Innovate UK

FOAK 2026 Winners

Challenge 1:
Safe Concurrent High-Speed Rail Installation in Constrained Environments

Application number	10203402
Title	ZoneWarden: Safe Concurrent Working in Constrained Rail Environments
Organisation	EARTEX LTD
Public Description	ZoneWarden is a wearable safety system that helps people work safely alongside each other, and alongside heavy plant, in the tight, crowded spaces of modern railway construction, such as tunnels and restricted access corridors. On big rail programmes, many contractors must often work in the same confined area at the same time to keep to schedule. That raises the risk of dangerous interactions: a person stepping too close to moving plant or a lift, someone entering an area they are not trained or authorised for, or a fatigued worker near a high-hazard activity. Today these risks are managed mainly by supervision and by keeping teams apart, which limits how much work can safely happen at once. ZoneWarden, developed by UK company Eave, brings three things together in real time and on one device worn by each worker: * how tired or over-exposed (to noise, dust or vibration) that person is; * exactly where they are in relation to plant, lifting operations and hazardous zones; and * whether they are trained and authorised to be there. It combines these into a single, live safety picture and warns the worker, through a gentle buzz on the wrist and an audible alert, before a dangerous situation develops, while giving supervisors a shared view of the whole work area. Crucially, it uses a wireless "mesh" network and precise indoor-positioning technology, so it keeps working deep underground where GPS and mobile signal do not reach, exactly where camera- and satellite-based systems fail. During this project, Eave will build ZoneWarden from technology already proven on UK railways, then demonstrate and trial it at a representative high-speed rail construction site, measuring the safety and productivity improvement it delivers. The goal is a ready-to-adopt system that lets the railway build faster and more safely at the same time.

Application number	10203730
Title	TunnelGuard: A Ground-Air Robotic Safety Twin for HS2 Construction
Organisation	DISTRIBUTED ANALYTICS SOLUTIONS LTD
Public Description	This project, TunnelGuard, will develop and demonstrate a robotic sensing system to improve safety and coordination in complex railway construction environments. TunnelGuard combines ground robots and aerial drones to monitor active worksites, identify temporary hazards, check access constraints, and support safer handovers between teams. The system will create a live operational picture of the worksite and convert this information into green, amber, and red micro-zones; helping supervisors understand where work can continue safely, where restrictions are needed, and where intervention may be required. The project will focus on representative HS2 tunnel construction scenarios, where multiple contractors, plant, materials and access routes must be managed in constrained spaces. By supporting safer concurrent working and faster coordination decisions, our project aims to reduce delays, improve productivity, and provide a practical route towards future adoption in railway construction.

Application number	10208155
Title	GeoShield
Organisation	GEOSPATIAL VENTURES LIMITED
Public Description	**GeoShield -- Resilient Geofencing and Operational Intelligence for Infrastructure** GeoShield is a next-generation safety and operational intelligence platform designed to improve safety, productivity and situational awareness across rail and critical infrastructure projects. Developed by Geospatial Ventures Limited (GVL), GeoShield builds on our proven Fix-One positioning technology to provide trusted, real-time awareness of workers, vehicles, plant and operational activities in complex environments. The platform combines high-accuracy positioning, resilient navigation technologies, AI-enabled visual verification and dynamic geofencing within a single integrated solution. Unlike conventional geofencing systems that rely primarily on satellite positioning and proximity alerts, GeoShield incorporates multiple complementary technologies, including GNSS, e-Loran, inertial sensors, Low Earth Orbit (LEO) positioning services and AI-enabled cameras. This creates a unique Position Integrity capability that helps maintain trusted location information even where satellite signals are degraded, obstructed or unavailable. GeoShield is designed to support safer concurrent working, improve coordination between contractors and plant operators, and provide infrastructure owners with greater visibility of site activities in real time. By combining positioning, visual assurance and operational intelligence, the platform helps reduce safety risks, minimise disruption and support better-informed operational decisions. The project will deliver and validate a TRL 7 operational demonstrator, proving the technology in a representative infrastructure environment and creating a clear pathway to commercial deployment. While initially focused on rail infrastructure, GeoShield has applications across construction, utilities, highways, ports, energy and other critical infrastructure sectors. The technology supports the growing need for safer, smarter and more resilient infrastructure operations while aligning with national priorities around infrastructure productivity, worker safety and resilient Position, Navigation and Timing (PNT). GeoShield represents the next evolution of geofencing---moving beyond simple location tracking to deliver trusted operational intelligence, resilient positioning and enhanced situational awareness for the infrastructure projects of tomorrow.

Challenge 2:
UK Dark Skies - Drone Operations BVLOS

Application number	10206900
Title	ProAgentic-SDS — Sentry Dark Skies Airspace Awareness for Rail BVLOS Operations
Organisation	PROAPTUS LTD
Public Description	Network Rail is expanding beyond-visual-line-of-sight (BVLOS) drone inspection to reduce the risk, delay and cost of sending people onto or near the railway. Routine BVLOS operation needs awareness of low-level aircraft and drones that may not announce themselves electronically. Current cooperative systems help manage known traffic, but they do not by themselves detect every non-cooperative airspace user near a rail corridor. ProAgentic-SDS, developed by Proaptus Ltd, is a distributed artificial-intelligence airspace-awareness system for rail BVLOS operations. Compact units placed beside the railway use passive radio/radar evidence and supporting observations from the local environment. Edge AI models tuned to each site interpret the evidence and neighbouring units cooperate when the signal is uncertain. The system then produces an operational cue: something is likely present, in this sector or uncertainty band, with this confidence, motion/persistence evidence and relevance to the planned drone route. The system is designed to feed DroneCloud/UTM and operator workflows alongside C2, RTK and LTE, not replace them. It is not a weapon, counter-drone system or certified autonomous detect-and-avoid product. It builds on Proaptus's Sentry background in distributed sensing, edge AI and rail innovation, adding new methods for site-specific airspace interpretation and corridor-level confidence. The seven-month project will build a five-node demonstrator, calibrate it at an aviation-rich reference site, and validate it with rail-site/integration support in a representative railway environment using controlled, permitted drone flights against known truth. Railway stakeholders will be invited to observe. Objective measurements will show detection performance, cue latency, false-candidate behaviour, route-conflict relevance and operator usefulness. The intended benefit is a safer and more affordable route to scaling railway drone inspection, with future potential across other linear infrastructure such as highways, utilities and ports.

Application number	10207961
Title	CORSAIR — Corridor Oversight Radar Surveillance and Airspace Integration for Rail
Organisation	DIGITAL & FUTURE TECHNOLOGIES LIMITED
Public Description	Project CORSAIR addresses a critical gap in the UK's low-level airspace: the inability to safely detect and deconflict drone operations with other airspace users along railway corridors, preventing the routine BVLOS drone inspections that Network Rail needs to maintain 20,000 miles of track efficiently and cost-effectively. The scale of this problem is significant: Network Rail operates over 20,000 route miles, with inspection backlogs directly contributing to delayed fault identification and increased maintenance costs. Current drone operations rely on cooperative traffic --- aircraft broadcasting their position electronically. Non-cooperative airspace users, whether light aircraft operating below the transponder mandate or drones not broadcasting Remote ID, are invisible to existing systems. This blind spot prevents the CAA from authorising routine BVLOS operations at scale along railway corridors. The UK's Strategic Oversight of Non-Cooperative Intelligence framework has formally identified non-cooperative detection as the single highest-priority barrier to safe BVLOS expansion, placing the CORSAIR capability at the centre of national airspace policy development. CORSAIR deploys three integrated layers to resolve this. A radar-led surveillance platform detects all airspace users regardless of cooperative status, fusing radar contacts with optical camera confirmation and outputting detection data to the Drone Cloud UTM platform used by Network Rail for approved BVLOS operations. An aviation communications system developed under a European Space Agency project provides the remote pilot with licensed VHF air-ground radio capability, integrating BVLOS drone operations into the shared aviation voice environment for the first time --- allowing the remote pilot to hear and communicate with other airspace users exactly as a manned pilot would. A panoramic multi-sensor camera array provides persistent 360-degree sky awareness throughout operations. The demonstration is conducted at Carnforth railway yard on the West Coast Main Line --- a site that provides active mainline railway conditions, operational steam traction that tests optical sensor performance in obscuration conditions, and a location within the CAA's defined Atypical Air Environment framework for railway corridor drone operations. All VLOS operations are conducted by D&F Tech under its existing CAA operational authorisation. The project generates real-world surveillance data and communications performance evidence during the CAA's live UTM regulatory consultation, contributing directly to the framework that will govern UK BVLOS operations at scale. Commercially, the validated CORSAIR architecture provides Network Rail, train operating companies, and railway infrastructure contractors with a deployable, standards-compliant airspace integration system that accelerates the transition to routine BVLOS inspection operations across the national rail network.

Application number	10205391
Title	VISTA - Visibility & Integrated Situational Tracking of Airspace
Organisation	ADJSOFT LIMITED
Public Description	Britain's skies are well monitored at the altitudes used by traditional aviation, but the low-level airspace where drones fly is largely invisible to today's radar and tracking systems. This project builds a working demonstration that "lights up" that low airspace for the railway, combining proven, sovereign UK-developed detection hardware, precise satellite positioning and a secure, reliable communications link into a single picture used to manage drone flights safely. It will show how Network Rail could inspect infrastructure and reactively manage incidents using drones flown beyond the operator's line of sight, safely sharing the sky with other aircraft, and provide a costed blueprint for rolling the capability out across the national network.

Challenge 3:
Improving Customer Experience in Isolated Spaces

Application number	10204510
Title	Not Alone: AI-assisted reassurance for isolated transport spaces
Organisation	SENSING FEELING LIMITED
Public Description	**Not Alone** will develop a privacy-preserving AI safety-and-reassurance system for isolated rail and interchange spaces such as unstaffed stations, platform shelters, underpasses, lifts, bike stores and bus/rail waiting areas. The project will combine visual sensing, acoustic/event sensing and edge-AI to help operators identify situations where customers may be alone, vulnerable or at risk, then trigger proportionate reassurance, support or escalation. The system is designed to improve customer confidence without facial recognition, biometric identification, speech analysis or default transmission of raw media.

Application number	10207493
Title	AccessRail Assist: AI-Enabled Passenger Assistance and Safety for Isolated Railway Environments
Organisation	University of Huddersfield
Public Description	AccessRail Assist is an AI-powered passenger assistance and safety platform designed to improve customer experience, accessibility, and passenger confidence within isolated and unstaffed railway environments by making better use of existing CCTV and station infrastructure. The project supports passengers with disabilities and reduced mobility, including wheelchair users, passengers using walking aids, elderly passengers, and other vulnerable rail users. Using computer vision and edge AI, the system identifies situations where passengers encounter accessibility barriers and automatically provides timely assistance through existing station systems. For example, if a wheelchair user approaches a staircase, nearby digital signage can direct them towards the nearest lift or step-free route, enabling safer and more independent journeys without requiring on-site staff. AccessRail Assist also creates more reassuring station environments by identifying accessibility hazards, safety-related incidents, and inappropriate behaviour that may affect vulnerable passengers, including women travelling alone. When required, the system can trigger proportionate responses using existing infrastructure, including digital signage messages, audio announcements, enhanced lighting, and notifications to remote CCTV operators or safety control centres, supporting rapid intervention even within unstaffed stations. The platform also provides intelligent evidence capture by automatically preserving relevant CCTV footage associated with incidents or operational events, reducing the time required to locate and review recordings and improving operational response. Unlike traditional CCTV systems designed primarily for surveillance and post-incident investigation, AccessRail Assist transforms existing infrastructure into a proactive passenger assistance and safety solution. By combining accessibility support, remote interventions, and intelligent evidence capture within a single integrated platform, the project demonstrates how existing railway technology can create more inclusive, safer, and easier-to-navigate stations while requiring minimal additional infrastructure investment across the UK rail network.

Application number	10204346
Title	StationGuard: Acoustic and Visual AI to Detect, Deter, Delay and Escalate Railway Infrastructure Crime
Organisation	INNOVATION FACTORY LIMITED
Public Description	**StationGuard responds directly to Challenge 3** by improving customer experience and safety in isolated, unstaffed railway station environments. Areas such as underpasses, waiting shelters, lifts, ticket machine zones, cycle storage facilities and station access routes can become hotspots for graffiti, vandalism, cable theft, trespass and anti-social behaviour, particularly during periods of low footfall. These incidents damage railway assets and make passengers feel unsafe and unsupported. Rail operators therefore need solutions that provide reassurance, enable intervention and deter inappropriate behaviour before damage occurs. Current approaches such as CCTV, help points and security patrols all provide valuable support but are largely reactive. CCTV captures evidence but depends on operators identifying incidents and coordinating responses. Help points rely on passengers reporting concerns, while patrols can only cover limited locations. As a result, incidents are often detected only after damage has occurred. StationGuard addresses this challenge through a proactive infrastructure protection platform that Detects, Deters, Delays and Escalates incidents in real time. The project combines acoustic AI, computer vision, thermal imaging and behavioural deterrence within a single autonomous, battery-powered edge device. Unlike traditional CCTV analytics, which rely mainly on visual monitoring, StationGuard continuously analyses sound and visual information locally on the device, enabling rapid identification of suspicious activity without constant monitoring or high-bandwidth communications. A key innovation is the fusion of acoustic and visual AI to improve detection confidence and substantially reduce false alarms. The system identifies indicators of graffiti vandalism, cable theft, trespass, asset tampering and anti-social behaviour, including aerosol spray sounds, cutting tools, impacts against infrastructure, suspicious loitering and unauthorised access attempts. Following verification, StationGuard automatically deploys context-aware deterrence responses, including realistic human voice announcements, police-style warnings, sirens, dog barking sounds and flashing blue and white visual alarms. These responses influence offender behaviour, increase the perceived risk of detection and encourage offenders to abandon their activity. The system captures evidence and generates real-time alerts via a secure cloud dashboard, supporting operator intervention and existing escalation processes. Innovation Factory Limited is a UK-based AI technology SME specialising in edge-AI acoustic sensing, computer vision and autonomous monitoring systems. The company has delivered projects with Network Rail, LNER and Irish Rail, achieving more than

20,000 successful deterrence events in operational railway environments. The FOAK26 project will validate twenty StationGuard units in live railway environments, demonstrating a scalable, practical, market-ready solution that improves passenger confidence, enhances safety, and reduces vandalism and anti-social behaviour rail-wide.

Application number	10206325
Title	Station Guardian
Organisation	PURPLE TRANSFORM LIMITED
Public Description	Rail stations can feel unsafe. For women travelling alone - at night, at unstaffed stations, or in isolated areas such as platform shelters, underpasses, and lifts - the risk of harassment, intimidation, and violence is both real and under-addressed. Despite extensive CCTV coverage across the UK network, existing systems capture incidents but cannot understand them, intervene in real time, or learn from patterns in what they see. SIYTE Station Guardian changes this. Station Guardian is an AI-powered passenger safety system that transforms the CCTV cameras already installed at rail stations into an active, intelligent safety layer - with a specific focus on preventing violence against women and girls (VAWG) on station platforms. Guardian works in three stages. At the edge - on or near the camera itself - lightweight AI models continuously scan platform scenes, looking for the behaviours associated with VAWG risk: persistent following, encroachment on personal space, intimidatory confrontation. When a scene is flagged, a Vision Language Model (VLM) in the cloud analyses the images and describes what is happening in plain English, giving a human operator the context they need to act. The operator can then issue a targeted tannoy announcement - designed using the evidence base for effective remote audio challenge - or escalate to British Transport Police. Critically, Guardian is built to prevent incidents, not just respond to them. By learning to recognise the antecedent behaviours that typically precede a VAWG incident - persistent following, gradual encroachment - the system enables operators to intervene before a situation escalates. Over time, it builds a strategic intelligence picture: identifying hotspots, peak risk times, and recurring patterns that operators can use to target resources and address systemic issues. The project is being developed with the Docklands Light Railway (DLR) and the Northern Rail Partnership, both of whom have confirmed their support and will host live demonstrations. The AI models will be trained using British Transport Police's officer training methodology for identifying VAWG risk - ensuring that Station Guardian learns to recognise the same warning signs as experienced officers. Station Guardian also integrates with Safest Way, a wayfinding application that helps passengers plan the safest onward route from the station - prioritising well-lit, CCTV-monitored paths - extending support for a passenger's journey from the platform to the destination. No comparable system exists. Station Guardian is a First-of-a-Kind innovation: the first integrated, AI-powered VAWG safety platform purpose-built for the rail station environment, designed to scale cost-effectively across the UK network and beyond.

Challenge 4:
Digital Hazard Log

Application number	10203420
Title	HazWatch
Organisation	DIGITAL TRANSIT LIMITED
Public Description	HazWatch is a project to improve how railway hazard logs are created, managed, reviewed and reused using modern digital and artificial intelligence technologies. Hazard logs are an important part of railway safety management, but they are often maintained using spreadsheets and disconnected systems, making safety information difficult to trace and reuse between projects, operators and maintainers. The project will develop a working demonstrator that transforms hazard logs into a searchable digital system linked to railway assets, operational conditions, safety controls, assumptions and previous project experience. The demonstrator will be built around a live railway asset scenario, showing how safety knowledge can be connected and updated across the full asset lifecycle, from design through operation to future upgrades. HazWatch uses Large Language Models and AI techniques to help competent engineers identify similar historic hazards, suggest draft hazard information, highlight gaps and improve the quality of safety evidence. The system is intended to support engineering judgement, not replace it. The project builds on previous AI and railway safety work delivered with Network Rail. It is led by Digital Transit Limited, with specialist support from the University of Huddersfield Institute of Railway Research.

Application number	10203632
Title	LANTERN: Data-Driven AI and Machine-Learning Framework for Transforming Static Rail and Transport Hazard Logs into Reusable, Traceable Safety Assurance Intelligence
Organisation	BASILICON GLOBAL LIMITED
Public Description	**_LANTERN_ will demonstrate how data, artificial intelligence and machine-learning methods can make rail and transport hazard logs easier to use, review and reuse in representative operating conditions.** Hazard logs record potential risks, causes, controls, assumptions and evidence during transport projects. They support safety assurance by helping teams understand how risks are identified, managed, reviewed and transferred across the asset lifecycle. In practice, however, many hazard logs remain static project records, held in spreadsheets, documents or separate systems. This makes them difficult to search, compare with earlier work, or reuse when similar assets, designs or delivery contexts appear on later schemes. _LANTERN_ will build on a RIRL5+ prototype capability and progress it through a market-readiness demonstration with Deltanext as integration supporter. The project will use an operationally representative digital rail assurance environment to test how selected hazard-log and assurance information can be converted into linked, traceable safety knowledge. The system will connect hazards with assets, causes, consequences, mitigations, assumptions, constraints, evidence, review status and ownership. Artificial intelligence and machine-learning methods will be used in bounded and human-reviewed ways. They will support structuring of records, semantic retrieval, similarity search, identification of incomplete fields and traceability between hazards, controls and evidence. _LANTERN_ will not automate safety approvals, replace duty-holder responsibilities or substitute professional judgement. Instead, it will help competent safety and assurance professionals navigate existing records faster, understand why suggestions have been made, and preserve accountability through provenance and audit trails. The project will include baseline testing, controlled demonstrator validation, a representative trial and a rail-industry demonstration event. Evaluation will compare _LANTERN_-supported tasks with current spreadsheet and document-based workflows, using objective measures such as retrieval time, expert-validated similarity precision, completeness of audit trails, visibility of missing evidence and user acceptance. This will provide practical evidence of deployment readiness rather than a purely theoretical assessment. **If successful, _LANTERN_ will provide a route towards a configurable digital safety-assurance service for railway infrastructure owners, operators, delivery alliances, engineering consultancies and assurance teams.** The commercial value lies in helping customers extract more benefit from hazard-log information they already produce,

reduce duplication, improve traceability and preserve learning between projects. It will also support clearer assurance reviews when teams inherit historic records from earlier project stages, suppliers or asset contexts. Longer term, the approach could be extended to other transport and infrastructure sectors where safety evidence reuse, assurance transparency and controlled AI-supported knowledge management are recurring operational needs.

Application number	10203837
Title	Challenge 4 - Digital Hazard Log. Stakeholders Network Rail, Southern Renewals Enterprise
Organisation	AUTOMATEX LTD
Public Description	AutomateX is delivering a first-of-a-kind digital hazard log for the railway, funded by Innovate UK and developed to answer the Digital Hazard Log challenge set by Southern Renewals Enterprise and Network Rail under the First of a Kind 2026 programme. Rail safety today depends on hazard knowledge that is hard to build, easy to lose, and rarely reused. This project changes that. We are creating an intelligent, connected hazard log that turns safety analysis into a living asset, one that stays useful long after a project ends and grows more valuable with every project that uses it. It also helps the railway move from reacting to safety problems to predicting and preventing them, alerting the right people to a risk before it becomes an incident, in step with Network Rail's drive to use technology to keep people safe and off the track. The benefit will reach the whole rail industry. Safer, better-informed decisions, made faster. Hard-won safety knowledge preserved and shared, rather than rebuilt from scratch. A more efficient and consistent approach to managing risk across the UK rail network. And by taking on the slow, manual work, it gives skilled engineers their time back for the judgement only they can bring, the very shift Great British Railways' AI Action Plan calls for in freeing people to apply their judgement and experience where it matters most. This is rail domain expertise meeting applied AI, built with the people who do this work every day. It points to a future where the railway learns from itself, compounding the knowledge and expertise live in it, and saving people time so they can spend them somewhere and help them make better decisions.

Challenge 5:
Scour Risks to Structures

Application number	10206136
Title	B-PRISM: Bridge Portfolio Response Intelligence for Scour Management
Organisation	University of Surrey
Public Description	B-PRISM (Bridge Portfolio Response Intelligence for Scour Management) is a novel approach for assessing scour-related risks in railway bridges without intrusive investigation. Scour occurs when flowing water removes material from around bridge foundations. It has been one of the leading causes of bridge failures worldwide and is becoming an increasing challenge as extreme weather events become more frequent and severe. Network Rail (NR) manages thousands of bridges over or near watercourses, many of which require ongoing monitoring and assessment to ensure their continued safety and reliability. Current approaches to understanding whether and how scour is affecting bridge's structural performance can require costly investigations, specialist access arrangements and significant engineering effort. While new technologies are improving the ability to detect signs of scour, asset managers still face a critical challenge of determining whether those signs are actually affecting the behaviour of the structure to prioritise required intervention. B-PRISM addresses this by combining information from multiple non-intrusive sources of evidence using Bayesian inference, a statistical approach that updates what we believe about a bridge's hidden foundation condition as new evidence arrives, rather than relying on one measurement alone. The sources include satellite observations tracking over time changes in riverbed, banks and surrounding ground, train-borne measurements collected during track monitoring with signatures of bridge's response to passing loads, and rapid photographic surveys capturing visual cues indicating settlement or distress. By bringing these data sources together, the project aims to provide a clearer picture of whether changes in the bridge's foundations are likely to affect its structural performance. The project will be demonstrated on 25 masonry arch railway bridges and evaluated against independent inspection and survey. The goal is to show how asset managers can prioritise investigations and interventions more effectively, helping focus resources on the structures that need them most while reducing unnecessary disruption and cost.

B-PRISM provides a scalable approach for monitoring and managing bridge portfolios across the UK transport network. The methodology has the potential to support safer and more resilient infrastructure, improve the efficiency of asset management, and reduce the cost of maintaining critical transport links. Beyond the rail sector, the approach could also be applied to highway bridges, canals and other infrastructure affected by changing environmental conditions.

The project is led by the University of Surrey in collaboration with NR as challenge owner and brings together expertise in bridge engineering, remote sensing, structural monitoring and infrastructure risk assessment.

Application number	10206838
Title	DeepScour: Vision-AI Driven Digital Twin for Rapid Scour Inference & Structural Risk Monitoring
Organisation	VESSEL & VECTOR LTD
Public Description	We are thrilled to announce the launch of DeepScour, an innovative project funded by Innovate UK's Contracts for Innovation: FOAK26 program. Our mission is to protect critical UK rail infrastructure from the growing threats of climate change and extreme weather. Underwater riverbed erosion, known as scour, is the leading environmental cause of rail bridge failures. Traditional manual inspections are cyclical, high-risk, and often delayed by the very storms that cause the damage. DeepScour changes the game by using a multi-sensor, data-fusion approach to infer the formation of underwater scour holes beneath bridge piers without requiring direct, high-risk sub-surface physical measurements. The platform constructs an intelligent, real-time Hydrodynamic Digital Twin framework for rail bridges by synthesising diverse data streams. It integrates satellite data and historical records to map long-term ground movement and river profile shifts. Simultaneously, deep vision AI processes trackside camera and drone feeds, providing vital forward-looking context by tracking water-level surges, spotting blocked structural arches, and flagging debris accumulation. By analysing these combined indicators, the digital twin dynamically calculates structural stress levels and updates a localised risk index. Delivering live, actionable safety metrics directly to route control room dashboards allows rail engineers to make proactive, data-driven decisions during flash floods. This cutting-edge software solution will dramatically improve passenger safety, reduce storm-related travel delays, and eliminate the need to send human dive teams into hazardous floodwaters.

Application number	10207835
Title	Bridge Foundation Assessment Dashboard
Organisation	FUTURE TRAVEL STUDIO LTD
Public Description	This project will develop and demonstrate a non-intrusive approach to assessing the foundations of masonry railway bridges over water. Many older bridges were built before complete construction records were routinely available, which can make it difficult to understand foundation depth, foundation type and vulnerability to scour. This creates a challenge for asset managers who need reliable evidence to support maintenance, inspection and investment decisions. The project will use a remotely operated survey vessel to gather information from the watercourse around bridge foundations. The survey will map the riverbed and surrounding underwater environment, helping to identify features such as scour, changes in bed level, debris, potential undermining and other conditions that may affect the structure. The project will explore how this information can be combined with existing records, drawings and inspection data to provide a clearer evidence base for engineering assessment. The aim is not to remove the need for intrusive investigations in every case. Instead, the project will test whether a repeatable, non-intrusive survey methodology can help engineers make better-informed decisions about where further investigation is genuinely required. This has the potential to reduce unnecessary drilling, avoid avoidable disturbance to historic structures, and help target more detailed investigations where they will add the greatest value. A key output will be a proof-of-concept decision-support dashboard. This will present interpreted survey findings, confidence levels, supporting evidence and known limitations in a clear asset-level format. The intention is to make specialist survey information easier for railway structures, maintenance and asset management teams to review, compare and use in practical decision-making. The project will also capture practical lessons from deploying remotely operated survey equipment at operational railway structures. Many bridge sites are difficult to access from the water because of restricted bankside access, low clearances, shallow water, currents, tidal conditions or the need to move equipment safely to the water's edge. The project will use these lessons to identify opportunities to improve future survey planning, portability, mobilisation and efficiency. If successful, the project could provide the foundation for a scalable approach to bridge foundation assessment across the rail network, supporting safer, more efficient and less disruptive management of structures exposed to water and scour risk.

Challenge 6:
Structures: Rapid Behaviour Verification to Support Assessment and Intervention Decisions

Application number	10207372
Title	MABEL — Measuring Asset Behaviour and Empirical Load
Organisation	PEAK TO PEAK MEASUREMENT SOLUTIONS LTD.
Public Description	Many railway bridges across the network are decades, or even more than a century, old. Under current assessment methods, a number of older metallic structures are conservatively classified as not meeting modern standards, even though they show no signs of distress and have safely carried traffic for many years. Confirming whether such a bridge is genuinely performing well today usually requires costly and time-consuming investigations. This project will develop and demonstrate a portable, easy-to-use measurement system that engineers can fit and remove quickly during a normal bridge inspection. By measuring how a structure actually responds as trains pass over it, the system gives clear, practical evidence about its real behaviour. This helps engineers make better-informed decisions and can reduce unnecessary repairs or replacements, saving cost and reducing disruption to passengers and freight. The work includes building the equipment, testing it in the laboratory, and demonstrating it on a representative railway bridge. The project is led by Peak to Peak Measurement Solutions, a Sheffield-based small business specialising in advanced sensing and measurement technology.

Application number	10206042
Title	Integrating Rapid Behaviour Verification of Rail Structures Using Digital Image Correlation (DIC) into Network Rail Assessments
Organisation	ATKINSRÉALIS UK LIMITED
Public Description	This project, led by AtkinsRéalis, looks to transform how rail structures are assessed by providing rapid verification of how bridges behave in service. It aims to reduce uncertainty in structural assessments and enable more proportionate, risk-informed decisions on maintenance and intervention. Across the UK rail network, many bridges are classified as substandard based on conservative assumptions about their behaviour. However, these assumptions do not always reflect real-world performance. This can lead to unnecessary restrictions, interventions, or costs. This project tackles that problem by generating measured evidence of structural behaviour under normal operating conditions. The solution combines advanced optical measurement techniques with engineering expertise to provide a fast, non-intrusive way of understanding structural performance. Digital Image Correlation (DIC) cameras capture how a structure moves and deforms as trains pass or as it expands or contracts. These measurements are taken over short periods without the need for physical sensors or intrusive testing. The project brings together three elements. First, field data capture uses a range of camera technologies to record structural response quickly and safely during routine operations. Second, the data is processed to identify key characteristics such as stiffness, load distribution, and articulation. These are mapped onto structural models, allowing engineers to compare measured behaviour with predicted performance. Lastly, results are translated into insights supporting decisions, such as whether a bridge can remain in service. While DIC is well established in laboratory environments, AtkinsRéalis has spent over a decade adapting and refining the technique for use on real infrastructure. This work has demonstrated its reliability in operational settings, including applications on a wide range of bridges and specifically on Overhead Line Equipment, where measurements have informed updates to Network Rail design standards. Importantly, the innovation is not just in capturing data, but in integrating it into existing engineering workflows. The project will work closely with Network Rail to apply the approach to targeted assets, generating practical outputs that align with current assessment processes. By providing accurate evidence of real-world behaviour, the project will help distinguish between structures that genuinely require intervention and those that are performing adequately. This will improve safety, reduce unnecessary work, and lower costs. It also

offers operational benefits by minimising disruption and reducing the need for engineers to access difficult or hazardous locations.

Overall, the project aims to deliver a safer, faster, and more reliable way to assess rail infrastructure, supporting a more efficient and sustainable railway.

Application number	10206612
Title	SAIN: Sonic Analysis of Infrastructure Networks for Rail Bridge Defect Evaluation
Organisation	TRL LIMITED
Public Description	The **S**onic **A**nalysis of **I**nfrastructure **N**etworks (**SAIN**) for Rail Bridge Defect Evaluation project will develop and validate an innovative acoustic monitoring system for assessing the structural condition of rail bridges. Unlike conventional monitoring systems that require attaching sensors directly to structures, SAIN uses a portable, non-contact handheld device to record the acoustic response of bridges as trains pass, creating a structural "fingerprint" used to identify early signs of damage and deterioration. The project is delivered by TRL in collaboration with Digital Transit and Network Rail. The Office of Rail and Road (ORR) (2026) highlights that the UK's rail network contains over 30,000 bridges, tunnels and viaducts and in 2024 the ORR identified more than 4,500 overdue safety examinations and structural assessments relating to bridges, tunnels and operational buildings. Moreover, hidden or difficult-to-detect structural defects can remain unidentified between inspections, increasing the risk of bridge or earthwork failures that may disrupt railway operations, endanger underpassing vehicles and compromise network safety. Improved approaches to structural monitoring could help infrastructure owners identify issues earlier and target maintenance more effectively and confirm bridge integrity in a cost-effective manner. Building on successful trials on road bridges, the project will adapt and validate the technology for use on the UK rail network through a programme of laboratory testing and field trials on operational rail bridges. TRL has combined commercial delivery with independent research and evidence generation for over 30 years. They will lead the project with Digital Transit, and support from Network Rail. The project aims to demonstrate a practical, scalable and cost-effective approach to structural health monitoring that can help infrastructure owners identify issues earlier, target maintenance more effectively and reduce disruption to railway operations. The resulting evidence will support future deployment of the technology across the rail sector, improving the management and resilience of critical transport infrastructure.

Challenge 7:
Green Engineering Solutions for Earthworks Resilience and Biodiversity Net Gain

Application number	10207717
Title	EcoRail Advisor: AI-Powered Climate Resilience and Biodiversity Intervention Planning for Railway Earthworks
Organisation	TRACKGENESIS LIMITED
Public Description	The UK railway network relies on ageing embankments and cuttings to keep trains running safely and reliably. However, these assets are increasingly vulnerable to **extreme rainfall, changing ground conditions, soil moisture variation, landslips and slope failure**. This is already visible in railway asset performance records: during one heavy-weather fiscal year cycle, **252 reportable earthworks failures** occurred, with **75% of failures, or 190 incidents, occurring in cuttings** due to rapid washout and earthflow. Managing these risks across large, dispersed and difficult-to-access locations is a major operational challenge for the rail sector. At the same time, railway infrastructure managers need practical ways to maintain and strengthen these assets while supporting **Biodiversity Net Gain** and sustainable infrastructure decisions. Traditional approaches can identify asset condition or highlight areas of concern, but they do not always help teams decide which intervention should be prioritised, why it is suitable, and what wider environmental or cost benefits it could deliver. TrackGenesis Limited is developing **EcoRail Advisor**, an artificial intelligence-powered decision-support platform for railway earthworks. The project directly supports the Department for Transport's First-of-a-Kind challenge on **green engineering solutions for earthworks resilience and Biodiversity Net Gain**. EcoRail Advisor is designed to help railway teams move beyond monitoring and risk identification towards evidence-based intervention planning. The platform will bring together railway asset information, satellite ground-movement observations, rainfall data, soil moisture indicators, vegetation health metrics and environmental information into a single decision-support environment. Using AI analytics, EcoRail Advisor will help identify vulnerable embankments and cuttings, assess climate and ground-related risks, and compare suitable intervention options. In practical use, EcoRail Advisor will support railway teams through four main steps. First, it will **identify risk** by analysing ground movement, environmental and asset data. Second, it will **assess intervention options** by comparing engineering and nature-based solutions. Third, it will **estimate benefits** by modelling resilience, biodiversity, carbon and cost impacts. Finally, it will **support decision-making** by providing clear recommendations and evidence for investment planning.

Instead of simply showing that an asset may be at risk, EcoRail Advisor will help decision-makers understand **what action should be taken and why**. The platform will assess both conventional engineering works and nature-based solutions, including drainage improvements, vegetation management, bioengineering approaches, targeted root planting, slope stabilisation and other resilience measures. It will estimate the likely impact of different options in terms of **safety, resilience improvement, biodiversity benefit, carbon impact, whole-life cost and practical delivery**.

Application number	10206301
Title	Habitat Wall: Net-Zero Precast Retaining Units for Resilient, Biodiverse Rail Embankments
Organisation	LOW CARBON MATERIALS LIMITED
Public Description	Railway embankments and cuttings need structures that hold back soil and prevent erosion, keeping the railway safe and reliable. These are usually built from precast concrete, which is durable but carbon-intensive and offers nothing for wildlife. At the same time, infrastructure projects are now required to deliver biodiversity net gain, leaving these two goals to be met separately and at extra cost. This project, HabitatWall, develops a precast concrete retaining unit that does both at once. The units stack and interlock to stabilise embankments and control erosion, just as conventional retaining walls do, but they are designed with built-in features that provide habitat for wildlife. Cavities and textures of different shapes and sizes offer shelter and nesting space for birds, solitary bees and other insects, small mammals and amphibians, and where it is structurally suitable, pockets for plants to grow. In effect, a single engineered structure delivers resilience and biodiversity together rather than as separate measures. The units are made from net-zero concrete using ACLA, a carbon-storing aggregate developed by Low Carbon Materials. ACLA allows the concrete to reach net-zero, and potentially to become carbon-negative, so that each unit can act as a carbon store rather than a source of emissions. This removes the carbon penalty usually associated with concrete while keeping its strength and long life. During the project, Low Carbon Materials will work with a precast manufacturer and an environmental consultant to design the units and the moulds, develop and test the concrete to the relevant construction standards, manufacture demonstration units, and install and evaluate them in a representative railway setting. The work will assess how well the units perform on structural resilience, biodiversity and carbon. The result will be a ready-to-deploy product that helps the rail industry, and the wider construction sector, build more resilient earthworks, meet biodiversity obligations and cut embodied carbon at the same time. By combining these benefits in one structure, the project supports greener, more nature-friendly infrastructure across the UK.

Challenge 8:
Enhancing Rail Adhesion Through Intelligent Vegetation Management and Biodiversity Net Gain

Application number	10205726
Title	Project Senescence: A Predictive Rail Adhesion Intelligence Platform for Low-Adhesion Management
Organisation	RIVELIN RAIL LIMITED
Public Description	Project Senescence will develop and demonstrate an integrated rail adhesion intelligence platform that predicts, monitors and manages low-adhesion risk across passenger, freight and light rail networks. Low adhesion caused by leaf contamination remains a major challenge for the railway, contributing to delays, wheel damage, increased maintenance costs, degraded operational performance and safety risk. Existing approaches rely on weather forecasting, vegetation management and railhead treatment activities, yet low-adhesion incidents continue to affect network performance. Network Rail currently spends approximately £78 million annually on railhead treatment operations. The project combines three complementary technologies. Treestock will provide LiDAR-derived vegetation intelligence, including tree species, canopy and proximity-to-track data. The University of Sheffield will provide a validated low-adhesion risk model that predicts locations susceptible to leaf-induced low adhesion using vegetation, environmental and route characteristics. Rivelin Rail will provide its Continuous Onboard Monitoring System (COMS), a low-cost vehicle-mounted platform that continuously captures railhead imagery and estimates contamination levels and wheel-rail adhesion using machine-learning models validated against Rivelin Rail's proprietary tribometer technology. The innovation lies in combining predictive modelling with real-world measurement. Project Senescence will create a continuous feedback loop between vegetation-driven risk predictions and observed railhead conditions, enabling more accurate identification of low-adhesion hotspots and more targeted intervention planning. The system will be demonstrated on a freight railway, a critical fuel supply route. The route experiences recurring low-adhesion issues, including wheel flats that cost approximately £100,000 annually and have resulted in significant fleet disruption. Project outputs will include geospatial adhesion risk maps, contamination hotspot identification, decision-support tools and validation of predictive low-adhesion modelling. The platform has the potential to improve operational performance, reduce maintenance costs, support biodiversity-positive vegetation management and optimise railhead treatment activities. The long-term vision is a national rail adhesion intelligence capability that can be integrated into existing railway asset management and decision-support systems to support more efficient and sustainable management of low-adhesion risk.

Application number	10206466
Title	LEAF - Lineside Ecology and Adhesion Fusion
Organisation	TREESTOCK LTD
Public Description	The UK rail network loses hundreds of thousands of delay minutes every autumn due to leaf contamination on the railhead. Current mitigations, including Rail Head Treatment Trains, sanding and manual vegetation clearance, cost Network Rail over £80 million per year and remain largely reactive and spatially indiscriminate. This project will develop a predictive vegetation intelligence platform that gives rail operators precise, actionable risk intelligence at individual-tree resolution. TreeStock Ltd will survey selected trial corridors using UAV-mounted LiDAR and optical sensors, classifying every lineside tree by species, canopy geometry and proximity to track. This feeds an AI risk model generating adhesion risk predictions at varying spatial resolutions and across time horizons from short-term operational decisions to 10-year strategic asset planning. Rivelin Rail Ltd will collect continuous, geolocated friction and railhead contamination measurements along the same corridors using a track trolley-mounted tribometer and camera system, measuring under both ambient and simulated wet conditions. This directly captures the adhesion risk that delay-based metrics routinely miss, providing the empirical ground truth that makes the risk model operationally meaningful. The University of Sheffield will contribute their validated, published location-based low adhesion risk model, providing an independent scientific evidence layer on leaf layer contamination. The three data streams are fused into a web-based decision support platform accessible to rail engineers without specialist GIS knowledge. It identifies high-risk species, supports targeted clearance and species replacement decisions, and enables treatment scheduling based on where and when risk is genuinely highest rather than across entire corridors. Trials spanning passenger and freight operations across three geographically distinct UK sites will demonstrate national transferability and provide the multi-context validation needed to support industry-wide adoption. The outcome is a step change in how the rail sector manages vegetation risk, from reactive, corridor-wide treatment to evidence-led precision intervention, reducing costs, minimising ecological disruption and laying the foundation for long-term biodiversity net gain compliance.

Application number	10206720
Title	LeafSat : Lineside Risk Intelligence for Rail Adhesion Management and Biodiversity Net Gain
Organisation	LAND SCRIPTS LTD
Public Description	Every autumn, a familiar problem returns to Britain's railways: fallen leaves. As trees along the tracks shed their leaves, a thin, slippery film can form on the rails, making it harder for trains to grip and brake safely, causing delays, cancellations, and significant cost every year. LeafSat is a new way of seeing this old problem. Developed by Land Scripts Ltd, LeafSat uses satellite imagery to watch how trees along the railway change through the season, tracking subtle shifts in leaf colour and canopy health from space, before the human eye would notice. Combined with weather forecasts, the system predicts, days in advance, exactly which stretches of track are at risk of leaf-related disruption, and when. This means Railway teams can act before a problem occurs, deployed precisely where and when they're needed, rather than reacting after incidents or dispatching treatment team without confirmed need, reducing cost and passenger disruption. LeafSat is about more than prediction. The platform also helps railways make smarter, kinder choices about the trees that line their tracks. Rather than cutting back vegetation indiscriminately, LeafSat identifies exactly which trees are causing problems and suggests gentler alternatives: native, wildlife-friendly species that will not cause the same issues. Every suggested change is reviewed by a qualified ecologist, ensuring that what's good for the railway is also good for nature, supporting the UK's broader commitment to leaving the natural environment in a better state than we found it. The project will be developed and tested along part of Elizabeth Line (Slough to Paddington), and TfL's Central Line, working closely with Transport for London. Field surveys on the ground will help confirm what the satellites observe from above, ensuring the system is accurate and trustworthy before wider use. Land Scripts Ltd is a UK-based startup combining expertise in satellite data, artificial intelligence, and environmental science, with specialists in remote sensing, ecology, climate science, and software engineering working together to turn complex data into clear, practical decisions for the people who keep our railways running. By looking down from space and forecasting forward in time, LeafSat offers a smarter, gentler way to manage one of autumn's oldest railway challenges, helping trains run on time, protecting the trees and biodiversity along our tracks, and putting innovative British technology to work on a problem that affects millions of rail journeys every year.