

## Results of Competition: Planning Rail Capacity Through Automated Infrastructure Design

Competition Code: 1810\_CRD\_NETWORKRAIL

Total available funding is £300,000

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
COSTAIN LIMITED	Rail: Automated Infrastructure Design - R:AID	£94,198	£47,099
BRYDEN WOOD TECHNOLOGY LIMITED		£75,568	£45,341

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Project description - provided by applicants

Costain and BrydenWood's longstanding and innovative partnership is leading disruption of the traditional design/engineering services marketplace through the development of an integrated suite of tools to automatically design the infrastructure of the future.

Our vision is for a **data-centric infrastructure design process** that will reduce the time and cost of railway design in a safe and transparent way.

We will support Network Rail's Whole Systems Modelling team in the development and demonstration of a new Rail: Automated Infrastructure Design (R:AID) toolkit.

The project aligns with the objectives of the Systems Operator, which are:

- \* planning future strategic infrastructure investment
- \* allocating capacity on the national rail network

The current mechanism for planning investment and allocating capacity is isolated from the real-world environment. The processes for designing rail systems isolated from the planning model, its capacity requirements and options.

We will demonstrate how:

- \* We have built on existing generative design technologies
- \* Can develop a solution relevant to rail
- \* Deliver a demonstrator within 6 months

Our project benefits from similar work for Highways England and seeks to remove the need for designing from first principles each time. We will take predetermined engineering standards, methods and procedures and adapt them to create a rules-driven multi-disciplinary process for rapidly designing and engineering a railway.

This process, using a generative design approach based on formulae, logic and the input from rail engineering specialists, will seek to create a design that complies to the rules and regulations of the railway and the ORR, but dramatically reducing the time it takes to design, with accurate design leading to improved certainty of constructing and operating a railway.

The result is a fully integrated digital design model that provides significant production efficiencies across the asset lifecycle and fully supports a projects business case and objectives. Digital design solutions will revolutionise productivity, lower exposure to harm, achieve predictable delivery on time, to lower cost, providing the desired quality with fewer defects.

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GRAFFICA LIMITED	Infrastructure Design and Evaluation Framework	£71,630	£50,141
VOLKERRAIL SPECIALIST BUSINESSES LIMITED		£50,296	£25,148

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## Project description - provided by applicants

Software tools have long been used to support the design of large infrastructure developments, with many off-the-shelf CAD products to support general construction projects and associated project management support. The railways require multi-discipline engineering to deliver to support track layout, signalling schemes, station design and power supply, requiring specialist design tools.

This project, Infrastructure Design Evaluation Framework, envisages how these existing tools can be integrated to utilise the data collected from these specialist railway tools and to combine this with other third-party data such as mapping, building plans and various government data sources. The infrastructure data model will be developed using modern object-oriented data modelling techniques to fuse this information into a single model offering a comprehensive BIM level 3 description of the infrastructure. The framework will provide access to the data model through service interfaces enabling information to be shared between the tools. The framework will be decoupled from but linked with these tools, using common system data exchange formats (such as SDEF) producing a whole system solution. It offers services to publish the information allowing tools to share a common data model and update their state in real time. The framework provides options to improve designs through application of generative algorithms to produce incrementally altered designs automatically, adjusting assets within user specified constraints and using the Graffica simulation platform HERMES to evaluate capacity and headway for the generated designs.

The infrastructure data model established can then be used as a baseline to evaluate different design options by using simulation to determine the efficiency of the solution in terms of construction cost, capacity, maintenance costs, project risk and safety. The project envisages a software framework that provides a generative infrastructure design facility to evaluate incrementally changed construction design options, running many simulations in parallel to determine improved solutions. The system and its associated tooling shall offer capability over the full GRIP lifecycle, including rapid feasibility assessment of future projects, through to the detailed project design, construction and long-term facility maintenance.

The first phase of the project will focus on the design of track layout and signalling scheme construction, allowing information to be defined in different coordinate frames, and including a temporal coordinate to indicate how the scheme might be progressed through time. The system shall utilise as much existing software as possible, including SIG design tools and Graffica's abstract toolkit, GSDK, to provide the foundation of the system.

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PEAN TECHNOLOGIES LIMITED	Development of automated track layout design tools	£70,000	£49,000

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## Project description - provided by applicants

The path of a proposed track alignment is constrained by surrounding topographical features, such as clearance to structures, as well as geometric features that have an impact on track maintenance and inter-station journey times. The relationship between track geometry and clearance features is key to a compliant track layout design; a track alignment that meets train performance requirements can not be used if the path of a train is likely to come into contact with a structure, and an alignment that is free of clearance infringements is also unusable if the track geometry is not capable of achieving target inter-station journey times.

Today, the majority of UK rail infrastructure projects use separate track geometry design and clearance assessment software systems as part of the track layout design process. As a result, an engineer is required to manually transfer data between these two systems, analyse clearance results and revise the track layout accordingly. Processes that require human intervention will ultimately limit the scope for development of automated track layout design systems.

This project aims to develop a suite of tools that will enable the digital gauging process to be undertaken within the 3D CAD environment. Bringing the clearance assessment and track design processes together will provide a platform for automated track layout design, enabling development of algorithmic scripts that can procedurally design, check and revise track alignment geometry.

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Plume Rail Ltd	Automated Traction Power Simulation and Design	£99,845	£69,892

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## Project description - provided by applicants

We aim to develop a solution to quickly assess impacts of changes on the railway network's power system. This is currently a key bottleneck in the development of rail schemes and holds up schemes which would otherwise boost local capacity and remove inefficient, noisy and polluting diesel powered trains from the network. Presently, detailed analysis is required every time a timetable change is required or a new train introduced. When it's not possible to undertake these, projects proceed risking delays and speed restrictions, something unacceptable for the travelling public.

Our solution will be driven by the needs of planners and timetable modellers, enabling a fast iterative solution that will allow early stage projects to test their traction power needs against the current infrastructure. The system will be cloud based which will reduce the requirements for users, and allow configuration management of proposed schemes against network configurations.

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