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**“Vision Zero India: Integrating Safety, Sustainability and Technology in Infra”**

**Rehabilitation of Distressed PSC Girders in Tungabhadra River Bridge using CFRP:**

**A Sustainable and Rapid Strengthening Solution**

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- Introduction
- Problem Statement
- Methodology
- Conclusions
- References

## Challenges of Aging PSC Girders

- ◆ Increasing Traffic Load (ODC/OWC Vehicles)
- ◆ Environmental Deterioration
- ◆ Cracking
- ◆ Spalling
- ◆ Exposed Reinforcement

## Why Traditional Methods Fall Short

- ◆ Section Enlargement
- ◆ Steel Plate Bonding
- ◆ Reconstruction of Super Structure
- ◆ External Prestressing

## The Requirement

- 🕒 Rapid to install
- ✅ Highly durable & corrosion-resistant
- 🍃 Lightweight with minimal structural intervention
- 🚗 Suitable for live traffic conditions
- 💰 Economical

## The Opportunity

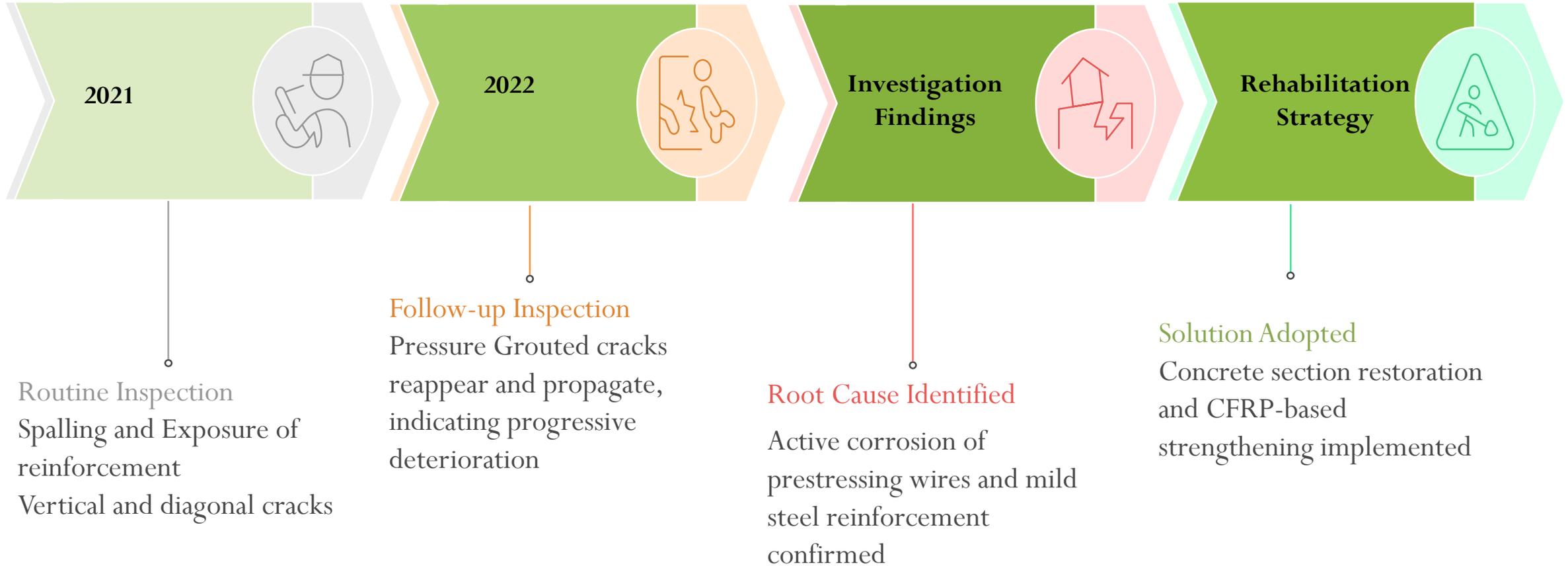
Advanced Composite Systems (e.g. CFRP) provide:

- ◆ Fast application
- ◆ High strength-to-weight ratio
- ◆ Long service life
- ◆ Minimum traffic disruption

Salient Features	
Description	RHS
Span Arrangement	32 x 19.40
Deck Width	8.5 m
Length	620.80
Type of Super Structure	PSC I girder
Type of Sub Structure	RCC Wall type
Bearing Type	Elastomeric
Year of Construction	1957

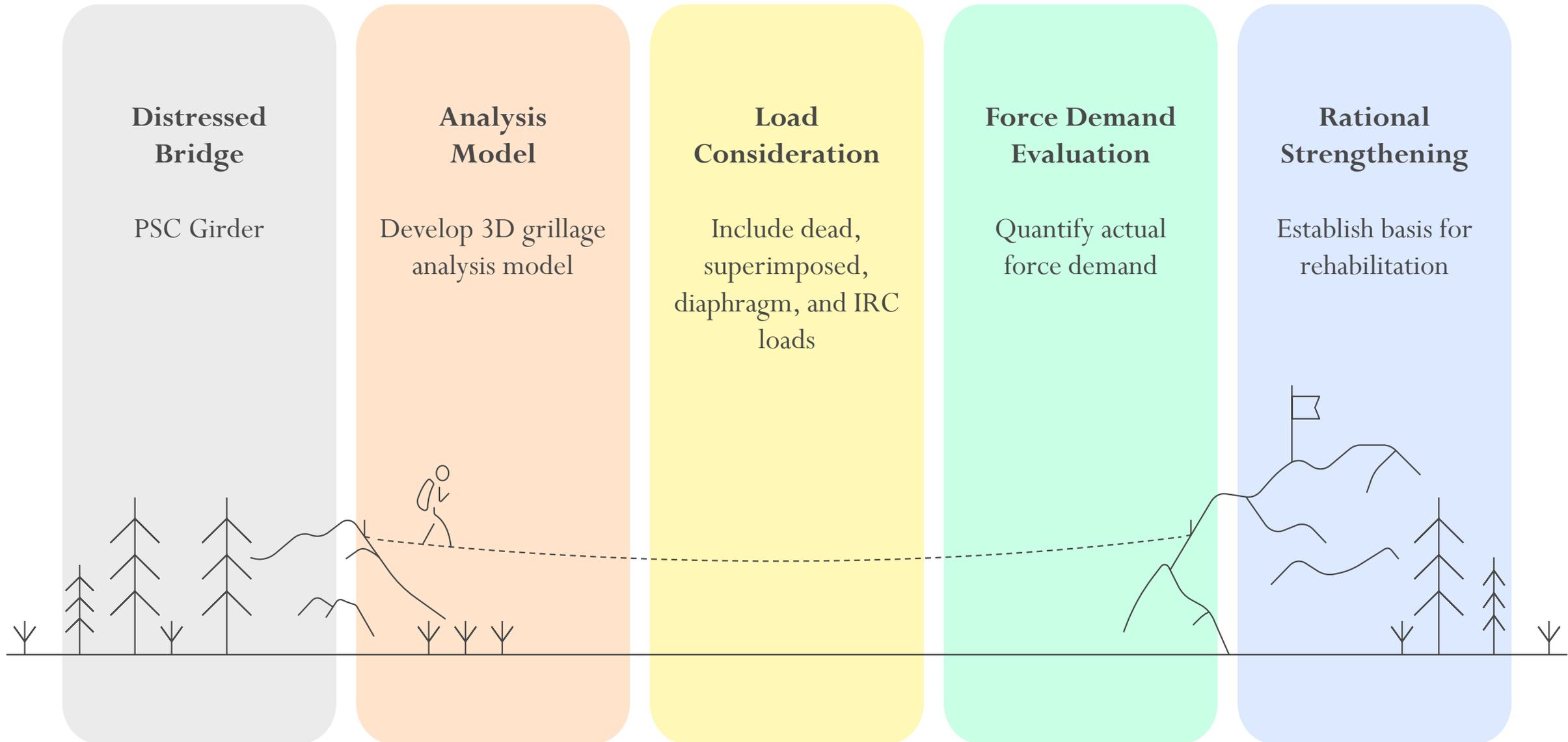


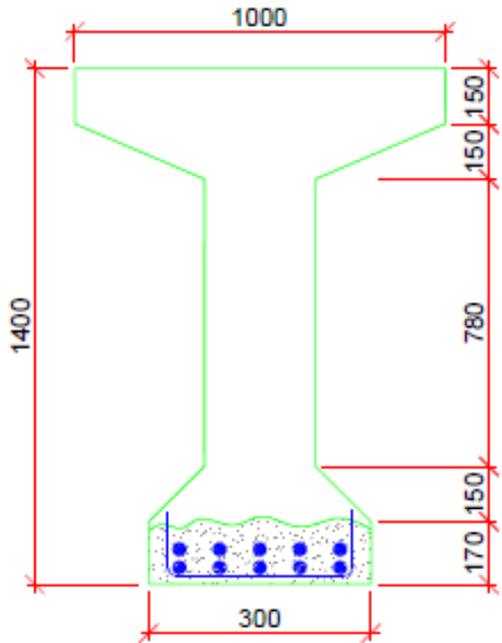
# Observed Distress and Problem Definition



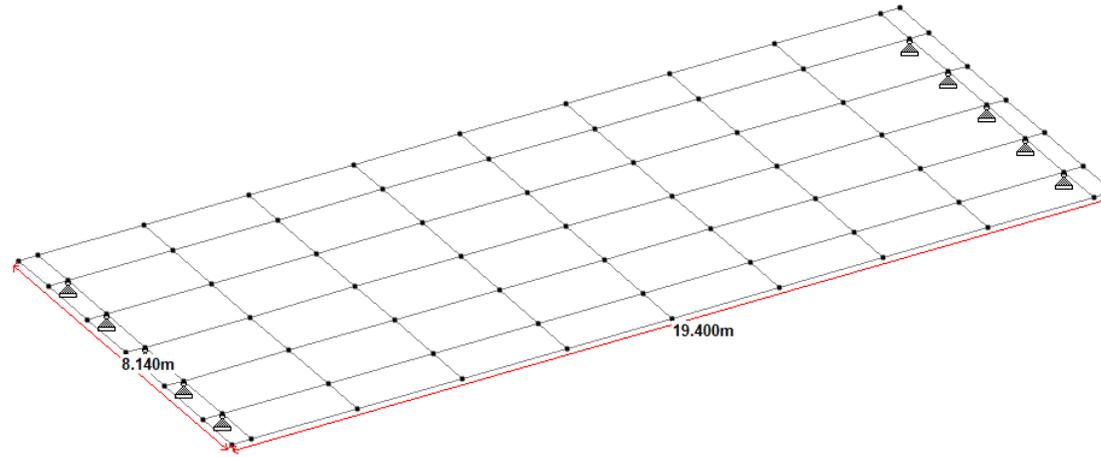


# Bridge Structural Reassessment

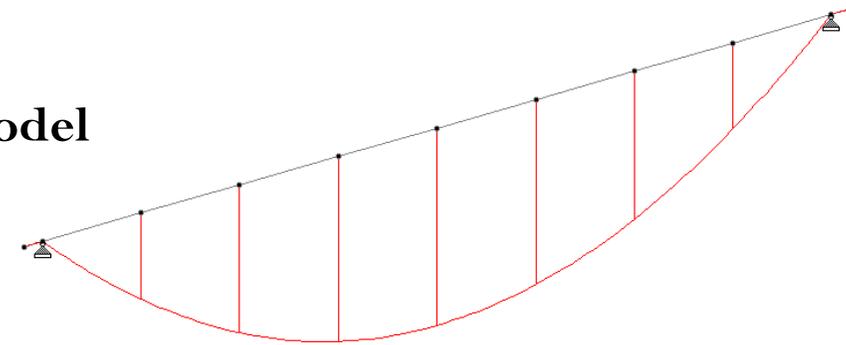




Section



Grillage Model



Load 1 : Bending Z

Postprocessing Workflow

Load : 1: SW

Input Units : kN-m

Bending Moment Diagram

## Carbon Laminates: Sika® CarboDur® LAM CFS

Dimensions of the ply	100 x 3 mm	ASTM D 3039
Laminate tensile strength	3000 N/mm <sup>2</sup>	
Laminate elongation at break in tension	1.5 %	
Laminate modulus of elasticity in tension	165 kN/mm <sup>2</sup>	

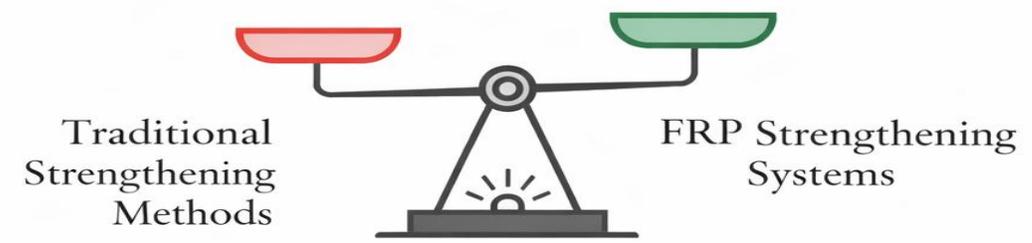
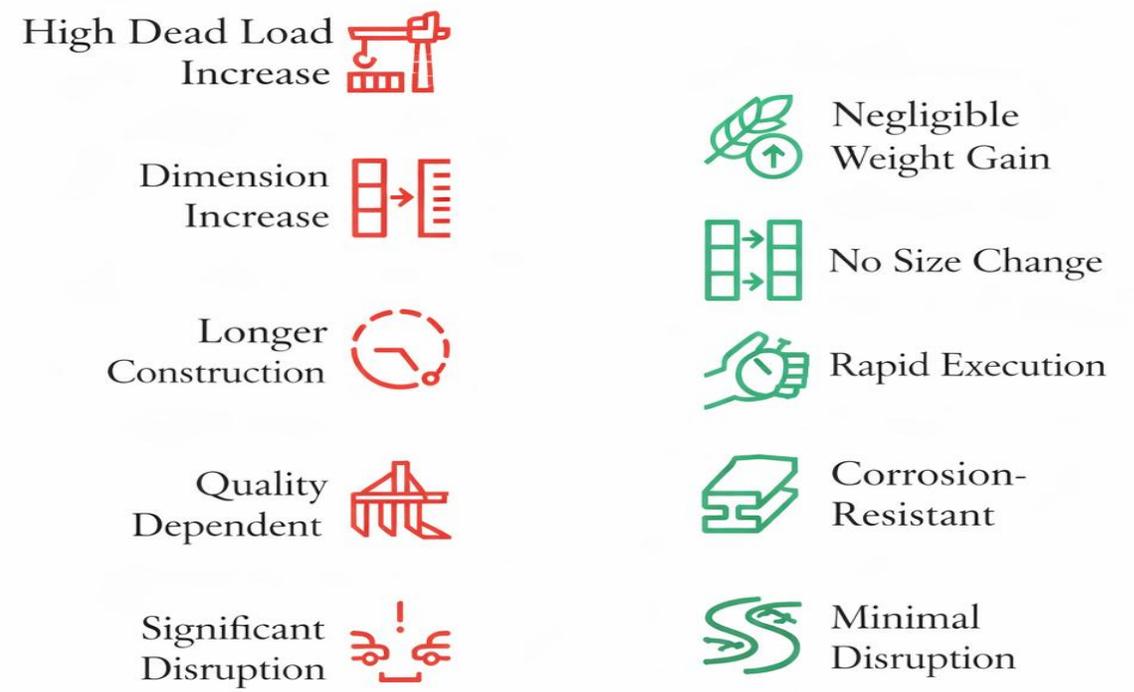


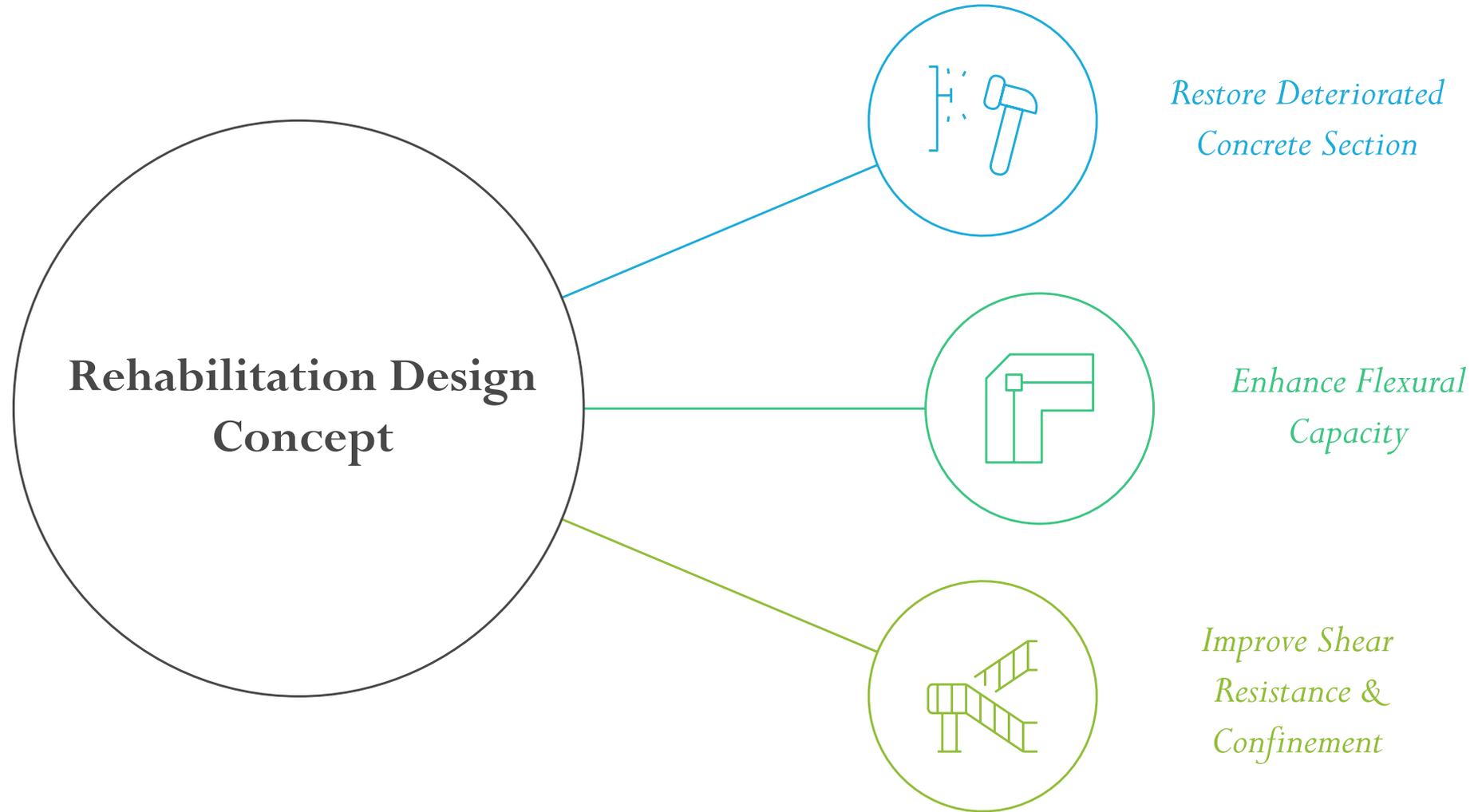
## Carbon fibre fabric: SikaWrap®-451 C IN

Dry fibre tensile strength	4900 N/mm <sup>2</sup>	ISO 10618
Dry fibre modulus of elasticity in tension	250 kN/mm <sup>2</sup>	
Dry fibre elongation at break	2.1 %	
Nominal thickness	0.250 mm	
Nominal cross section	250 mm <sup>2</sup> per m width	

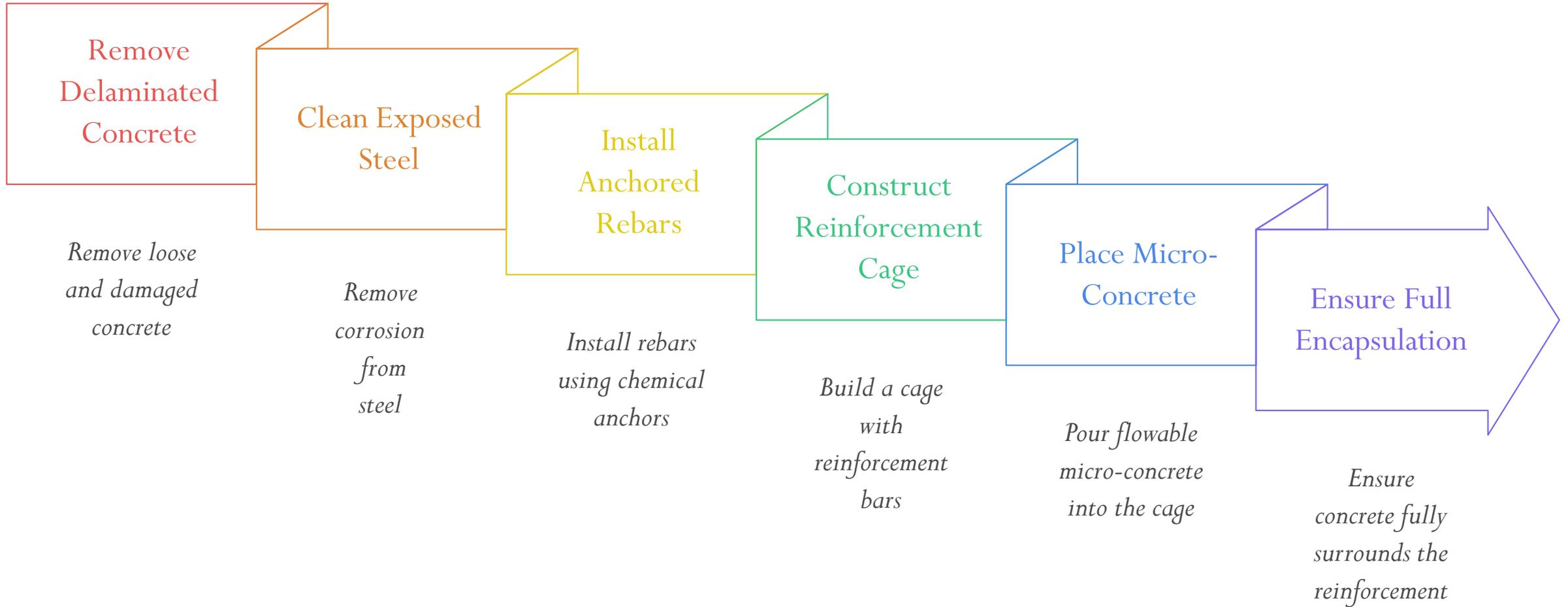


## FRP Systems Offer Superior Strengthening Advantages

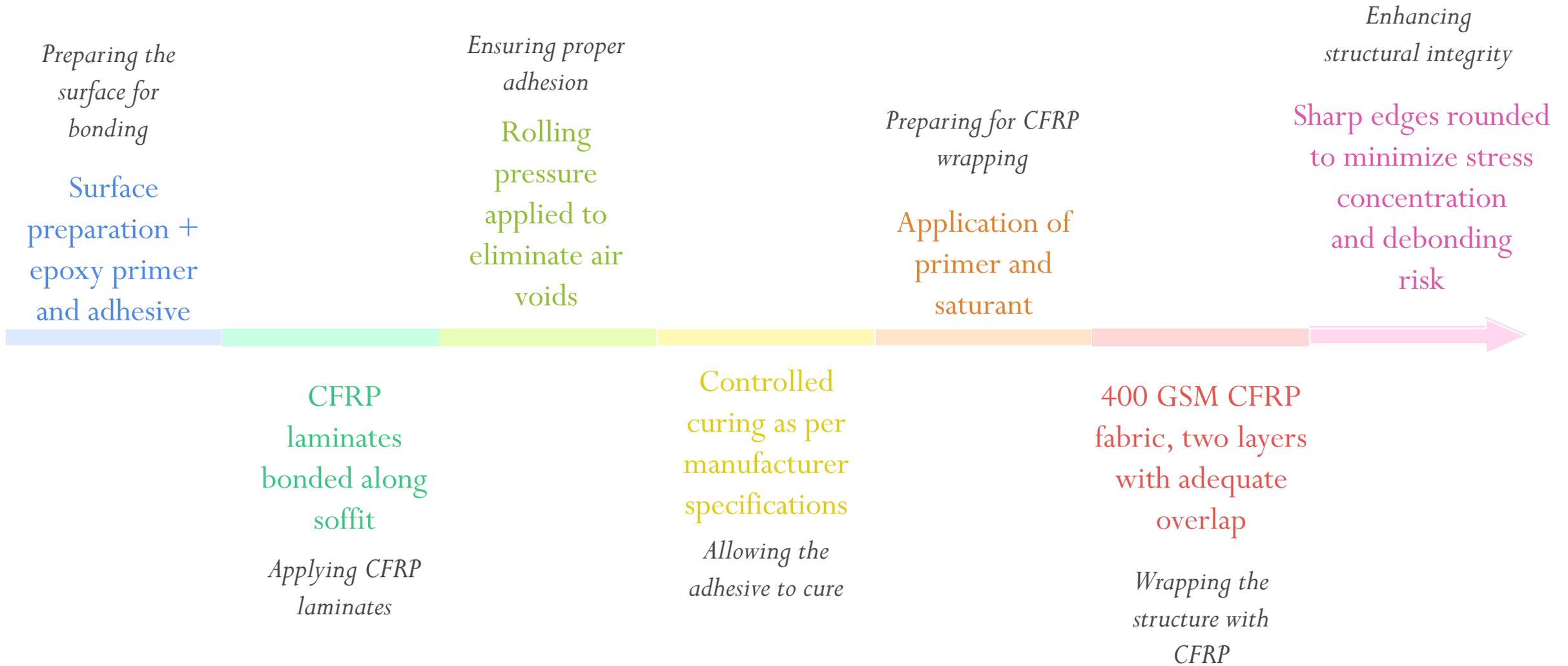




# Strengthening Methodology and Execution Sequence



# Installation of CFRP Laminates and Wraps

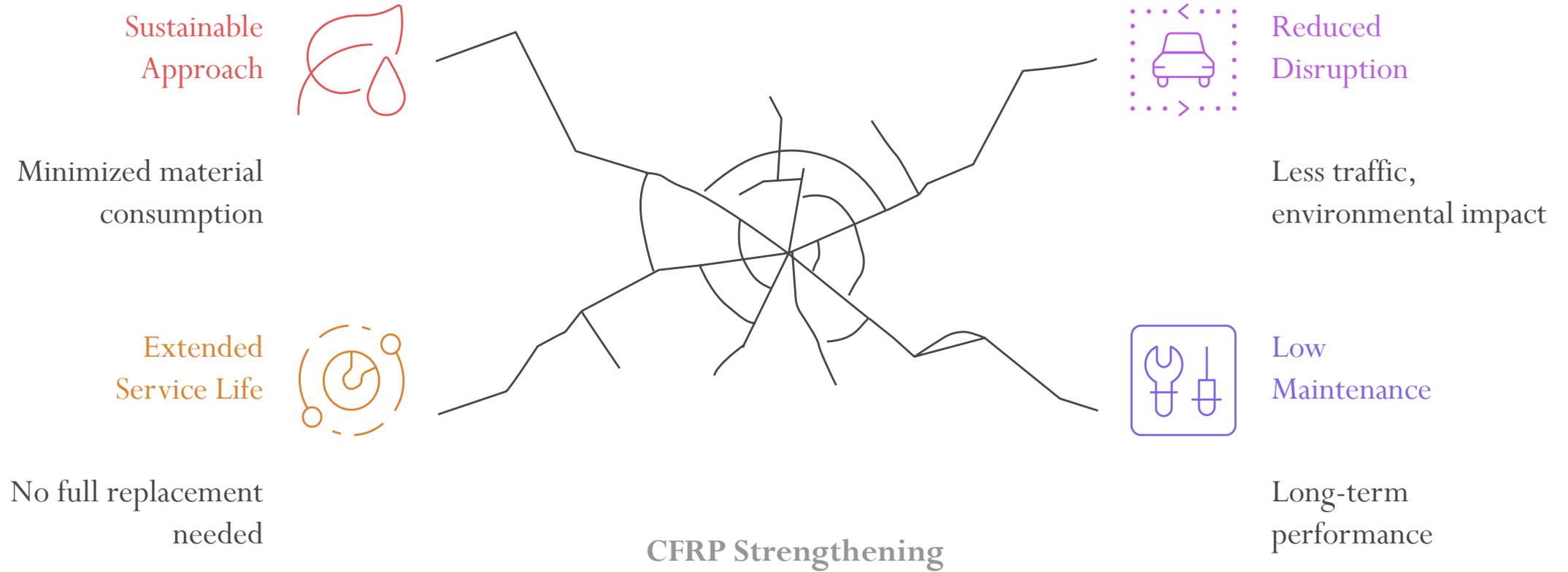




**Installation of CFRP laminates**



**Installation of CFRP wraps**



- [1] IRC:112-2020. Code of Practice for Concrete Road Bridges. Indian Roads Congress.
- [2] ACI Committee 440. ACI 440.2R-17: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures. American Concrete Institute, 2017.
- [3] fib Bulletin 14. Externally Bonded FRP Reinforcement for RC Structures. Fédération internationale du béton, 2001.
- [4] Elsafty, A. (2012). The Repair of Damaged Bridge Girders with Carbon-Fiber Reinforced Polymer (CFRP).

THANK YOU



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