Europe's Rail

Co-funded by the European Union

Extending the life and capacity of ageing tunnels and bridges

Critical rail infrastructure components include:

Tunnels: smoothing the passage of trains under potential obstacles

Bridges: enabling trains to travel over potential obstacles

THE CHALLENGE

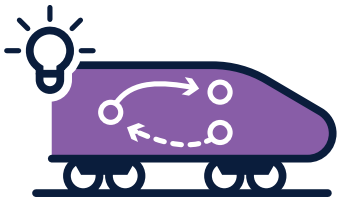
Much of Europe's rail infrastructure is nearing its end of life, and no longer meets today's stringent requirements. On top of this, growing demand for passenger and freight capacity means:

- less time to access bridges and tunnels for inspection and repair → faster deterioration of structures
- in the long run, delayed damage detection → longer, costlier repairs → extensive track closures

Rail must improve the quality of inspections while reducing corrective maintenance costs.

HOW DO WE DO THIS?

By using innovative, sometimes automatic, solutions to proactively assess, repair and upgrade rail infrastructure. Shift2Rail 5 Technical Demonstrators do exactly that, with a focus on long performing tunnels and bridges.



LONG PERFORMING TUNNEL SOLUTIONS

	Tunnel drainage, health, and structural monitoring	Tunnel repair technologies
Description	• Tunnel Substructure Investigation Radar (TSIR) system produces 3-D images of tunnel subsurface morphology • Fibre optics enhance tunnel structural monitoring	• Faster drainage restoration (e.g. long-distance flushing systems, improved pipe materials) • Faster replacement of damaged lining (e.g. 3-D scanning, tailormade spare parts) • Adaptable, tailored lining: fibre reinforced concrete applied by robotic shotcrete technology
Who benefits	Infrastructure managers Railway operators	Infrastructure managers Railway operators

THE BENEFITS OF LONG PERFORMING TUNNEL SOLUTIONS

Easier, faster, higher quality inspections – and repairs – of diverse tunnel types at various stages of deterioration.

LONG PERFORMING BRIDGE SOLUTIONS

	Railway bridge health monitoring	Bridge service capability improvements	High-speed low-cost bridges
Description	• Optical monitoring • Virtual monitoring of critical components for enhanced fatigue capability utilisation • Scour monitoring from train-induced vibrations	• Shear capacity (e.g. shear strengthening technology used on concrete bridges without disrupting traffic) • Fatigue capability • Classification capacity (e.g. a new model determining stresses in bridge components)	A new methodology to estimate damping coefficients in bridges for high-speed trains. Researchers assessed bridges under rapid cyclic loading, and with non-ballasted tracks.
Who benefits	Infrastructure managers	Infrastructure managers Railway operators	Infrastructure managers Railway operators

THE BENEFITS OF LONG PERFORMING BRIDGE SOLUTIONS

- Improved bearing capacity and fatigue capacity
- Extended bridge life, thanks to better fatigue assessment
- Reduced noise and vibrations for train passengers and nearby residents
- Reduced over-engineering and traffic disturbance

The findings also enable:

- better design of future bridges and high-speed trains
- the revision of a European standard for traffic loads on bridges

Did You Know?
These innovations can extend the remaining life of existing bridges by more than **10** years on average

Key Finding
These new technologies can reduce expensive tunnel and bridge inspections by **50%** while improving safety and quality

Fast Fact
The EU rail network includes:

- more than **3 000 km** of tunnels over **1 km** long
- more than **200 000** bridges

Overall, by reducing inspection frequency and complexity, cutting repair times, and automating certain key tasks, these solutions enable, better planning, lower maintenance costs, reduced traffic disturbance, and better working conditions. In short, a more reliable, higher-capacity rail network.

WANT TO LEARN MORE?

rail-research.europa.eu

Solutions developed by Shift2Rail, Europe's Rail's predecessor programme