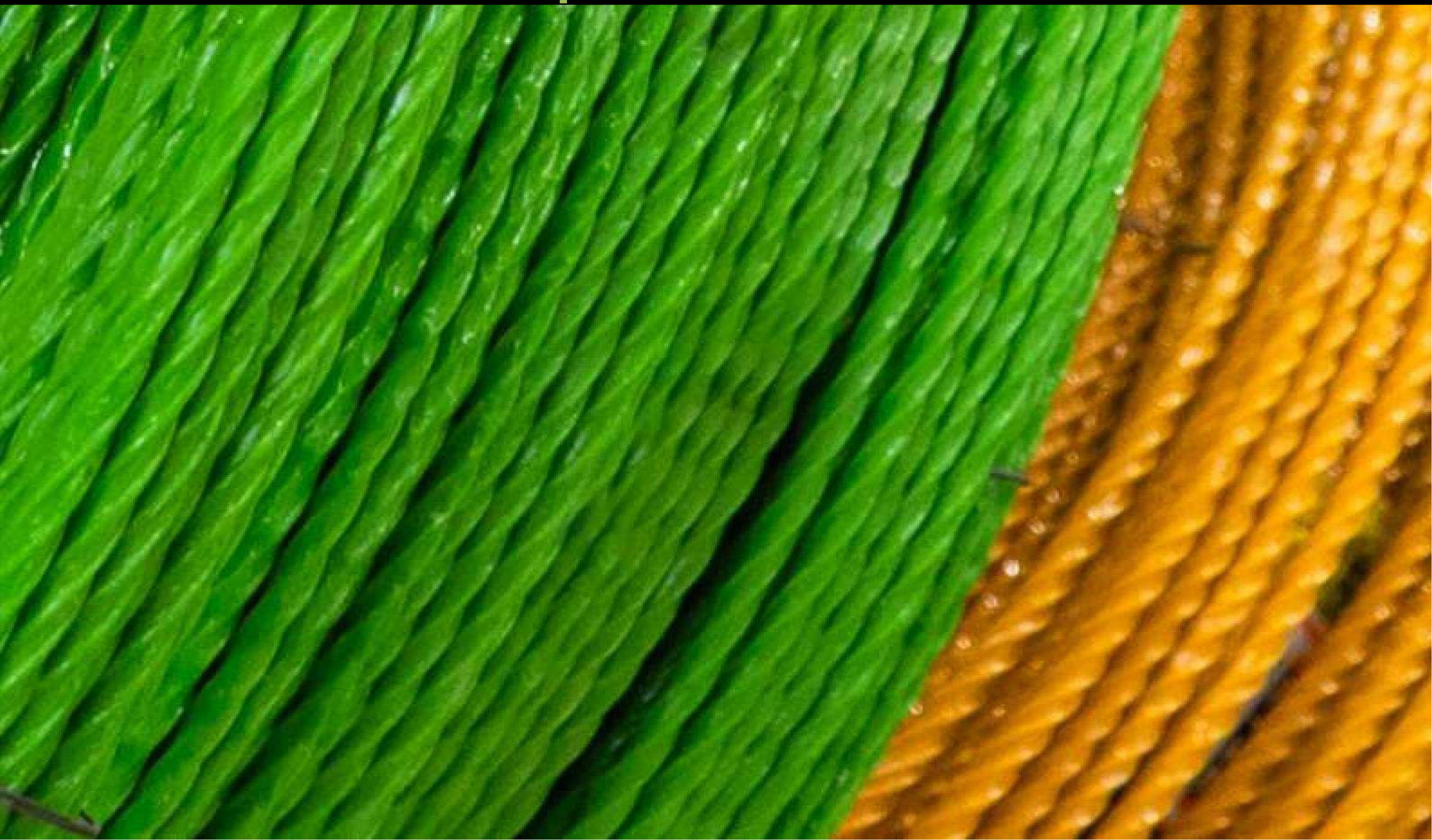
For a body as strong as iron

You need nerves of

TITAN TECHNOVATORS

"Empowering Sustainability through Technology"



GFRP
Revolutionizing Construction

Glass Fiber Reinforced Polymer (GFRP) is one of the most promising advancements in building materials and techniques the construction industry has witnessed recently. It is a compelling alternative to traditional construction material like steel.

GFRP is a composite material that comes with the excellent strength of glass fiber and the versatility of polymers. The glass fiber imparts reinforcement and mechanical properties to the material, giving it its exceptional strength and durability.
Polymer matrix, on the other hand, acts as binders protecting the fiber thus providing resistance against damages caused due to environmental factors such as corrosion and UV radiation.

The revolutionary **GFRP** material has been put to many uses over the years. One of the most important uses of **GFRP** has been in the form of rebars i.e. reinforcing bars. Its introduction in the field of reinforcing is a game changer.
Replacement of traditional steel rebars with **GFRP** rebars has the potential to revolutionize the construction industry as they do not rust and are sustainable and durable in addition to being lightweight.

Titan Technovators is making a mark in the construction industry with its innovative, highly engineered, and impactful **GFRP** reinforcing bars. We provide exceptionally sturdy, corrosion-resistant, and lightweight reinforcement bars promising maintenance-proof structures. **Titan Technovators** is proudly specialized in efficient and feasible design accepted by all.

Titan***bars*** are remarkably lightweight fiberglass and polymer rod that can be fabricated into various shapes, sizes, and forms allowing room for innovation in construction. The characteristics like resistance to corrosion, non-magnetic, electrical, and thermal insulation, and high strength make it a better alternative to traditional steel rebars for concrete reinforcement applications. The durability, longevity, and sustainability of Titan***bars*** give it a strong foothold in the future of the construction industry.

With **Titan Technovators**, you can rest assured of the quality of the product as we use the best material and manufacturing processes. **Titan Technovators** provides efficient and feasible design solutions concerning all codal provisions benefitting its overall manufacturing process. Titan***bars*** is a superior alternative to traditional rebars, with their strength, durability, and robustnesscatering to the needs of high-quality lifeof the structural elements. We ensure that the manufacturing processes of theTitan***bars*** are safe and secure for the environment.

The long-term factors such as increased durability and reduced maintenance, makes Titan***bars*** are very often a more cost-effective investment for concrete reinforcement.

APPLYING
PASSION to **PROJECTS**

Projects of Infrastructure:

Their high strength, durability, and resistance to corrosion make GFRP reinforcement bars an ideal choice for infrastructure projects like highways, bridges, and tunnels that are constantly exposed to environmental damage.

Marine and Coastal Structures:

Due to the resistance to salt waters and harsh marine environments, GFRP reinforcement bars are better suited for marine and coastal structures such as seawalls, piers, and docks.

Retrofitting and Rehabilitation Projects:

GFRP Re-Bars are a cost-effective solution for retrofitting and rehabilitation needs of existing structures. They can enhance the structural performance and extend the service life of the structures in want of retrofitting and rehabilitation.

A CLEAR EDGE
OVER STEEL

CHARACTERISTICS	METAL REBARS	GFRP REBARS
CORROSION RESISTANCE	SUSCEPTIBLE	HIGHLY RESISTANT
WEIGHT	HEAVIER	SIGNIFICANTLY LIGHTER
STRENGTH	HIGH STRENGTH	HIGHER STRENGTH (BETTER STRENGTH-TO-WEIGHT RATIO)
ELECTRICAL CONDUCTIVITY	CONDUCTIVE	NON-CONDUCTIVE
THERMAL CONDUCTIVITY	HIGH CONDUCTIVITY	LOW CONDUCTIVITY
BOND STRENGTH	EXCELLENT	EXCELLENT
SUSTAINABILITY	LIMITED SUSTAINABILITY	HIGH SUSTAINABILITY; RECYCLED AND ECO-FRIENDLY
DURABILITY	SUBJECT TO CORROSION AND DEGRADATION	HIGHLY DURABLE; LONG-LASTING
COST	VARIES DEPENDING ON THE MATERIAL	VARIES DEPENDING ON THE MANUFACTURER
APPLICATIONS	GENERAL CONSTRUCTION USAGES	• GENERAL CONSTRUCTIONUSAGES • MARINE AND COASTAL INFRASTRUCTURE • RETROFITTING AND REHABILITATION

TECHNICAL DATA

A PROPERTY	SPECIFICATIONS
Type of Fibre	E-CR Glass
Type of Resin	Epoxy/Vinyl Ester
Production Process	Pull Winding Pultrusion
Bar Geometry	Indented
Surface Treatment	Optional if Required
Coefficient of Longitudinal Thermal Expansion	Not Available
Coefficient of Transverse Thermal Expansion	Not Available
Colour	Light Brown

			Values for GFRP Rebar Dia in mm						
B. PROPERTY	Test Method	Unit	6	8	10	12	16	20	25
Mean Ultimate Tensile Strength	ASTM D7205	Mpa	1050						
Standard Deviation of Ultimate Tensile Strength		Mpa	Not Available						
Number of Samples for Standard Deviation		Count	Not Available						
Mean Transverse Shear Strength		Mpa	140	140	140	140	140	140	140
Standard Deviation of Transverse Shear Strength		Mpa	Not Available						
Number of Samples for Standard Deviation		Count	Not Available						
Mean Bond Strength		Mpa	7.9	7.9	7.9	7.9	7.9	7.9	7.9
Standard Deviation of bond strength		Mpa	Not Available						
Number of Samples for Standard Deviation`		Count	Not Available						
C. PROPERTY	Test Method	Unit							
Nominal Cross Section Area	ASTM D792	sq mm	32	55	73	113	199	314	510
Unit Weight/Length	ASTM D792	kg/m	0.056	0.1	0.155	0.225	0.400	0.620	0.980
Nominal Ultimate Tensile Force	ASTM D7205	KN	27	44	59	85	131	189	297
Nominal Ultimate Tensile strength	ASTM D7205	Mpa	844	830	808	752	658	602	582
Nominal Ultimate tensile strain	ASTM D7205	%	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Nominal Ultimate transverse shear strength	ASTM D7617	Mpa	140	140	140	140	140	140	140
Nominal Tensile Modulus of Elasticity	ASTM D7205	Mpa	65000						
Nominal Bond Strength	ASTM D7913	Mpa	7.9	7.9	7.9	7.9	7.9	7.9	7.9
D. PROPERTY	Test Method	Unit							
Fibre Mass Content	ASTM D2584		75	75	75	75	75	75	75
Mean Glass Transition Tempreature	ASTM E1356		102'	102'	102'	102'	102'	102'	102'
Degree of Cure	ASTM E2160		97'	97'	97'	97'	97'	97'	97'
Moisture Absorption in 24 Hours at 50 °C	ASTM D570		$0.25%	$0.25%	$0.25%	$0.25%	$0.25%	$0.25%	$0.25%
Moisture Absorption to saturation at 50°C	ASTM D570		$1.0%	$1.0%	$1.0%	$1.0%	$1.0%	$1.0%	$1.0%
Total Enthalpy of Polymerisation	ASTM E2160		Not Available						
Alkaline Resistance Tensile load retention	ASTM D7705-A		$80%	$80%	$80%	$80%	$80%	$80%	$80%

Disclaimer: $ Reasonable care has been taken in the preparation of this information, but the manufacturer makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. All information mentioned in this document is believed to be approximate & is given without acceptance of liability. All values have been generated from limited data. The values listed for Diameter, weight, Area and Tensile strengths are approximate values, unless otherwise noted. Users should make their own assessment of the suitability of any product for the purpose required. The following factors are unrelated to GFRP Rebar by ABHUVA and may affect performance of the structure or flatwork soil/ support type and compaction, loadtype and magnitude, engineering design, installation or implementation, concrete strength and thickness, joint layout and ground slope.

TECHNICAL DATA

Titan*bar* 46 (ASTM D7957, ACI 440.6, IRC 137:2022)

Titan*bars* 46 (ASTM D7957, ACI 440.6, IRC 137:2022)									
	Units	#2 (6mm/ 0.23in)	#3 (10mm/ 0.39in)	#4 (13mm/ 0.51in)	#5 (16mm/ 0.62in)	#6 (19mm/ 0.74in)	#7 (22mm/ 0.86in)	#8 (25mm/ 0.98in)	#10 (32mm/ 1.25in)
Guaranteed tensile force	kN	27	59	96	130	182	241	297	437
	kip	6.1	13.2	21.6	29.1	40.9	54.1	66.8	98.2
Tensile modulus	GPa		46						
	ksi		6670						
Guaranteed transverse shear capacity	MPa		150						
	ksi		23.2						
Primary Materials			**Epoxy Backboned Vinylester and Corrosion Resistant E-CR Glass**						
Weight	g/m	97	144	315	415	589	780	1030	1680
	lb/ft	0.07	0.096	0.211	0.278	0.395	0.524	0.692	1.128
Nominal cross-sectional area	mm^2	32	71	129	199	284	387	510	819
	in^2	0.049	0.11	0.20	0.31	0.44	0.60	0.79	1.27
Outer diameter (including ribs)	mm	8.2	10.0	14.0	16.0	19.0	21.8	25.0	31.4
	in	0.250	0.375	0.500	0.625	0.750	0.875	1000	1.270

Please contact our team for information on the material properties, shape availability and dimensional limitations of bent bars.

Titan*bars* 60 (CSA Grade III), (ASTM D7957, ACI 440.6, IRC 137:2022)

	Units	#2 (6mm)	#3 (10mm)	#4 (13mm)	#5 (15/16mm)	#6 (19/20mm)	#7 (22mm)	#8 (25mm)	#9 (30mm)	#10 (32mm)
Guaranteed tensile force	kN	27	71	129	199	284	387	510	600	735
	kip	7.2	16	29	44	64	87	115	134.9	165.2
Tensile modulus	GPa			60						
	ksi			8700						
Guaranteed transverse shear capacity	MPa			180						
	ksi			26.1						
Primary Materials				Epoxy Backboned Vinylester and Corrosion Resistant E-CR Glass						
Weight	g/m	97	185	315	476	702	960	1252	1575	2050
	lb/ft	0.07	0.12	0.21	0.32	0.47	0.64	0.84	1.06	1.37
Nominal cross-sectional area	mm^2	32	71	129	199	284	387	510	645	819
	in^2	0.049	0.110	0.200	0.310	0.440	0.600	0.790	1000	1270
Outer diameter (including ribs)	mm	8.2	10.8	14.0	17.2	20.6	24.1	27.4	30.8	35.0
	in	0.315	0.425	0.551	0.677	0.807	0.949	1.087	1.213	1.378

Direct Comparisons: Steel And Titan*bars*

Material Properties	Units	Titan*bars*	Stainless Steel (ASTM A955)	Steel (ASTM A615)
Tensile Strength	MPa	800 - 1100	420	420
	ksi	116 - 159	60	60
Tensile Modulus	GPa	46 - 60	200	200
	KSI	6675 - 8700	29000	29000
Bond Strength	MPa	10	10	10
	PSI	1450	1450	1450
Thermal Conductivity	W/ (m·°C)	< 1 (1)	16	54
	BTU/(hr·ft·°F)	< 0.6 [1]	10	32
Electrical Resistivity	Ω·m	> 200×10^{10}	1×10^{-4}	1.5 x 10
	Ω·in	> 8×10^{13}	4×10^{-5}	6 x 10
Unit Weight	kg/m^3	2100	7800 - 8000	7850
	lb/ft^3	130	485 - 500	490

Approximate value

APPLICATION

GFRP reinforcing bars may be used in the following concrete components in road projects subject to complying with the provision of Guidelines:

(as per IRC:137-2022 & IS 18256:2023)

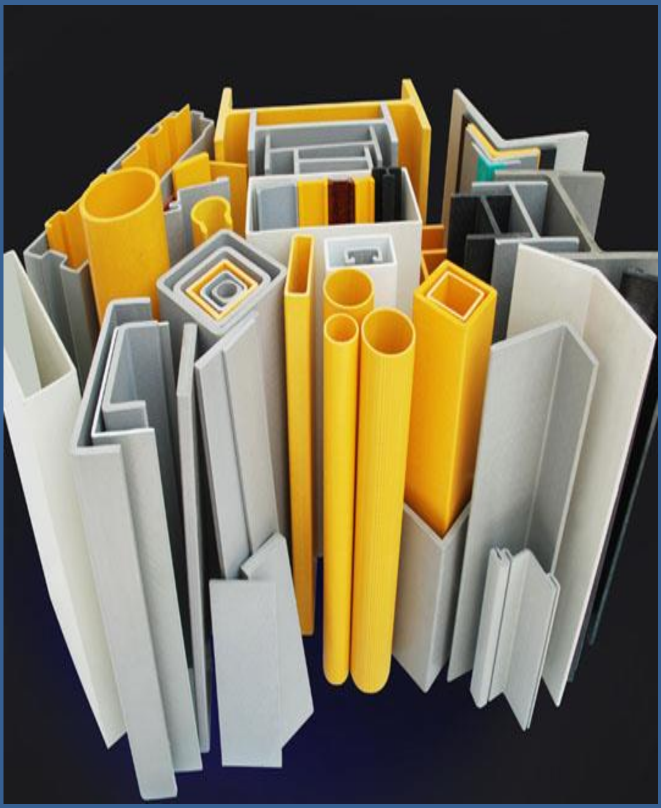
- Approach Slabs
- Bridge Decks and Bridge Deck overlays, Walkways of Foot Over Bridge, Slab Culverts
- Bridge cum Bandhara, including Deck Slabs and barriers between Piers
- Concrete Roads including Jointed Plain Concrete Pavement, Continuously-Reinforced Concrete Pavements (CRCP) and Short-Panel Concrete pavements (both cast-in-situ and precast)
- Retaining Walls
- Noise barriers
- Box Culverts
- Crash Barriers & Bridge Parapets
- Pedestrian Parapets and Railing
- Bulkheads and Bulkhead Copings
- Mechanically Stabilized Earth Wall Panels and Coping Beam
- Drainage Structures
- Plain Concrete Components
- Swimming pool, building Construction
- Industrial Shed and Heavy Load Bearing Flooring
- Marine Structure

Applicable Design Standards

The load calculations shall be based on the relevant IRC Specifications & Guidelines and MORTH Specifications. The Load combinations shall also be based on the IRC Codes & Guidelines and MORTH Specifications.

The modelling of structure, analysis method and determination of design forces shall also be based on the relevant IRC Specifications & Guidelines and MoRTH Specifications.

Our Products and Services



GFRP STRUCTURAL PROFILE

FRP Structural Profiles are as strong as traditional materials such as steel, timber, and aluminium. In fact, they are highly superior compared with other traditional materials as they are lightweight, corrosion resistant, fire retardant, and much more. They are also cost-effective with low installation costs and little to no maintenance required. These ready-made construction profiles can be sourced within your construction schedule.

GFRP BAR

Titan*bar* boasts comprehensive in-house testing facilities adhering to ACI-440.1R-15 and BIS 18256-2023 standards. Currently, we offer GFRP straight bars in diameters ranging from 4mm to 22mm and bent stirrups from 6mm to 22 mm.

- Straight GFRP Rebars: Made by extruding a mix of glass fiber and thermoset resins through a heated die, producing solid, cured rebars ready for cutting and packaging.
- Bent GFRP Rebars: Similar extrusion process but the material remains partially cured, allowing it to be bent into various shapes like hooks or stirrups before full curing.
- GFRP Mesh: Similar extrusion process but the material forms a mesh pattern with specific spacing in both axes.

FREQUENTLY ASKED QUESTIONS

Q. Are GFRP reinforcement bars compatible withexisting construction practices?

Ans: Yes, GFRP reinforcement bars are compatible with existing construction practices in India governedby IRC 137:2022 code with reference to ACI 4401R code and can be easily integrated into the traditional concrete construction method.

Q. Are there any limitations or considerations whenusing GFRP reinforcement bars?

Ans: While GFRP reinforcement bars present a myriadof benefits over metal rebars, you might need to keepin mind some considerations –

- It may require appropriate design consideration dueto its different thermal expansion properties from the metal rebars.
- Proper installation practices such as handling andanchorage should be followed.

Q. How can I ensure the quality of GFRPreinforcement bars?

Ans: You can be confident of the quality when you source it from a reputable manufacturer like Titan Technovators. We adhere to the needs of national and international standards and certifications.

Q. What are the cost implications of using GFRPreinforcement bars?

Ans: The actual cost of GFRP reinforcement bars mayvary depending on factors like length, diameter, manufacturer, and region. The initial cost of purchasemay be more than the metal rebars too. However, when considering long-term factors such as increased durability and reduced maintenance, GFRP reinforcement bars are usually more cost-effective investment.

Q. Are there any limitations on using GFRP reinforcement bars in specific environments orclimates?

Ans: GFRP reinforcement bars are better suited for awide range of environments and climates. However, you might need some pre-thought for extreme temperature conditions like sustained heat. You cantake professional advice from structural engineers and Titan Technovators experts.

Q. Can GFRP reinforcement bars be used alongsidesteel reinforcement bars in concrete structures?

Ans: Yes, GFRP reinforcement bars can be easily usedalongside steel reinforcement bars in concrete structures. However, to ensure compatibility and optimize the performance of both rebars, you must consider having a proper design and detailing process.

Q. Are GFRP rebars being used in the construction ofroads in India?

Ans: GFRP rebars are an evolving addition to the construction industry. Indian roads are seeing an expansion in the usage of GFRP rebars. They are, in fact, being used in NH projects under the GoI guidelines under IRC 137:2022 code with reference toACI 4401R code.

Q. Are there any standards of manufacturing andusage of GFRP rebars?

Ans: The manufacturing of GFRP rebars is guided by an international standard ACI 440.1R-15. The Indian guidelines for road projects specify that GFRP rebars that fulfill the requirements of ASTM D578 can only beused in any road project in India.

Contact Us:-

India

Reg. adress: 425 kalasagar shopping hub, near satadhar cross road, ghatlodia ahmedabad,380061

:+91-6354548738

:info@titantechnovators.com

:www.titantechnovators.com

CANADA

Reg. 216 Thomas Avenue, Brantford, Ontario, N3S 0E2.

:+1(289)9259224