# National Highways and partners advance muon scanning technology for ageing infrastructure



National Highways, in partnership with the AtkinsRéalis-Jacobs joint venture, is advancing its efforts to address the significant challenge posed by the ageing infrastructure within its strategic road network. Much of this network, originally constructed between the 1950s and 1980s, comprises structures now nearing or exceeding 50 years of age. Faced with the need for increasingly frequent and intensive maintenance interventions, National Highways launched the Structures Moonshot programme in 2023 to explore and develop cutting-edge technologies aimed at enhancing the monitoring and maintenance of these ageing assets.

The initiative was highlighted during a visit by representatives from National Highways, AtkinsRéalis, and technology firm GScan to Tartu, Estonia. There, the collaboration is helping to refine GScan’s innovative technology, which utilises the tracking of muon particles—naturally occurring cosmic radiation that passes harmlessly through structures—to create detailed three-dimensional models of steel and concrete within bridges and viaducts.

Colin George, deputy head of structures at National Highways and project sponsor for the Structures Moonshot, explained the organisation’s context and ambitions: “The reality we face at National Highways is that we have an ageing network and in particular, ageing structures. Most structures on the National Highways network were built in the ‘50s, ‘60s, ‘70s and ‘80s and by the end of this current decade, almost two thirds of our structures will be more than 50 years old.” He further emphasised the value of emerging technology: “If we can understand the condition of our structures better, that means that we can intervene at the optimum time and avoid some of the unplanned closures that cause real problems for road users.”

GScan’s technology tracks the scattering and absorption of muons as they pass through concrete and steel, allowing for the non-destructive assessment of internal features such as post-tensioned steel corrosion and voids. Initial trials have demonstrated the technology’s capability to produce 3D images of internal structural components. Chris Mundell, technical director at AtkinsRéalis, overseeing the project on behalf of National Highways, described the progress: “We have 3D images of the concrete and the steel strands themselves. We could actually start to see the tendons within the concrete. It is incredibly exciting for us to start to see the level of detail the technology is giving.”

Phase two of the project involved testing the technology on a specially constructed beam embedded with various post-tensioning methods and known defects. This controlled environment allowed the GScan team to refine their scanning capabilities, resulting in the ability to detect individual wires within the steel strands, as well as discern different reinforcement placements and material densities.

The current GScan scanners resemble large, pool table-sized boxes that can be installed permanently on or near structures to continuously gather data with minimal human intervention. Sander Sein, GScan project manager and civil engineering PhD, detailed the technology’s functionality: “We use insulating fibre, so the fibre reacts to each muon, emitting a small flash of light when the muon passes through it. And to be intensely accurate, we have 10 miles of fibres inside each single scanner.” The data is then processed by advanced software that reconstructs muon trajectories and applies object detection and classification to interpret the scanned materials.

On the collaborative approach underpinning the project, GScan co-founder Andi Hektor spoke of the value of National Highways’ client-led development method. He said, “Money is important, but it isn’t just about finding the money to do it. It’s about making the thing you’re building into something practical that clients will be able to use... With Moonshot, we have been able to do things very differently... They’ve consulted with us all the way through, making sure we know the challenges they face in detail, and what would be most valuable and practical for us to develop for them.”

The Structures Moonshot programme is working with multiple emerging technologies, promoting open collaboration and the potential for transformative impacts on how infrastructure is monitored and maintained in the future. The ongoing partnership between National Highways, AtkinsRéalis-Jacobs, and innovators like GScan exemplifies this pragmatic, technology-driven approach to managing ageing infrastructure assets.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

1. <https://www.newcivilengineer.com/latest/new-tech-uses-cosmic-rays-to-detail-structural-integrity-of-infrastructure-15-02-2024/> - This article discusses GScan's development of scanning technology using cosmic rays to assess the structural integrity of infrastructure, corroborating the use of muon tracking technology in the Structures Moonshot programme.
2. <https://www.newcivilengineer.com/latest/national-highways-harnesses-cosmic-rays-to-inspect-abandoned-scots-railway-tunnel-09-11-2022/> - This piece highlights National Highways' use of cosmic ray technology to inspect the Balgray Tunnel, demonstrating the application of muon imaging in infrastructure assessment.
3. <https://www.theengineer.co.uk/content/news/project-will-utilise-muons-to-assess-aging-infrastructure/> - This article details a project funded by the Science and Technology Facilities Council to develop muon-based methods for assessing aging infrastructure, supporting the use of muon tracking in the Structures Moonshot programme.
4. <https://www.bindt.org/News/january-2025/cosmic-ray-measurements-could-help-extend-lifespan-of-uk-bridges/> - This news piece discusses the University of Glasgow's initiative to use cosmic rays for assessing the structural integrity of UK bridges, aligning with the objectives of the Structures Moonshot programme.
5. <https://nationalhighways.co.uk/our-work/innovation-and-research/news/finding-pioneering-ways-to-take-care-of-bridges/> - This article outlines National Highways' Structures Moonshot programme, highlighting their collaboration with AtkinsRéalis-Jacobs and GScan to develop innovative technologies for monitoring and maintaining aging infrastructure.
6. <https://www.worldhighways.com/wh10/news/nuclear-technology-can-provide-structural-assessments> - This piece discusses how GScan's technology, developed for the nuclear industry, can be applied to assess the structural conditions of tunnels and bridges, supporting the use of muon tracking in infrastructure assessment.
7. <https://www.newcivilengineer.com/in-depth/national-highways-drives-forward-muon-scanning-for-bridge-inspections-30-04-2025/> - Please view link - unable to able to access data