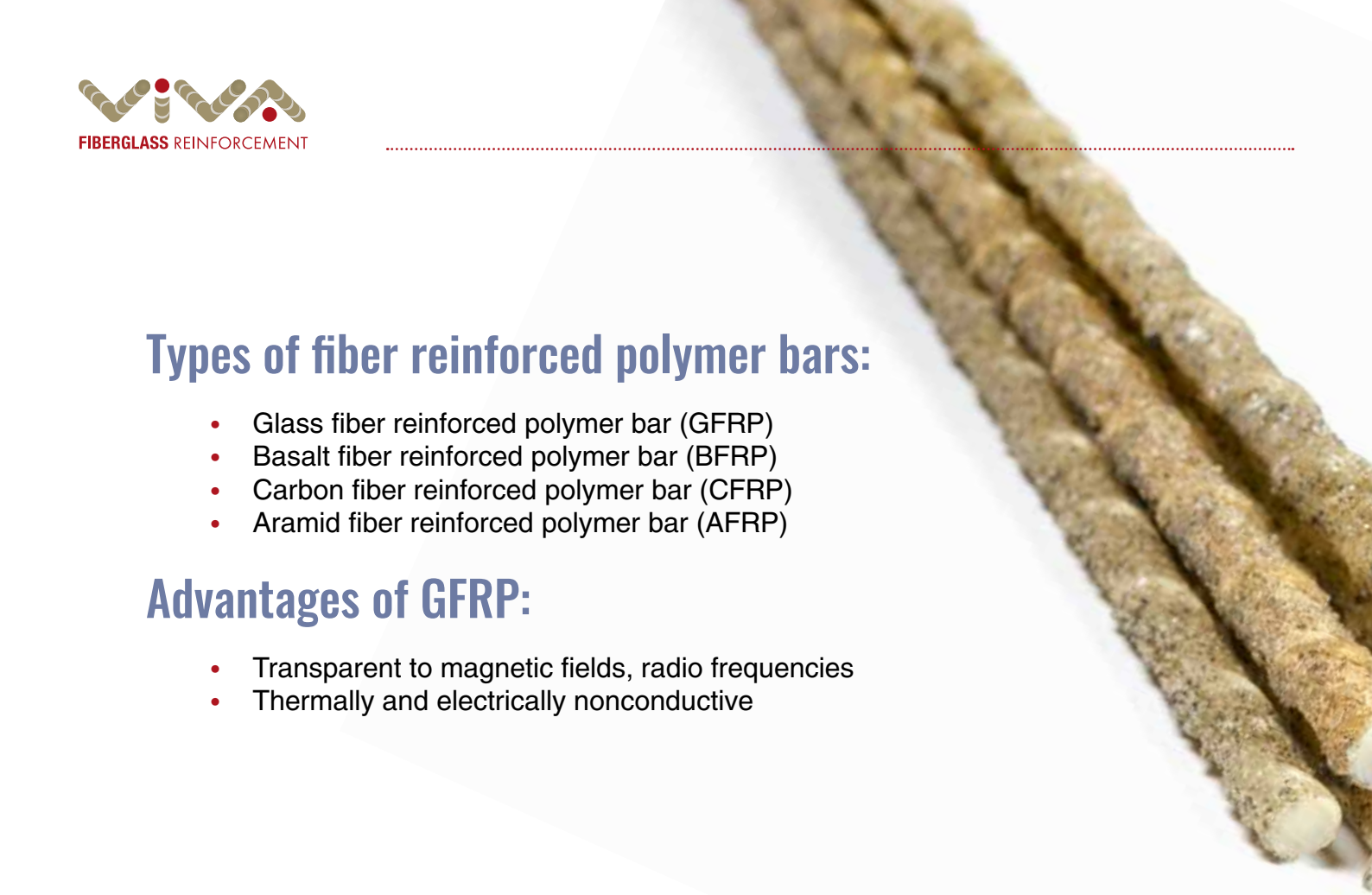
Worldwide applications

3rd Concession Bridge, Ontario, Canada, 2008

University of Miami bridge, USA

I-635 Bridge,
KansasCity,USA

18th Street Bidge,
Manitoba,Canada,2010



Types of fiber reinforced polymer bars:

- Glass fiber reinforced polymer bar (GFRP)
- Basalt fiber reinforced polymer bar (BFRP)
- Carbon fiber reinforced polymer bar (CFRP)
- Aramid fiber reinforced polymer bar (AFRP)

Advantages of GFRP:

- Transparent to magnetic fields, radio frequencies
- Thermally and electrically nonconductive

FRP bar

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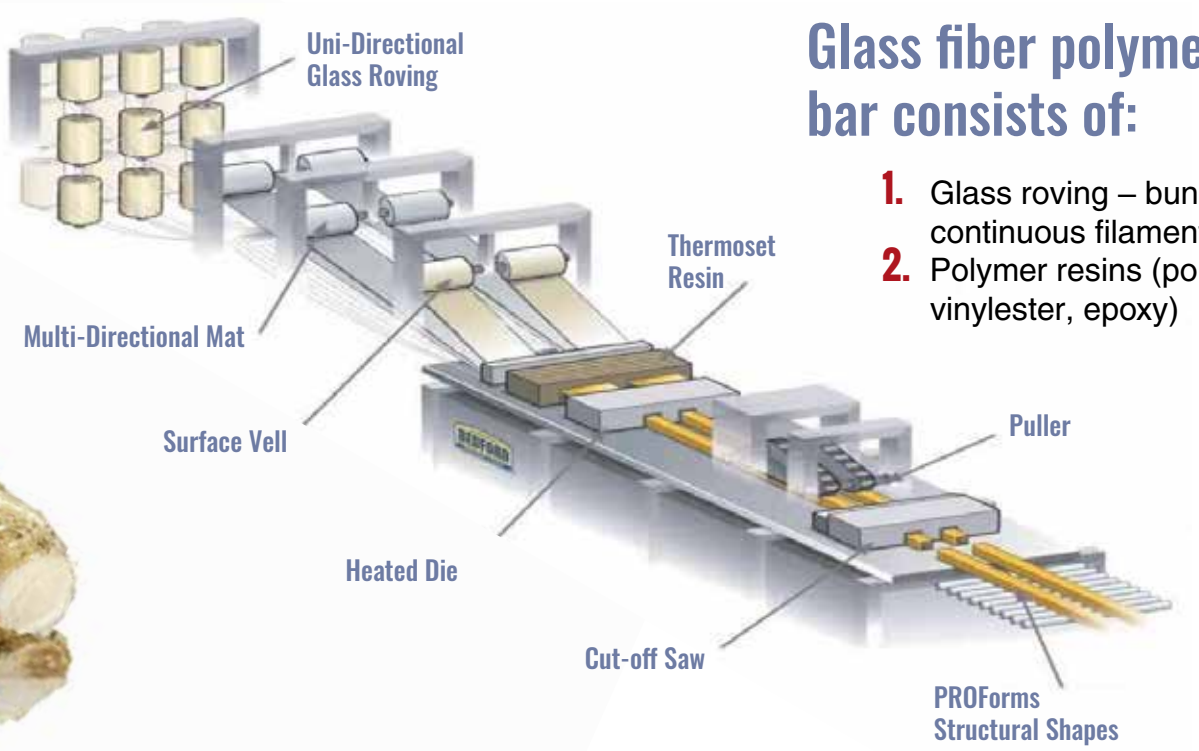

Glass fiber polymer bar consists of:

1. Glass roving – bundles of continuous filaments
2. Polymer resins (polyester, vinylester, epoxy)

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Applications and Standards

GLASS FIBER REINFORCED POLYMER (GFRP) BARS ARE PROUDLY **MADE IN GHANA**

USING LATEST TECHNOLOGIES AND BEST WORLD PRACTICES AND RECOMMENDATIONS OF **AMERICAN CONCRETE INSTITUTION (ACI)** AND **ASTM STANDARDS**. Standards approved by **GHANA STANDARDS AUTHORITY**

VIVA FIBERGLASS REBAR IS AN ALTERNATIVE TO CONVENTIONAL STEEL REBAR

BUT WITH

HIGH	LOW
Corrosion resistance	Maintenance
Strength	Weight
Impact resistance	Concrete layer

ALL CONCRETE FUNDATIONS

MINING AND TUNNELING

MARINE APPLICATIONS

SPECIALIZED CONCRETE CONSTRUCTION

BRIDGE DECKS

ROADS

CHEMICAL ENGENEERING

Applications and Standards

Viva Fiberglass Reinforcement is produced in accordance with best world practice and recommendations of **American Concrete Institution** standards.

Quality is controlled by **Ghana Standards Authority** and confirmed by **Bureau Veritas**. Respective quality certificates are prepared for each batch.

We are pleased to make quality changes in construction industry of West Africa and be first of a kind in delivering revolution technology to West African communities.

American Concrete Institute
Always advancing

BUREAU VERITAS

GHANA STANDARDS AUTHORITY
REPUBLIC OF GHANA

Technical Committee

The National Technical Committee on Building and Construction (TC 11) was reconstituted as follows:

NO	NAME	ORGANIZATION	POSITION	E-MAIL / TEL NO.
1	Ing. Seth Bright Attipoe-Denyah	Consultant	Chairman	Sethbad93@yahoo.com / 0244 666196
2	Mr. Nana Ansah Benyi	ISADA	Member	nbenyi@yahoo.co.uk / 0264 464449
3	Ing. Kweku Nyarko Twumasi	Ghana Institution of Engineers	Member	twumasi@hotmail.com / 0208 133933 / 0235 133933
4	Mr. Mawuli Tsaku	GSA, Testing	Member	mtsaku@yahoo.co.uk / 0208 156861
5	Ing. Mike Addo	Structural Tekniks	Member	moeataddo@gmail.com / 0244 674 515 / 0205 663 577
6	Mr. Matrevi Enyo Koku	Ghana Highway authority	Member	enyomatrevi@gmail.com / 0244 377420
7	Mrs. Adelaide Aikins	GSA, Testing	Member	teimlel@yahoo.com / 0244 612040
8	Ing. Charles N. Adigvom	VIVA / AESL	Member	adigvom1967@yahoo.com / 0243 613742
9	Ing. Joseph Oddei	VIVA / AESL	Member	joddei@yahoo.com / 0244 726164
10	Prof. Samuel Kwofie	Dept. of Metallurgy, KNUST, Kumasi	Member	drskwofie59@yahoo.com / 0548 002384
11	Mr. Kofi Nagetey	GSA	Member	fnagetey@gsa.gov.gh
12	Mr. K.O. Boadu	GSA	Member	kboadu@gsa.gov.gh
13	Adelaide D. Appiah (Ms)	GSA	Member	adda1m@yahoo.co.uk / 0266 101427
14	Mr. William Nimako	GSA	Member/Sec.	wnimako@yahoo.com / 0208 972246

American Concrete Institution

440.1R-15: Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars

440.5-08: Specification for Construction with Fiber-Reinforced Polymer Reinforcing Bars

440.6-08: Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement

440.3R-12: Guide Test Methods for Fiber-Reinforced Polymer (FRP) Composites for Reinforcing or Strengthening Concrete Masonry Structures

440.2R-08: Guide for the Design and Construction of Externally Bonded FRP Systems or Strengthening Concrete Structures

440.7R-10: Guide for the Design and Construction of Externally Bonded Fiber- Reinforced Polymer Systems for Strengthening Unreinforced Masonry Structures **American Association of State Highway & Transportation Officials**

AASHTO GFRP-1: AASHTO LRFD Bridge Design Guide Specifications for GFRP- Reinforced Concrete Bridge Decks and Traffic Railing

Advantages

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- Impervious to chloride ion, low pH chemical attack and bacteriological growth
- Non-existent corrosion, rust free
- Non Toxic
- 80+ years of lifespan and corrosion resistance

- Cost effective vs traditional iron rods in West Africa
- Maintenance free
- Easily cut and machined
- Easy and
- Rapid Installation

- 7 x lighter in weight than the equivalent strength of steel rebar
- Less rebar diameter
- Less handling
- Less load on basement

- High Fatigue endurance and Impact Resistance
- Up to 2 x tensile strength of steel

Save money with GFRP advantages

Direct savings on material 37,89%

1 ton of 8 mm high tensile (ultimate tensile strange 20,1 kN) steel has 2,531 meters and costs 855 USD
Same meters of 6 mm GFRP (ultimate tensile strength 21,4 kN) costs 531 USD

Savings – 324 USD per 1 ton*

Save up to 5% without overlaps

Standart overlap is 40 sizes of the diameter or 0,32 m for 8 mm steel
One coil of GFRP 6 mm has 150 meters.
Standart length of 1 steel rebar is 11,8 meters which means that on 150 meters there will be 12 overlaps or 7,68 meters of waists (0,32*2*12)
This will give us 129,6 meters of overlaps on 1 ton of steel (7,68*(2,531/150))
Thus when you avoid overlaps with GFRP you are additionally

Saving 43,8 USD per 1 ton

*price comparison is made with Imported High Tensile Iron Rods 400Mpa and may fluctuate within diameters

Additional savings with GFRP

Transportation

1 truck can take 20 tons of steel reinforcement or 50,620 meters (8 mm)
Same truck by weight will take 277,778 meters of GFRP 6 mm which is equivalent to 109,8 tons of 8 mm steel

Therefore you may save 88% percent of your transportation expenses with GFRP

Overall project speed up

Since GFRP bars are lighter and can be coiled, it takes less time to transport them to the top floors (for multistorey constructions) and lay them on the site, which will allow to economize money by paying less amounts to workers and complete the project faster.

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Examples of practical implementation

For a three successful years of practical implementation in West African sub-region, Viva has participated in more then 1000 projects in areas of industrial, road, real estate and other construction.

We are grateful to all our clients for their choice of innovative, modern and ‘green’ material that will serve its purpose on a one side and save money on the another.

Below you can find pictures of some of the projects where GFRP bars were applied in the Republic of Ghana.

We hope to see you as our future client!

Construction of Sports centre at 6 Garrison at Tamale for the Ghana Armed Forces

Consultant: Eng. John Ankrah (SRC Engineers)

Examples of practical implementation

Construction of a church, Madina, Greater Accra

Consultant: Project and estate department of church of pentecost

Construction of Fertilizer Factory, Tema Industrial Area, Tema

Consultant: Eng. John Ankrah
(SRC Engineers)

Examples of practical implementation

Beach hotel project, Axim area, Western Region

Consultant: Eng. Philip K.Yeboah
(Ndede Construction company LTD)

Construction of Ecoblock office building, Pokuase, Accra-Kumasi road

Consultant: Eng. Kwabena Bempong

Examples of practical implementation

Construction of Palace mall, Atomic Junction, Aburi road

Consultant: Eng. Solomon Oguah (ABP Consult)

Swimming pool for Ghana Armed Forces (GFA) (NAVAL HEADQUARTERS) at ENC – Tema

Consultant: Eng. Asamoah

Examples of practical implementation

Pokuase Interchange Project, Accra-Kumasi Road

Consultant: Eng. Kwabena Bempong (Associated Consultants)

Example of practical implementation of Viva Fiberglass reinforcement in Cote d'Ivoire

Examples of practical implementation

MPS JETTY REPAIRS, TEMA PORT

Contractor: De Simone Group

Atomic Police Campus

Contractor: De Simone Group

Examples of practical implementation

Beach Resort Project
Sakumono, Accra

Factory Project
Tema Industrial Area

Examples of practical implementation

Oyarifa Park by Indigo Homes

Consultant: Associated Consultants

GNPC
Research and Technology Centre of GNPC (Accra, Ghana)

Consultant: CONPRO LTD / BI-ARCHITECT CONSULT
Contractor: CONSAR LTD

Examples of practical implementation

Construction of an Art Center at Community 25, Tema

Contractor: Atlantic contract works ltd

Construction of gated community real-estate project at Community 27, Tema

Contractor: Nyame Dua Homes LTD

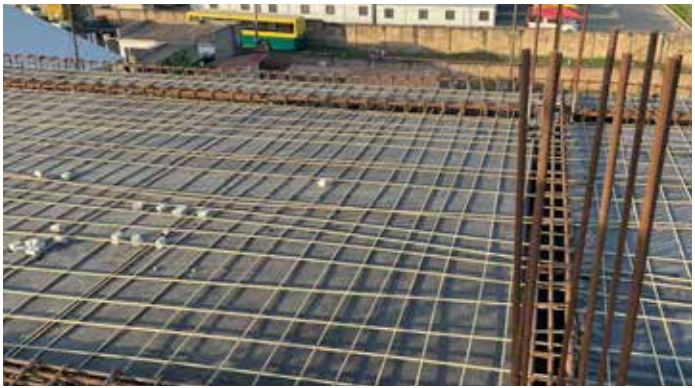
Examples of practical implementation

REBEACON HEIGHTS business center (Accra, Ghana)

Consultant: Ing. Solomon Oguah Location: HAATSO

Community 25 business center (Tema, Ghana)

Consultant: AKADAMS CONSTRUCTION LTD AND ARCHITECTURAL BUILDING PLANNER



Examples of practical implementation

Typical residential 2-floor building (Accra, Ghana)

2-floor commersial building (Kara, Togo)

FIBERGLASS REINFORCEMENT

Contact us for any assistance you may need for use of GFRP bars:

+233 24-545-87-97
info@vivafiberglass.com

You are also invited to visit our website:

www.vivafiberglass.com

Look for
VIVA Fiberglass Reinforcement
on **Facebook** and **LinkedIn**