Stark Composites LLP

Composite Rebars

Rajkot, 01.02.2023

Agenda

1. Introduction
2. Our Team
3. Composite Rebar
4. Projects
5. Future Prospect

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Introduction

- Composite Materials:
  - A composite material is made by combining two or more materials – often ones that have very different properties. The two materials work together to give the composite unique properties like:
  - Stronger
  - Lighter
  - Corrosion resistance
  - Cost effective
- Major users of composite materials:
  - Aerospace
  - Automobiles
  - Trains
  - Ships & Boats
  - Wind mills
  - Construction Industry

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Our Team

- **Bhavesh Gadhiya:**
  - He has completed his Masters degree from FH Aachen in Automobile engineering from Germany. He has also worked with companies like Porsche & Mercedes-Benz for 10 years. He has vast knowledge and experience of automobile & composite industries.

- **Rushil Jalavadia:**
  - He has completed his Bachelors & Masters degree from RWTH Aachen in Mechanical engineering, Automobile engineering & business administration. During his time in Germany, he has worked in the field of engine, drive-train development and weight reduction technology for automobiles for 9 years.

- **Shubham Jalavadia:**
  - He shall complete his Masters degree from Swinburne University, Melbourne in Master of Entrepreneurship and innovation (advance). During his time in Australia, he has taken active part in multiple case studies and competitions in his field of study.

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Composite Rebar - Features

- “Composite Rebar” which has potential to replace the traditional steel reinforcement in construction materials. The GFRP rebar are made with glass fiber and other chemical compound bound together with our own developed manufacturing technology.
- The main advantages are:
  - Lighter in weight (About 7 times lighter than steel rebar*)
  - Stronger (Tensile strength is more than double to steel rebar)
  - Long Service Life
  - Resistant to corrosion, alkalies, acids
  - It does not create electromagnetic interferences, does not conduct heat
  - Non conductivity - High dielectric strength
  - Simpler and more economic to transport (Round coils)
  - Low thermal conductivity of fiberglass provides for additional preservation of heat indoors
  - Unlike metal rebar, composite rebar does not cause short circuits inside concrete constructions
  - Easy to cut, fast to install and easy to handle
  - Minimization of repair work and increases durability of the reinforced construction design

*(When compared with equal strength rebar of steel)

Composite Rebar - Features

- Green technology (No pollution)
- Major cost savings due to high strength and reduction in concrete with our optimised structure design (upto 50%)
- Reduction in concrete cost due to remaovla of corrosion protection layer
- Does not conduct magnetism
- Life of concrete structure will be increased up to 100 years
- Drastic reduction in maintenance and life cycle cost
- Labour cost will reduce significantly due to lighter weight and ease of placement and handling
- Reduction in overall construction time
- Ease of logistic and transport to construction sites and also in remote and hilly areas
- GFRP rebars comes in 100 meter coils so very few overlapping are required
- Our company will provide complete technical and design solutions along with the rebars certified as per all international requirements and codes

Comparison with steel

- Steel Rebar vs Composite Rebar:

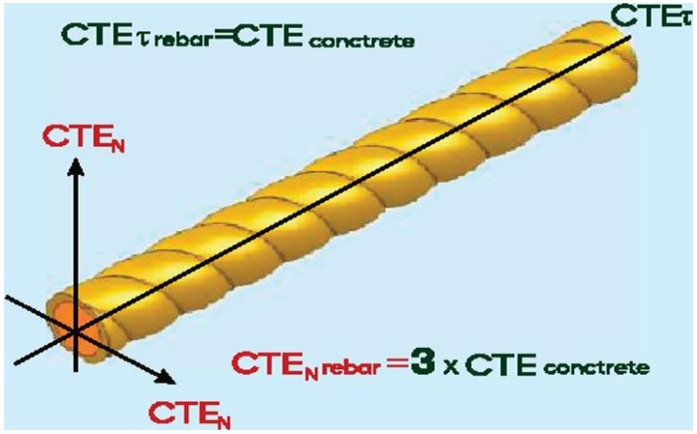
Parameter	Steel Rebar *	Stark Rebar	Benefit
Tensile Strength (MPa)	545	1100	Stronger
Modulus of elasticity (GPa)	200	50	No straightening required
Elongation (%)	25	2.2	No deformation due to stress
Linear Meters Weight (8mm)	0.395kg	0.075kg	Lighter
Bar's Size	12m	Until 100m	No Wastage
Durability embedded in concrete	50 Years	(+) 100 Years	More durability
Durability embedded in concrete (Aggressiveness class III & IV)	(+/-) 5 Years	(+) 100 Years	More durability
Corrosion Resistance	No	Yes	More durability
Electric Conductivity	Yes	No	No accident risks
Thermal Conductivity	Yes	No	Does not dissipate heat
Concrete covering in aggressiveness class III & IV	35mm to 45mm	20mm	Lowe concrete volume

*(Tata Tiscon Fe500 rebar)

Examples of bent elements

*(Tata Tiscon Fe500 rebar)

Composite Rebar – Coeffecient of thermal expansion



- The coefficient of thermalexpansion depends on the properties of the fiber in the longitudinal direction
- The properties of the resin in the transverse direction
- The ratio of binder andfiber

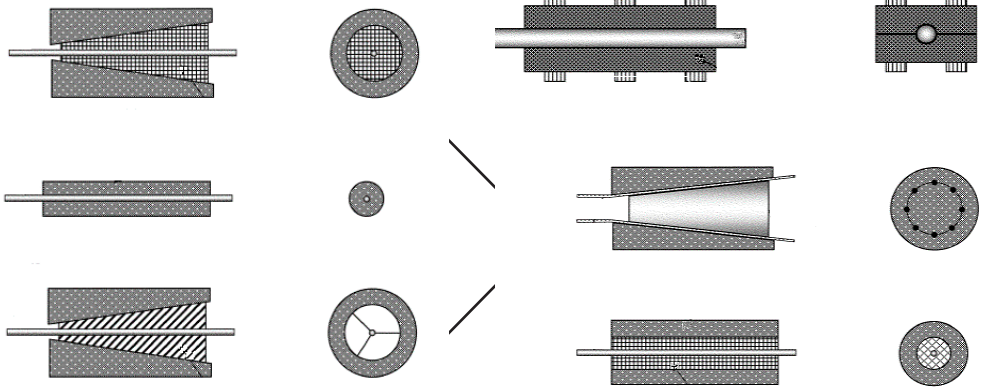
Direction	Steel	Concrete	CFRP	GFRP	BFRP
Longitudinal	11	7-13	-9..0	6-10	6-10
Transverse	11	7-13	74-104	21-23	20-22

*(Tata Tiscon Fe500 rebar)

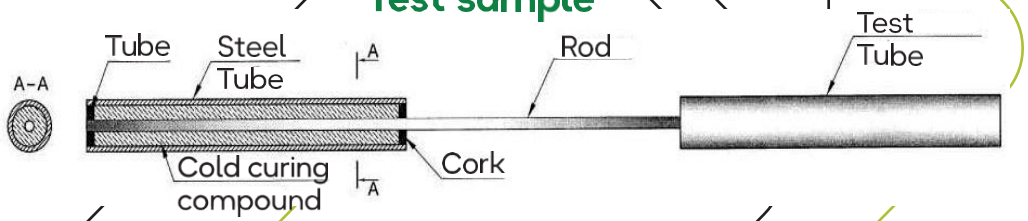
Composite Rebar – Testing method

Axial tension test method

Test devices



Test sample



*(Tata Tiscon Fe500 rebar)

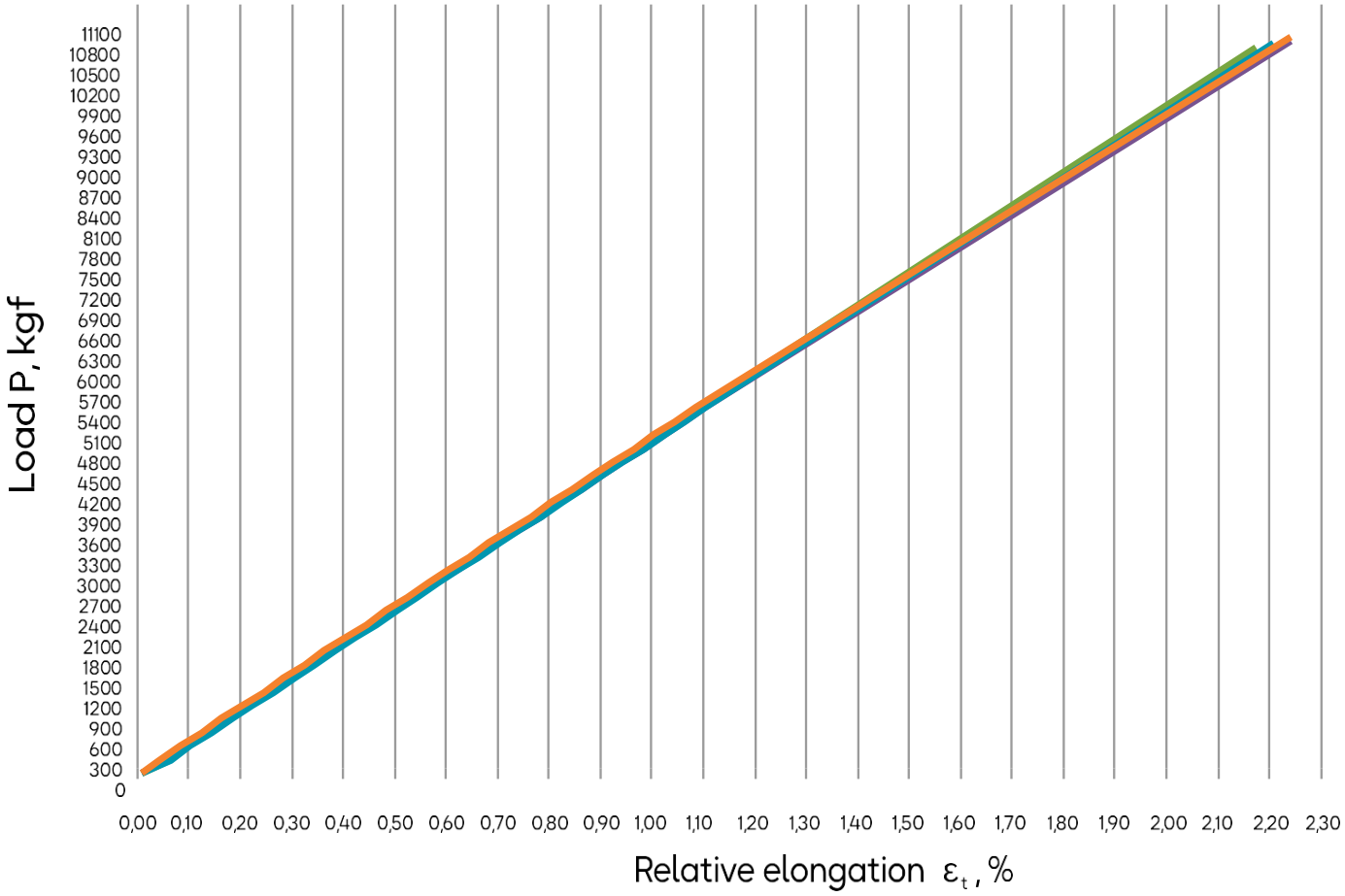
Composite Rebar – Axial tension Testing method

FRP Rebar before testing

FRP Rebar after testing

*(Tata Tiscon Fe500 rebar)

Composite Rebar – Test results



Composite Rebar – Characteristics of GFRP in concrete

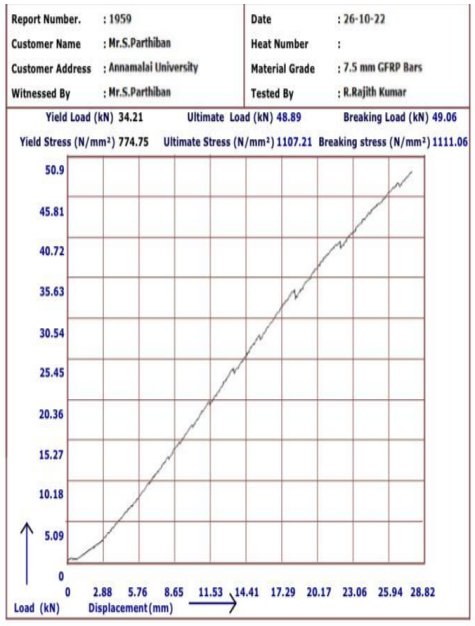
- FRP material linear until failure
- GFRP RC has lower flexible stiffness
- Hence, higher elasticity region
- Higher energy absorption capacity

International Standards & Testing

- Maximum advantage of this material can be only achieved by optimizing the whole structural design according to the properties of GFRP rebars.
- Through our extensive experience with this materials and our collaborations, we have the technology and experties in designing any structure according to all major international codes.
- Worldwide standards for the structural use of GFRP rebars are as followings:
  - ISO 10406-1:2015 – INTERNATIONAL
  - ACI440.IR-15 - UNITED STATES
  - AASHTO LRFD GFRP 2015 — UNITED STATES
  - CAN/CSA - S806 - 02 – CANADA
  - CNR—DT 203/2006—ITALY
  - GOST 31938—2012 — RUSSIA
  - DITEC590 — CUBA
  - FIP TASK GROUP 9.3 — REPORTS #TF 22 A 98741 EUROPEAN UNION
  - TECHNICAL COMMITTEE CT 303, IBRACON/ABECE, GT03 — Concrete structures with rebar of non-conventional materials.

International Standards and Testing

- We have rigorously tested our rebars according to procedure of ASTM D 7250 M/ACI 440.6 M (Minimum tensile strength of 760 MPa) and also GOST 31928 (Minimum tensile strength of 1000 MPa) at government certified test laboratory.
- Our rebars pass the tests with a tensile strength of more than 1100 MPa.




BUILDERS' SERVICES CENTRE

An ISO 9001:2015 Certified Material Testing Laboratory

Govt. of Tamil Nadu - SSI Regn. No. 330152106077 Pt.II & Firm Regn. No. 109/2015

TEST REPORT

PHYSICAL PROPERTIES OF HIGH STRENGTH GFRP COMPOSITE REBARS

Report. No. BSC/SPPS/2610-0001 Date 26.10.2022

Name & Address of the Customer:
Mr.S.Parthiban (Research Scholar),
Annamalai University,
Chidambaram,
TamilNadu, India

Sl. No	Dia* (mm)	Identification of samples*	Ultimate Load (kN)	Ultimate Stress (N/mm²)
1	8	S-1	55.65	1107.31
2	8	S-2	57.63	1147.97
3	8	S-3	56.79	1129.80

*As per Cl.6d provision ASTM D 7205 M/ACI 440.6 M, Tensile Strength of GFRP Rebar is 760 MPa (Specified).
*As per Codal provision GOST 31928, Tensile Strength of GFRP Rebar is 1000 Mpa (Specified).

* As per information furnished by the customer.

Note: 1. This results relate only to the particular sample submitted for test.
2. This report shall not be reproduced except in full, without our written approval.
3. If any corrections made, will invalidate this report.

----------END OF REPORT----------

For BUILDERS' SERVICES CENTRE

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Project examples

- Structures made with composite reinforcement around the world:

Armur region of Russia - 1975

Moscow Underground Station

Highway Construction USA - 2008

Eindhoven airport Runway CRCP – Netherlands 2009

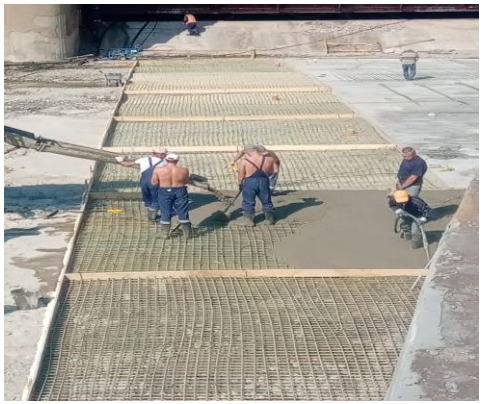
Brandon Bridge – Canada 2010

Miami-Dade Metro Project – USA

Project examples

- Structures made with composite reinforcement around the world:

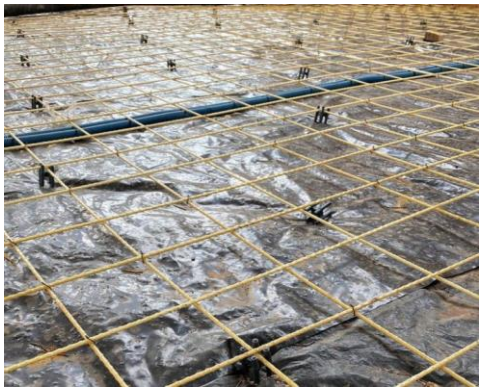
Road paving with composite mesh
Russia



Dam Construction,
Russia

Grocery Store Flooring
Russia

Void Slabs – Residential Building
Brazil



Industrial Flooring
Brazil

Strip foundation - Russia

Project examples

- Our projects in India:

Drain Precast Slabs – NHAI Project, L&T, Gadhidham

Residential Building Slab - Chennai

Industrial PCC - Ahmedabad

Commercial Building Basement Trimix Raghuvir Builders, Surat

Water Sump - Chennai

Pre-Cast Products

Project examples

- Our projects in India:

Road Construction – Forest Department, Gir, Gujarat

Basement PCC – Shaligram Builders, Ahmedabad

Road Construction Aurangabad

Swimming pool – Weekend Villas Savan Builders, Rajkot

Flower Bed- Residential Building Sangini Builders - Surat

Retaining Walls - Chennai

Project examples

- Joints:

Project examples

Project examples

Applications – Concrete Bridge Decks

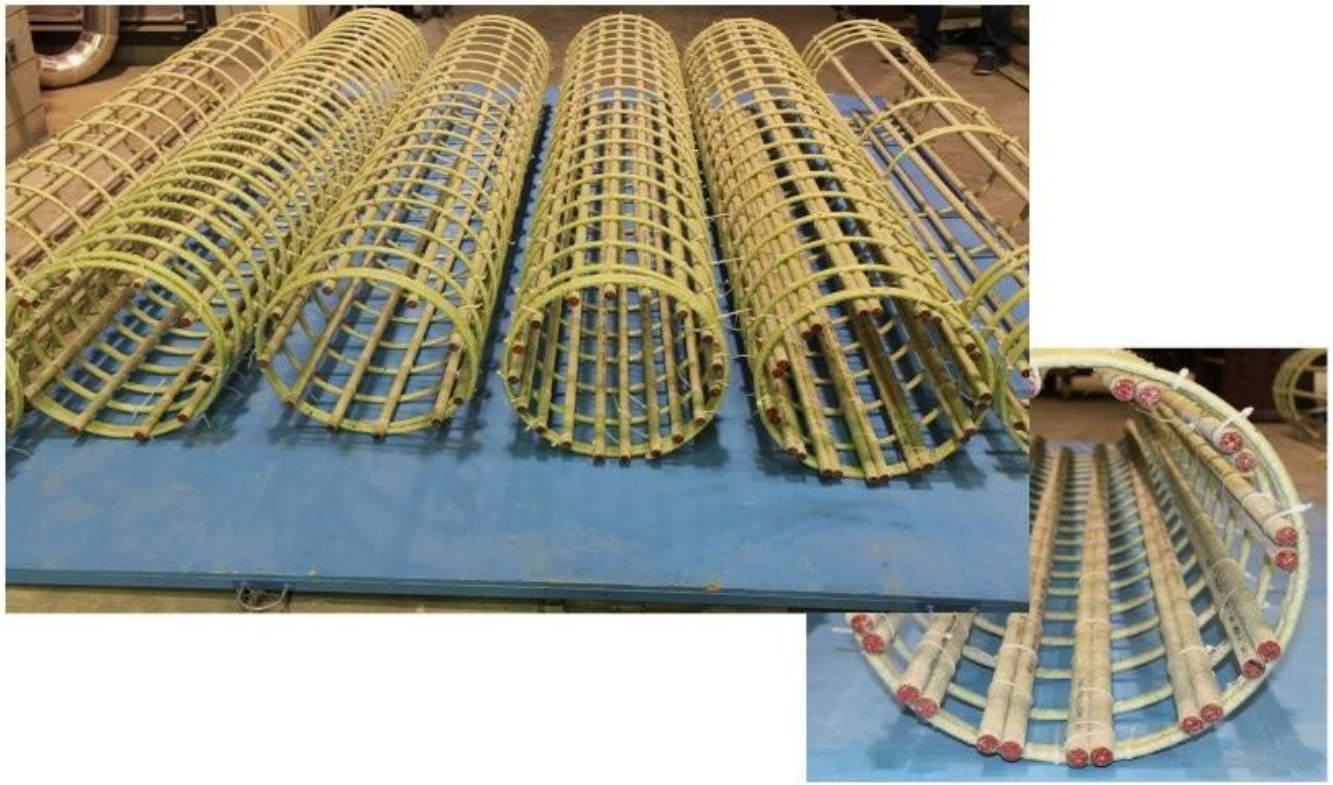
Melbourne Bridge 2005, QC

View of the Completed Bridge

Placement of Glass FRP Bars

NSERC Industrial Research Chair in FRP Reinforcement for Concrete Structures

Project examples



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Future Prospect for Road Transport & Highway Projects

Drains

Crash Barrier

CRCP

Box Culverts

Retaining Walls

Bridge Decks &Barriers

Thank you!
Any questions?

STARK COMPOSITES

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