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CASE STUDY · CIVIL ENGINEERING

Retrofitting a 40-Year-Old Road Bridge for Modern Traffic Loads

Engineering assessment and strengthening of an ageing RCC bridge

ORGANISATION District Public Works Division (illustrative)

SECTOR Infrastructure

PREPARED BY Case writer: Your Name

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At a Glance

Organisation	District Public Works Division (illustrative)
Sector	Infrastructure
Location	Central India
Challenge	Cracking, corrosion and higher traffic loads
Solution	Condition survey, carbon-fibre strengthening and bearing replacement
Timeframe	14 months

25+ yrs

–60%

14 mo

Extended service life (design)	Closure time vs rebuild	Project duration
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Organisation and outcomes are illustrative; figures are sample data for teaching and templating purposes.

Background

The bridge is a four-span reinforced concrete structure built about forty years ago over a seasonal river. Traffic volumes and axle loads have increased greatly since it was designed.

Inspections showed cracking in the girders, spalling of concrete and corroded reinforcement in some areas.

The Challenge

Engineers had to decide whether to rebuild or strengthen the bridge, while keeping the route open as much as possible.

- Visible cracks and spalling
- Corroded reinforcement
- Worn-out bearings
- Only one alternative route, much longer

Replacing the bridge would have cut off villages for over a year.

— Executive Engineer (illustrative)

Objectives

1. Assess structural condition accurately.
2. Restore and enhance load capacity.
3. Minimise disruption to traffic.

Approach

The project followed a structured assessment and design process before any repair work.

Phase 1: Condition assessment

Visual inspection, rebound hammer and ultrasonic tests, cover meter surveys and core samples.

- Non-destructive testing
- Core tests

- Load rating analysis

Phase 2: Strengthening design

Engineers designed carbon-fibre reinforced polymer wrapping for girders and repairs for damaged concrete.

- Repair mortar specification
- FRP design
- Bearing replacement plan

Phase 3: Execution

Work was done span by span with one-lane traffic and night closures for bearing replacement.

- Surface preparation
- FRP application
- Jacking and bearing replacement

Implementation Timeline

Period	Milestone	Notes
Month 1–3	Assessment and testing	Report and load rating
Month 4–5	Design and approvals	Drawings and specifications
Month 6–12	Strengthening works	Span by span
Month 13–14	Load test and handover	Monitoring plan

Results

The strengthened bridge passed a load test and returned to full service.

Parameter	Before	After
Load rating (relative)	0.78	1.15
Crack width (max, mm)	0.6	Sealed
Deflection under test load (mm)	—	Within limits
Full closure days	—	9

Exhibit 1: Key metrics before and after (sample data)

Chart placeholder — insert a before/after chart

Exhibit 2: Trend over the implementation period (sample data)

Lessons Learned

Test before deciding. Detailed testing showed the structure could be saved.

Plan traffic carefully. Span-by-span work kept the route open.

Monitor after repair. Sensors and inspections protect the investment.

Analysis

What worked • Accurate testing • Phased execution	What was difficult • Monsoon interruptions • Quality control of FRP
Opportunities • Apply method to other bridges • Digital monitoring	Risks to sustain • Overloaded trucks • Maintenance budgets

Discussion Questions

Use these questions for classroom discussion or self-study.

4. What information is needed to choose between repair and replacement?
5. Why was FRP selected for strengthening?
6. How would you manage traffic during the works?
7. What should the maintenance plan include?

Teaching Note

Suitable for courses in structural engineering, construction management and infrastructure policy.

Appendix: Additional Exhibits

Test	Location	Result
Rebound hammer	Girders	Fair to good
Ultrasonic pulse velocity	Girders	Medium quality
Cover meter	Soffit	Low cover in places
Carbonation depth	Cores	Reached reinforcement in places

Exhibit 3: Test results summary (sample data)

Conclusion

A careful engineering assessment allowed the bridge to be strengthened at lower cost and disruption than replacement.