Steel Rebar vs GFRP Bar

When confronting challenging, corrosive environments, traditional steel rebar often falls short, Glass Fiber Reinforced Polymer (GFRP) emerges as an innovative solution that outperforms conventional steel. Here's how it stacks up against conventional options.

	GFRP Rebar	Steel Rebar
Cost	Higher initial cost	Lower initial cost
Corrosion Resistance	Resists a broad range of chemicals and is unaffected by water.	Subjected to oxidation and corrosion and might need some form of protection, escalating cost

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Electrical Conductivity	No Electrical conductivity	Conducts electricity.
EMI/FRI Transparency	Transparent to Radio wave	Can interfere with signal transmission
Fabrication/Bending Schedule	Can be cut on site. cannot be bent on site.(Specialise bending)	Can be cut and bent on site.

Technical Document

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Modulus of Elasticity > 50Gpa - 150Gpa

Shear Strength (MPa) > 250 (MPa)

Nominal Diameter	Nominal area (mm²)	Ultimate Tensile Load (kN)
6mm	30	35
8mm	50	55
10mm	70	75
12mm	125	123
16mm	200	255
20mm	290	260
22mm	390	335
25mm	505	430
30mm	795	630

Shear Strength (MPa) ≥ 250 (MPa)

Nominal Diameter:	Guaranteed Tensile Strength (MPa)	Weight (g/m)
	Minimum	Estimated
6mm	1500	66
8mm	1500	105
10mm	1500	150
12mm	1500	266
16mm	1500	417
20mm	1000	605
22mm	1000	813
25mm	1000	1348
30mm	1000	1665

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Steel Rebar vs GFRP Bar

GFRP vs Steel Reinforcement: Understanding the Structural Differences

Using the right material for the right application. Glass Fiber Reinforced Polymer (GFRP) offers significantly higher tensile strength than traditional steel reinforcement—more than double in many cases. This makes GFRP ideal for elements under tension, such as the underside of simply supported beams or the top of cantilever slabs.

However, GFRP behaves differently from steel in other ways. It has lower flexural strength, yield strength, and modulus of elasticity. While GFRP can handle greater tensile force, steel has the advantage when it comes to bending and elastic deformation. Steel's high ductility allows it to bend before it breaks, while GFRP is elastic but not ductile - meaning it breaks once it reaches its limit, without noticeable deformation.

Because of these differences, design approaches also vary: GFRP-reinforced concrete is typically engineered with concrete crushing as the failure mode, while steel-reinforced concrete is designed to yield before failing.

Choosing between GFRP and steel depends on the specific demands of your project—and we're here to help guide that choice.

In structural applications, GFRP-reinforced elements typically experience greater deflection than those reinforced with steel. This is due to GFRP's lower modulus of elasticity. To compensate, larger cross-sections or increased reinforcement ratios may be required to meet performance criteria.

One of the key advantages of GFRP is its superior bond strength with concrete, which enhances crack resistance. Additionally, GFRP's corrosion resistance allows for wider crack tolerances in wet environments—up to 0.7 mm compared to steel's 0.4 mm—without compromising durability.

GFRP also significantly outperforms steel in terms of fatigue resistance. It can endure up to 20 times more loading cycles, withstanding approximately 420,000 cycles versus just over 23,000 for steel, making it an excellent choice for structures exposed to repeated or dynamic loads.

Weighing in at just a quarter of steel's mass, GFRP is lightweight and easy to handle on-site. This not only improves efficiency in transport and installation but also helps reduce the overall dead load of concrete structures.

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Structure	Steel bar	EnviraBar
Density (g/cm³)	450 to 500	1500 (Starting)
Modulus of Elasticity (GPa)	>200	>50 – 150
Thermal conductivity (W/mK)	46	0
Adhesion Strength	10 – 14	15 +
Corrosion Resistant	No	Yes
Magnetism	Positive	Negative
Electrical conductivity	High	None
Bending Schedules	Possible	Specialised bending (Specific to client requirements)
Welding	Yes	No

Design Specific and Manufacture to order

enviramesh

EnviraMesh Products

GF Ref .100	grade 1	150x150 Grid	Specialised	4mm Green + Black Thread
GF Ref .100	grade 2	200x200 Grid	Standard	4mm
GF Ref .193	grade 1	150x150 Grid	Specialised	5mm Red + Blue Thread
GF Ref .193	grade 2	200x200 Grid	Standard	5mm
GF Ref . 245	grade 1	150x150 Grid	Specialised	7mm Yellow + Blue Thread
GF Ref . 245	grade 2	200x200 Grid	Standard	7mm
GF Ref .395	grade 1	150x150 Grid	Specialised	8mm Black + White Thread
GF Ref .395	grade 2	200x200 Grid	Standard	8mm

Custom Mesh Designed & Manufactured on Order
Design Specific and Manufacture to order

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Durability Performance: GFRP vs Steel Reinforcement

Innovative Strength for Modern Construction

The durability is a key factor in our approach to long-term structural integrity. When comparing Glass Fiber Reinforced Polymer (GFRP) to traditional steel reinforcement, the differences in durability are significant and impactful—especially in aggressive or corrosive environments.

Reshaping Reinforcement GFRP - an advanced alternative to conventional steel reinforcement, designed to redefine strength in concrete structures. With a tensile strength starting at 850 MPa and reaching beyond 1500 MPa, vastly outperforming traditional steel, which typically offers only 450 MPa. This enhanced strength allows for greater flexibility in design specifications.

Corrosion Resistance

Steel reinforcement is prone to corrosion, especially in coastal, marine, or chemically exposed environments. Over time, corrosion can lead to concrete spalling and reduced structural capacity. GFRP, on the other hand, is inherently non-corrosive. It does not rust or degrade when exposed to moisture, chlorides, or other corrosive agents—making it ideal for infrastructure in harsh environments such as bridges, sea walls, wastewater treatment facilities, and basements.

Chemical Resistance

GFRP offers excellent resistance to a wide range of chemicals, including acids, alkalis, and salts. This makes it suitable for industrial applications where steel reinforcement would require additional protective coatings or treatments to withstand chemical exposure.

Thermal and Electrical Insulation

Unlike steel, GFRP is a non-conductive material. This gives it natural thermal and electrical insulation properties, reducing risks associated with electrical currents or temperature transfer. It's particularly useful in tunnels, substations, and hospitals where electromagnetic neutrality is important.

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Lightweight and Cost-Efficient

Lightweight composition—just a quarter of conventional steel—simplifies handling and reduces transportation costs, resulting in a cleaner, more efficient application. Additionally, EnviraBar contributes to lower CO_2 emissions and offers the significant advantage of being non-corrosive, making it an ideal choice for enduring infrastructure projects.

Fatigue and Long-Term Performance

GFRP has a much higher fatigue resistance than steel, making it more reliable under cyclic or repeated loading over time. Its long-term performance is stable, with minimal degradation under environmental stressors. This translates to lower maintenance needs and longer service life in the structures where it is used.

No Maintenance for Corrosion Protection

Steel reinforcement typically requires ongoing monitoring, protective coatings, or cathodic protection systems in corrosive environments. GFRP eliminates these maintenance costs, offering a lower lifecycle cost despite a higher initial investment.

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Steel Theft is a Problem. GFRP is the Solution.

Across South Africa and beyond, theft of steel reinforcement bars on construction sites costs the industry millions each year — delays, replacements, and insurance claims are just the beginning.

That's where EnviraBar steps in.

Made from Glass Fiber Reinforced Polymer (GFRP), EnviraBar has zero resale value to scrap dealers, making it an unattractive target for theft.

No scrap value
Lightweight and easy to install
Corrosion-resistant and high-strength
Long-term savings, better site security

At Amiel Solutions, we believe your materials should build your future, not disappear overnight.

Conclusion

For projects where durability and long-term performance and zero resale are critical, GFRP provides a robust, corrosion-free alternative to steel. We help clients identify where GFRP adds the most value—ensuring their structures stand strong for decades to come.

Build safer. Build smarter. Build with EnviraBar.

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