CIVIL ENGINEERING FOR RAIL CIVILS, STRUCTURES AND SYSTEMS

WHITFIELD CONSULTING SERVICES

Delivering the UK and Republic of Ireland's rail ambitions through civil engineering expertise

Agile | Experienced | Collaborative

CIVIL SUPPORT FOR SUCCESSFUL DELIVERY

Why skilled civil engineering design is key to upgrading and decarbonising the UK and Republic of Ireland's rail landscape

The rail industry faces unprecedented challenges and opportunities, requiring innovative solutions and strategic collaboration. Ageing infrastructure is in urgent need of upgrades, while the need to transition to a net-zero emission economy necessitates extensive decarbonisation of our rail transport systems.

Delivering these improvements cost-effectively is essential. The recent directives outlined in Network Rail's Control Period 7 (CP7) stress the importance of achieving more for less; this requires agile, experienced, and collaborative thinking to meet the rigorous demands of modern rail projects, while staying on budget.

The All-Island Strategic Rail Review (AISRR) echoes this sentiment, emphasising the need for integrated, cost-efficient solutions to improve rail infrastructure and connectivity across the island of Ireland, ensuring a sustainable and resilient transport network for the future.

Success in this sector relies heavily on partnerships with civil engineering firms that possess an in-depth understanding of the rail environment and safety regulations, and that deliver value without compromising on sustainability, quality, or compliance with industry standards. Our core values of agility, experience, and collaboration underpin our approach to every project.

> *"The design was of a very high quality... I hope we get to work with such pragmatic and experienced design houses on future electrification projects.*
>
> Project manager, Capital Delivery Eastern, Network Rail

Working alongside our trusted partners, Whitfield Consulting Services (WCS) offers a comprehensive suite of multidisciplinary rail services, spanning from planning and design to implementation.

CIVIL SUPPORT FOR SUCCESSFUL DELIVERY

In this booklet, you'll find a selection of case studies demonstrating how WCS can provide specialist civil design support at every stage of a project, built on a breadth of experience across the rail sector.

FEATURED CASE STUDIES:

- Detailed civil engineering design for a £2.9 billion line upgrade, London Underground's Piccadilly Line
- Civils design of substation compounds and cable feeder routes, Intercity Express Programme Doncaster Depot Power Upgrade
- Civils design for substation compounds and cable feeder routes, Northern Trains Battery Electric Multiple Unit (BEMU) project
- Survey and design services for lineside civils & substations for a £1.5 billion electrification and modernisation programme, Midland Main Line upgrade
- Design services for foundations for new signalling infrastructure, Wessex Signalling
- Emergency response and repair strategy, Hawk Bridge Road collision
- Civil and structural engineering design and 3D BIM analysis, Reading West Station upgrade
- Revitalising a historic railway bridge, Downs Park Road Overbridge

Detailed civil engineering design and surveys for a £2.9 billion line upgrade

London Underground's Piccadilly Line

Client
UK Power Networks Services

End Client
London Underground Limited

Project Date
2023 - Ongoing

OVERVIEW

WCS was engaged by UK Power Networks Services (UKPNS) to provide detailed civil engineering design for a major Piccadilly Line upgrade.

This includes work on several substations, new electrical infrastructure, control systems, and cables along key parts of the line. The project involves significant improvements to the Manor House and Cobourg Street substations and the installation of around 10km of upgraded 11kV and 22kV high-voltage cables to support a new fleet of modern trains.

Nick Lowe, Director and Contractors Responsible Engineer (CRE) at WCS, was named Lead Civil Engineer.

CHALLENGE

The upgrade of the Piccadilly Line presented numerous challenges, particularly due to the constraints of working within the Victorian architecture of the existing system. The narrow tunnels, measuring only 3.56 metres wide and already congested with infrastructure, posed significant limitations for new installations.

The works needed to be conducted while the line remained operational, requiring meticulous planning and coordination to ensure safety and continuity of service.

SOLUTION

The team performed comprehensive civil engineering design for the removal of walls, installation of new walls and creation of a new room, plus installation of new switchgear and other equipment.

As well as completed tender support, work included gauge assessments along the cable routes, to ensure all equipment would lie outside of the train envelope, various ground investigation and structural surveys, and dilapidation surveys.

With Nick Lowe as the Lead Civil Engineer, WCS effectively collaborated with UKPNS and London Underground to ensure that all designs met stringent safety and operational requirements.

CIVIL ENGINEERING DESIGN FOR SUSTAINABLE RAIL POWER UPGRADES

Civils design of substation compounds and cable feeder routes Intercity Express Programme Doncaster Depot Power Upgrade

Client: Hitachi ABB Powergrids
End client: Network Rail
Project date: 2017-2020

OVERVIEW

WCS provided civil engineering design for a power upgrade at a Doncaster train depot.

The project involved designing two substation compounds for a Static Frequency Converter, a 33kV substation, a 25kV Feeder Station, and a 3.5km cable route to connect to Overhead Line Equipment (OLE), including converting a footbridge for high-voltage cables.

CHALLENGE

The project required managing environmental impacts on nearby stakeholders, including the Potteric Carr nature reserve. The complexity increased as the Static Frequency Converter was the UK's first, demanding innovative integration with the existing infrastructure.

SOLUTION

Typically, connecting new feeds to power the railway involves stepping down power from the grid. Instead of sourcing power from the National Grid, the distribution network operator (DNO) was utilised, as it offered a more cost-effective and practical solution.

WCS maintained ongoing Construction and Design Responsibility (CRE) to ensure smooth oversight and collaboration throughout the project.

Identifying potential risks and key civils constraints Battery Electric Multiple Units (BEMU) project

Client: UK Power Networks Service (UKPNS)
End client: Northern Trains
Project date: 2022

OVERVIEW

WCS supported UKPNS in the Northern Trains Battery Electric Multiple Units (BEMU) project, helping with the GRIP 3 option selection report to upgrade diesel trains to battery electric, improving sustainability and efficiency.

CHALLENGE

The key challenge was identifying risks and civil constraints in integrating new battery-electric trains into the existing network, requiring a deep understanding of current infrastructure and operational impacts.

SOLUTION

WCS provided critical civil engineering support for the GRIP 3 report, identifying risks and constraints, and developing preliminary designs for substations and cable routes, enabling informed stakeholder decisions.

Survey and design services for lineside civils & substations for a £1.5 billion electrification and modernisation programme

Midland Main Line upgrade

Client
SPL Powerlines

End Client
Network Rail

Project Date
2020 – ongoing

OVERVIEW

The Midland Main Line, which connects London to Sheffield, is undergoing upgrades to electrify the route, a vital step for the UK's transport decarbonisation goals. WCS is supporting SPL Powerlines in this extensive £1.5 billion initiative, which began with early works in June 2020.

Our contributions include civil engineering design and surveys to facilitate various project phases, including lineside civils & substations and the transportation of the UK's largest ASG25 substation to site.

CHALLENGE

A more recent phase of the project focused on electrifying the London to Corby line, where a significant challenge was the need for road rail access points (RRAP) at the Sharnbrook site.

The initial plans required acquiring additional land, which risked escalating costs and complicating community relations.

SPL Powerlines proposed relocating some OLE equipment to stay within the existing site boundary, thereby minimising the need for land acquisition.

SOLUTION

WCS played a crucial role in providing civil engineering design for SPL Powerlines' alternative scheme. Collaborating with Andromeda Engineering, we developed solutions that maintained safety and functionality without costly land purchases. Network Rail approved the revised plan, allowing faster project delivery.

WCS also supported the installation of new OLE structures and substations along the Luton to Market Harborough route, encompassing the design of foundations, drainage, and maintenance access points.

A highlight of the project was the safe transportation of the UK's largest ASG25 substation at the Wigston mid-point auto transformer site (MPATS) using a gantry lifting system, enabling placement without closing the railway. Successful completion involved extensive site preparations, including excavation and effective collaboration site partners.

COMPREHENSIVE CIVIL AND STRUCTURAL ENGINEERING SOLUTIONS FOR RAIL INFRASTRUCTURE

Foundation design for new infrastructure Wessex Signalling

Client: Andromeda Engineering

Project date: 2023 - 2024

OVERVIEW

The Wessex Signalling project involved designing foundations for new signalling infrastructure along the Wessex rail route to enhance efficiency and safety.

WCS provided civil engineering expertise to ensure designs met required standards.

CHALLENGE

Early client involvement and clear communication were crucial for designing foundations that complied with safety standards. Coordinating with stakeholders and managing potential service disruptions further heightened the challenge.

SOLUTION

A screw pile foundation was designed to minimise time on site during construction as limited possessions were available, reduce waste by minimising spoil and provide a flexible base solution upon which to install the new signals.

Early engagement with clients and stakeholders enabled WCS to provide civil engineering designs and valuable adjustments, ensuring smooth installation and minimising rail operation disruptions.

Emergency response and repair Hawk Bridge Road Collision

Client: Murphy

Project date: 2021

OVERVIEW

The Hawk Bridge Road Collision project required a rapid emergency response after a vehicle struck the bridge.

WCS was tasked with assessing damage and creating a repair plan to ensure the structure's safety.

CHALLENGE

A fast, in person response was vital to minimise traffic disruption and ensure public safety. A visual inspection had to be undertaken without extensive preliminary work.

SOLUTION

Within two hours, WCS was onsite to assess the bridge's condition and identify immediate risks.

Based on the findings, WCS developed a comprehensive repair strategy to restore the bridge's integrity and meet safety standards, enabling quick reinstatement of the bridge, minimising downtime and impact on the surrounding area.

Civil and structural design with 3D BIM Reading West Station

Client: Nationwide Engineering

Project date: 2022-2023

OVERVIEW

The Reading West Station project required a new ticket hall and gate to enhance passenger facilities and accessibility.

WCS provided full civil and structural engineering design services, including 3D Building Information Modelling (BIM) analysis.

CHALLENGE

The main complexity was coordinating work across two constrained sites while integrating engineering and architectural services effectively.

SOLUTION

WCS used advanced 3D BIM techniques for detailed visualisation and effective collaboration across all disciplines.

Through its supply chain, WCS provided architectural services and led regular design team meetings to ensure stakeholders remained aligned throughout the project.

WCS also maintained on-site support during design and construction to address issues promptly.

Revitalising a historic railway bridge

Downs Park Road Overbridge

Project Date
2022- ongoing

Client
Murphy

End Client
Network Rail

OVERVIEW

The Downs Park Road Overbridge, a 154-year-old structure in Hackney, required urgent restoration due to severe structural deterioration. WCS was appointed by Murphy to provide civil engineering design services as part of Network Rail's CP6 East Anglia Structures remit.

The project aimed to restore the bridge's integrity, increase traffic capacity, and enhance safety for road users, ensuring it remains functional for another 120 years.

CHALLENGE

The project faced several design constraints, including the need to accommodate numerous services (water, power) within the bridge deck while maintaining strict clearance for overhead electrification wires. Some areas had sub-standard headroom, which required careful adjustments. Site limitations additionally restricted crane size and component weights.

The site's proximity to residential areas and schools necessitated careful planning to minimise disruption during construction, while limited site access complicated logistics.

SOLUTION

WCS provided comprehensive civil engineering design, from concept to detailed design, attended an off-site trial erection and offered on-site technical support. The team proposed a filler beam deck design that accommodated all services while reducing structural depth to meet clearance requirements.

Sustainable practices included reusing original materials and optimising the steel girder sizes, reducing the carbon footprint by approximately 10%. Jacking points and elastomeric bearings were incorporated for future maintenance, and weathering steel was chosen for all steelwork for its durability, ensuring a design life of 120 years with minimal ongoing maintenance.

Construction was planned in a rail blockade during school holidays to minimise community disruption, and the use of precast concrete reduced work-at-height risks.

> *"Thank you Whitfield Consulting Services for such a seamless design and for the technical support."*
>
> Kieran Moore, Engineering Manager – CRE, Murphy

COMPREHENSIVE CIVIL ENGINEERING SERVICES

THROUGH OUR IN-HOUSE EXPERT TEAM AND TRUSTED PARTNERS

MULTI-DISCIPLINARY EXPERTISE

WCS offers creative and effective civil and structural engineering design for both civil structures and system civils to support project success and help our clients meet their goals.

CIVIL STRUCTURES

Includes over and under bridges, ground retention structures, slope stability analyses, platforms, stations, and tunnels.

SYSTEM CIVILS

Includes lineside services, troughing routes, over and under-track crossings, and OLE support structures.

IN-HOUSE SPECIALIST SERVICES AT WCS

With specialist experience in both temporary and permanent works, our in-house capabilities include:

- Specification and management of intrusive and non-intrusive surveys
- Reactive and planned condition inspections
- Concept design and feasibility studies
- Detailed design and carbon impact calculations
- Temporary works design and coordination
- CAD & BIM expertise, including 4D software and BIM360
- Cable pulling calculations
- Bid support and tender designs

PARTNERSHIPS:

Through long-term trusted partners, including Andromeda Engineering, we can offer comprehensive design services, including OLE, signalling, HV (high voltage) and LV (low voltage) design, safety assurance, and permanent way work such as track alignment.

> *"WCS engineers have had plenty of site experience, which gives a better appreciation of what the construction team will eventually face. We don't often get that with designers. That's one of the strong points that WCS offers."*
>
> William Ross, Design Manager, Murphy

WHY CHOOSE WHITFIELD CONSULTING SERVICES?

Through our commitment to collaboration and design excellence, we seek to understand our clients and their projects' needs first; tailoring our service to meet their vision for project delivery.

WCS is a growing and passionate civil engineering design company serving numerous tier 1 contractors and other clients. Our dynamic team is agile, experienced and collaborative.

We take great pride in the consistency and quality of our work, and in our ability to contribute to the success of our clients and partners.

We believe infrastructure projects are best supported with a holistic approach where we take the time to fully understand the needs and issues particular to the individual case, before proceeding to the bespoke design, each project always being regarded as unique. We are then always available to advise as needed as works progress, so as to ensure successful delivery.

We offer creative and effective engineering solutions designed to support the project and help our clients meet their goals.

WCS is passionate about using its expertise to contribute to a sustainable future, we are proud to partner with clients to help them deliver sustainable infrastructure and to positively contribute to the UK's drive towards net zero in the future.

In 2021, we launched our SustainableFuture plan, an ambitious strategy which puts the three pillars of ESG – environment, social purpose, and good governance – at the heart of all our activities. In recognition of the impact we are having and our leadership on sustainability, WCS won Environmental, Social and Governance Leader at the 2023 New Civil Engineer (NCE) Awards.

COLLABORATIVE

Based on experience and expertise, we can adapt our service and provide tailored engineering solutions to fit any infrastructure project.

COMPLIANT

We are UVDB qualified, and our systems are accredited to ISO 9001, 14001 and 45001.

AGILE

We provide our clients and partners with a fast and responsive service aimed at keeping projects on time and on target.

> *Exceptional service from the team. Able and willing to assist and overcome obstacles encountered during site visits."*
>
> Kim Kelly, Project Manager, UK Power Network Services

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