



*Hands-on railway experience,
world class consultancy skills*

An aerial photograph of London, showing the dense city skyline. The Shard is the most prominent building on the left. In the foreground, the roof of London Bridge Station is visible, with its distinctive white, curved structure. The River Thames flows through the city, and various other skyscrapers and buildings are scattered throughout the scene.

We know how to run a railway because we do it every day

Network Rail

Network Rail owns, operates and develops Britain's railway infrastructure; that's 20,000 miles of track, 30,000 bridges, tunnels and viaducts and thousands of signals, level crossings and stations. It manages 20 of the UK's largest stations while all the others, over 2,500, are owned by Network Rail and managed by the country's train operating companies.

Every day, Network Rail dispatches and manages the operation of over 20,000 trains carrying more than 4.8 million journeys. People depend on Britain's railway for their daily commute, to visit friends and loved ones and to get them home safe every day.

As part of Network Rail's multi-billion pound Railway Upgrade Plan key projects such as Birmingham New Street Station, Great North Rail Project, Great Western Mainline and the Thameslink Program are transforming Britain's network to meet the tremendous growth the railway has experienced in the past 20 years.

Network Rail Consulting

Network Rail shares its expertise with the world's rail operators through Network Rail Consulting. We understand the institutional, regulatory, technical, policy and strategic issues of running a 19th century railway in the 21st century. We know how to operate a network, manage its assets and deliver enhancement programs.

We have unrivalled expertise in getting more out of legacy infrastructure, operating in a closely monitored market and continuously upgrading an active, heavily-used rail system.

What makes us different from other consultants is that our people have genuine hands-on experience in solving the challenges you face in the real world of rail operations. We are men and women operating and maintaining one of the world's leading railway systems who want to share their expertise, experience and passion for the job.

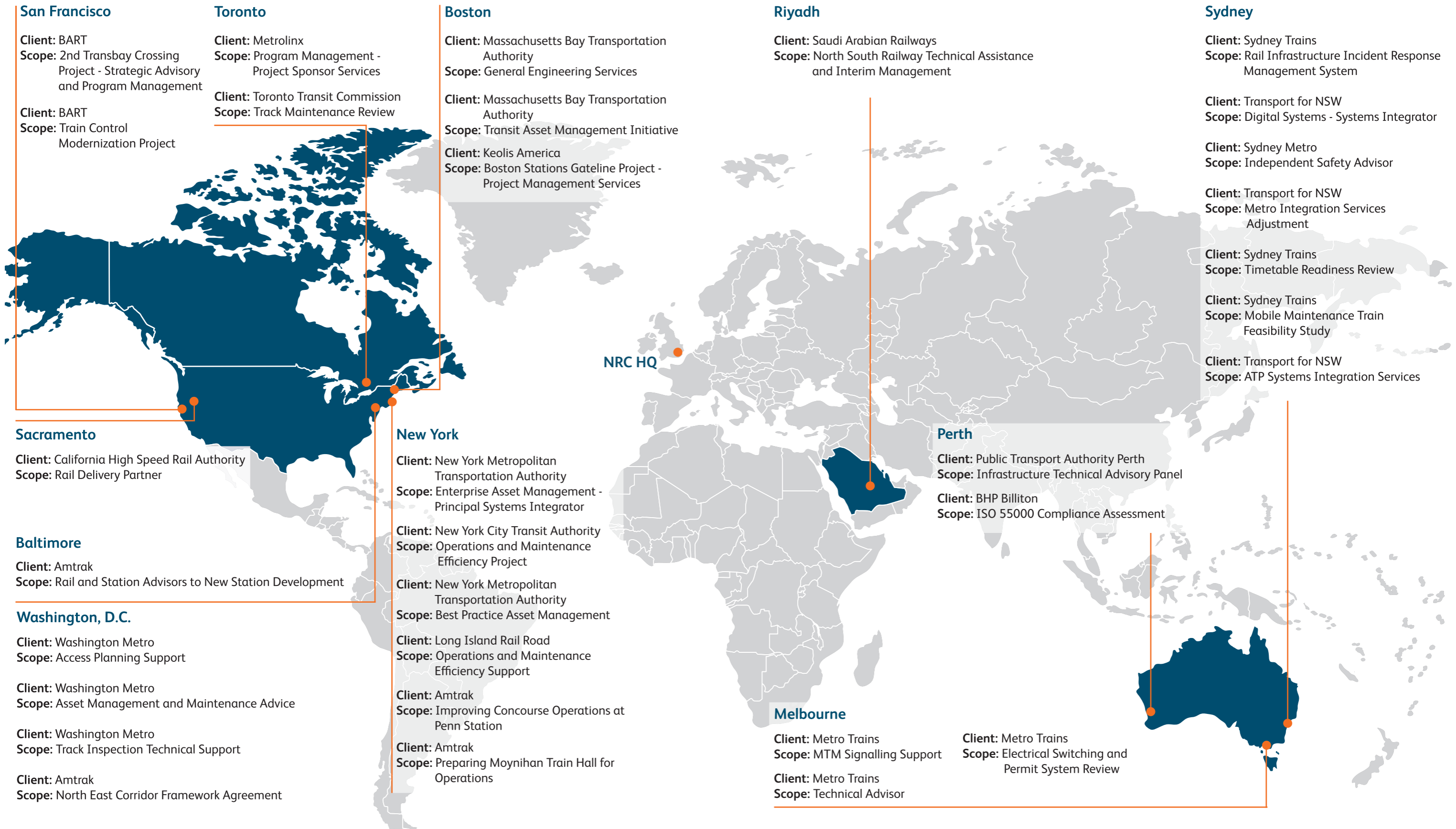
Network Rail Consulting in Australia, the Middle East and North America

We have been active in the Australian, the Middle East and North American markets since 2013 and have successfully delivered more than 150 consultancy contracts for government, public and privately owned companies; and for passenger and freight owners and operators.

Our advice covers the full range of the project life cycle, from concept, project development and delivery through to operations and maintenance.

Whilst our unique selling point is our access to Network Rail's expertise in the UK, we are committed to developing our local workforce through a structured training and development program using Network Rail's award winning training capability. This will ensure that we continue to provide our clients with leading edge technical and management advice delivered by a blend of local and British experts.

Network Rail Consulting Around the World



San Francisco

Client: BART
Scope: 2nd Transbay Crossing Project - Strategic Advisory and Program Management

Client: BART
Scope: Train Control Modernization Project

Toronto

Client: Metrolinx
Scope: Program Management - Project Sponsor Services

Client: Toronto Transit Commission
Scope: Track Maintenance Review

Boston

Client: Massachusetts Bay Transportation Authority
Scope: General Engineering Services

Client: Massachusetts Bay Transportation Authority
Scope: Transit Asset Management Initiative

Client: Keolis America
Scope: Boston Stations Gateline Project - Project Management Services

Riyadh

Client: Saudi Arabian Railways
Scope: North South Railway Technical Assistance and Interim Management

Sydney

Client: Sydney Trains
Scope: Rail Infrastructure Incident Response Management System

Client: Transport for NSW
Scope: Digital Systems - Systems Integrator

Client: Sydney Metro
Scope: Independent Safety Advisor

Client: Transport for NSW
Scope: Metro Integration Services Adjustment

Client: Sydney Trains
Scope: Timetable Readiness Review

Client: Sydney Trains
Scope: Mobile Maintenance Train Feasibility Study

Client: Transport for NSW
Scope: ATP Systems Integration Services

Sacramento

Client: California High Speed Rail Authority
Scope: Rail Delivery Partner

Baltimore

Client: Amtrak
Scope: Rail and Station Advisors to New Station Development

Washington, D.C.

Client: Washington Metro
Scope: Access Planning Support

Client: Washington Metro
Scope: Asset Management and Maintenance Advice

Client: Washington Metro
Scope: Track Inspection Technical Support

Client: Amtrak
Scope: North East Corridor Framework Agreement

New York

Client: New York Metropolitan Transportation Authority
Scope: Enterprise Asset Management - Principal Systems Integrator

Client: New York City Transit Authority
Scope: Operations and Maintenance Efficiency Project

Client: New York Metropolitan Transportation Authority
Scope: Best Practice Asset Management

Client: Long Island Rail Road
Scope: Operations and Maintenance Efficiency Support

Client: Amtrak
Scope: Improving Concourse Operations at Penn Station

Client: Amtrak
Scope: Preparing Moynihan Train Hall for Operations

Perth

Client: Public Transport Authority Perth
Scope: Infrastructure Technical Advisory Panel

Client: BHP Billiton
Scope: ISO 55000 Compliance Assessment

Melbourne

Client: Metro Trains
Scope: MTM Signalling Support

Client: Metro Trains
Scope: Technical Advisor

Client: Metro Trains
Scope: Electrical Switching and Permit System Review

Advisory and Strategic Planning

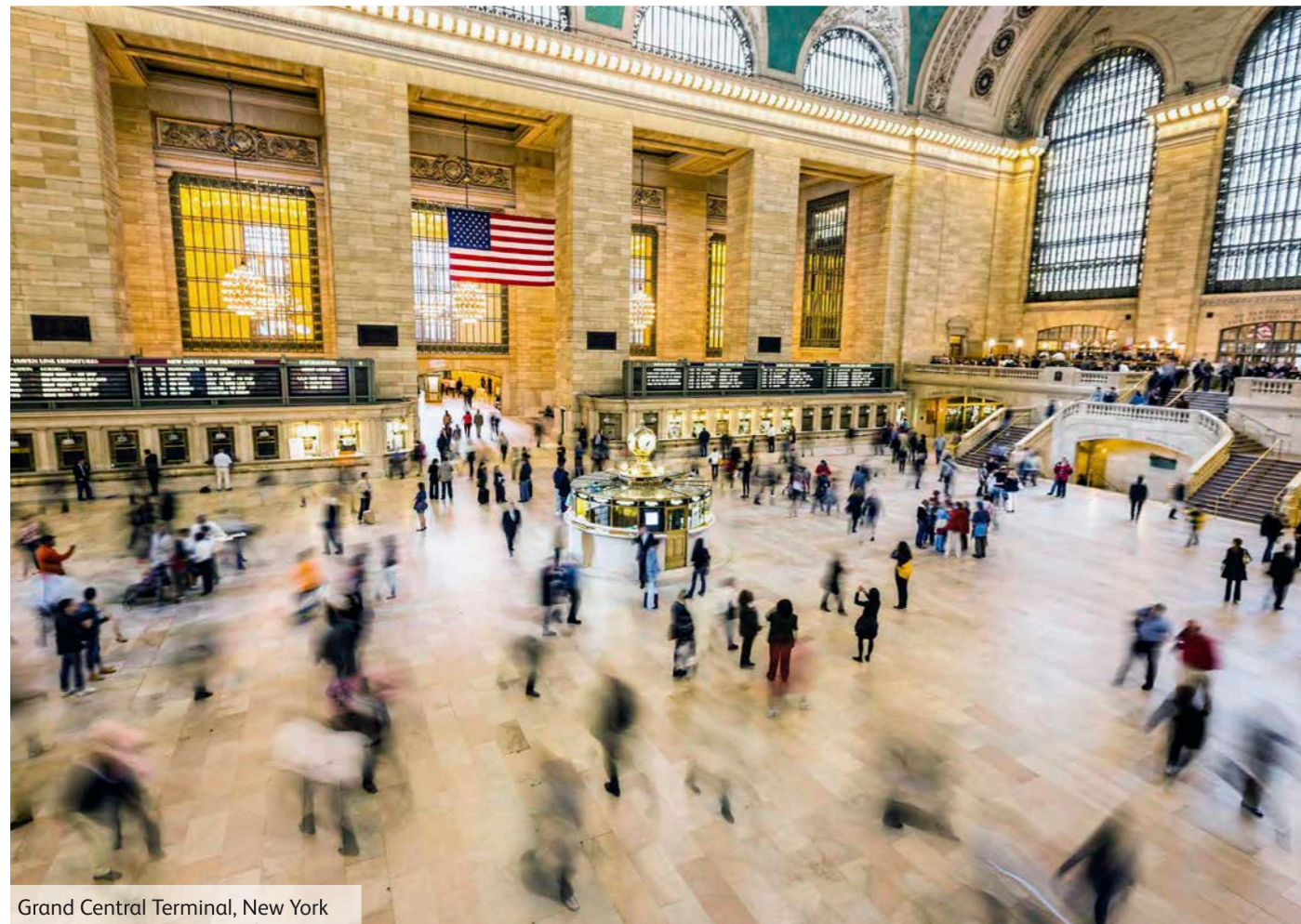
We can advise national and regional governments, rail infrastructure owners and operators and funding agencies on the best way to structure, set up and run rail services. Unlike many traditional consultants, our people have hands-on railway experience. We don't base our analysis and recommendations on how railways behave purely in theory. Instead, we use our understanding of the theory combined with our knowledge of what actually happens in practice. Our expertise extends across the strategic spectrum, to cover aspects such as industry re-structuring, change management, business planning and strategy development building on our experience of transforming Britain's rail system to become a world leader in safety, performance and efficiency over the past 15 years.

We can also help with rail service franchising (including bidding, specification and evaluation), station planning, demand and revenue forecasting, creation and negotiation of access agreements, network code

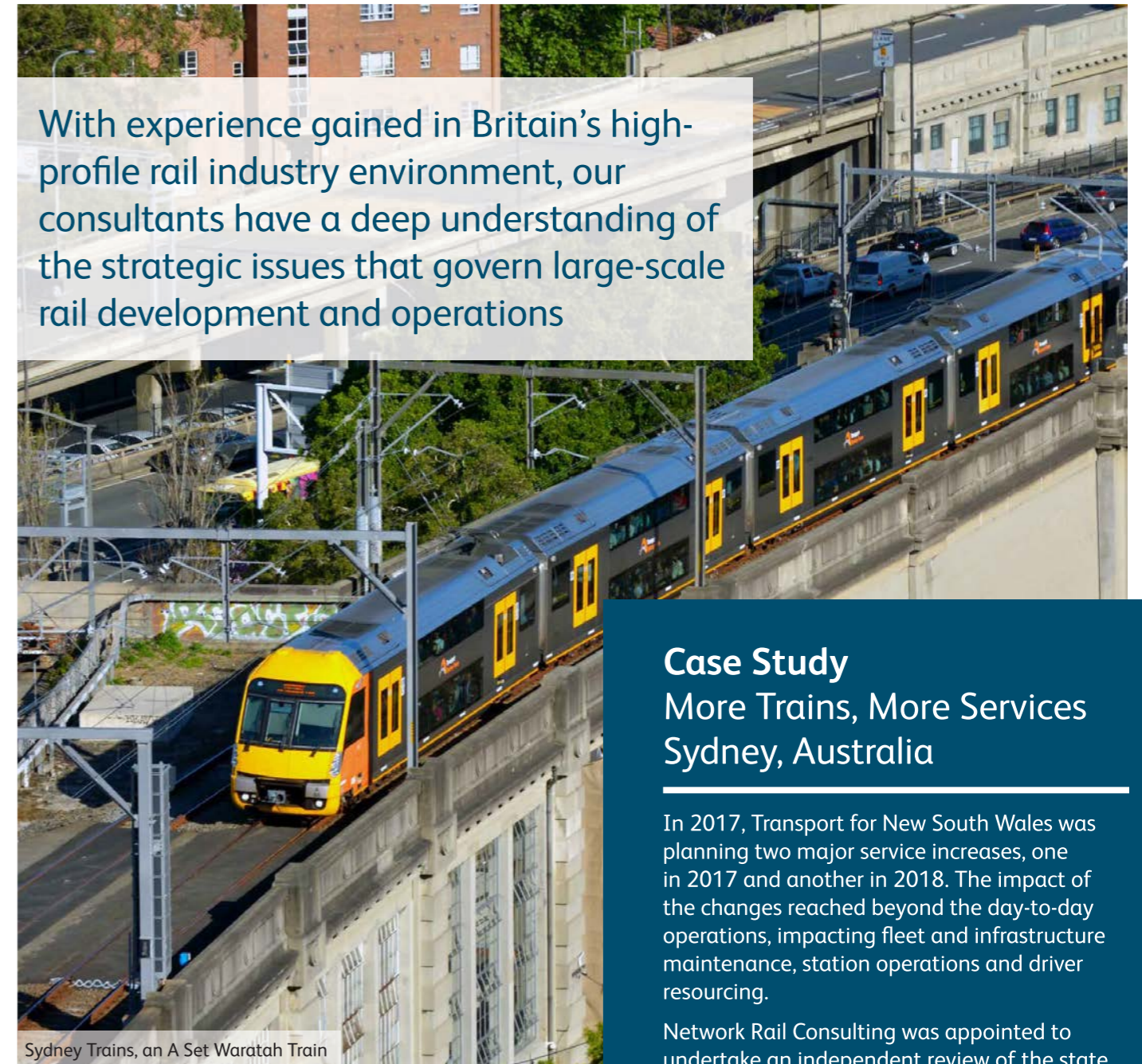
(access conditions), customer satisfaction monitoring and train performance improvement plans.

By auditing your procurement processes we can identify potential savings and work with you to implement a transparent, non-discriminatory sourcing system which complies with international best practice. We can help you set up partnering alliances with major suppliers and sustain best practice.

Benchmarking against comparable rail organisations in other countries is one of the best ways to assess the management and operations of railway systems. Our consultants are experienced in organisational change and transformation management in the rail industry. This expertise can add value if you need to implement change to improve financial performance.



Grand Central Terminal, New York



Sydney Trains, an A Set Waratah Train

With experience gained in Britain's high-profile rail industry environment, our consultants have a deep understanding of the strategic issues that govern large-scale rail development and operations

Case Study More Trains, More Services Sydney, Australia

In 2017, Transport for New South Wales was planning two major service increases, one in 2017 and another in 2018. The impact of the changes reached beyond the day-to-day operations, impacting fleet and infrastructure maintenance, station operations and driver resourcing.

Network Rail Consulting was appointed to undertake an independent review of the state of readiness for these service increases and make recommendations to Transport for New South Wales. We interviewed over 30 groups to ascertain whether all of the areas impacted by the change were adequately prepared and risks to the implementation of the program had been suitably considered and mitigated. Our findings were used to give assurance to the Deputy Secretary regarding readiness for the new services.

Project and Program Management

Legacy rail networks designed for a different era present their owners and operators with major constraints to modernisation, as we know only too well. Sometimes it's possible to make marginal system improvements, but eventually the time comes to make the big decisions.

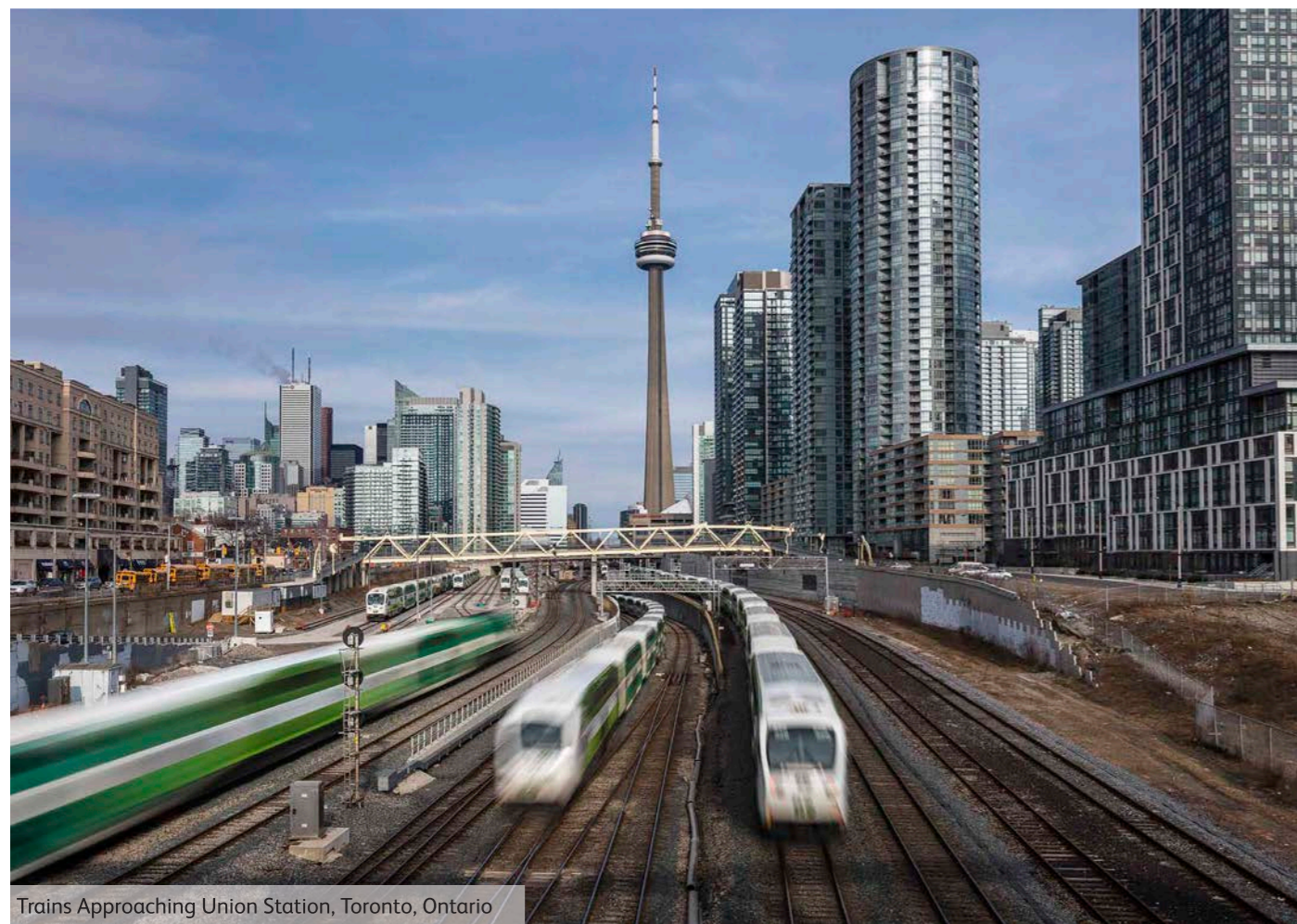
Over the period 2014-2019, Network Rail spent over £35bn (circa US\$ 44bn) on running, maintaining and enhancing Britain's rail infrastructure. We have successfully delivered a number of large-scale projects such as London Bridge station and creating new infrastructure that links seamlessly into the existing network such as London's Crossrail Project. Every year, our team carries out thousands of enhancements to our track, bridges, tunnels, buildings & civils, signalling, power & electrification and telecommunications network.

Our network is heavily used, so its essential to limit the disruption to train services. Works are largely

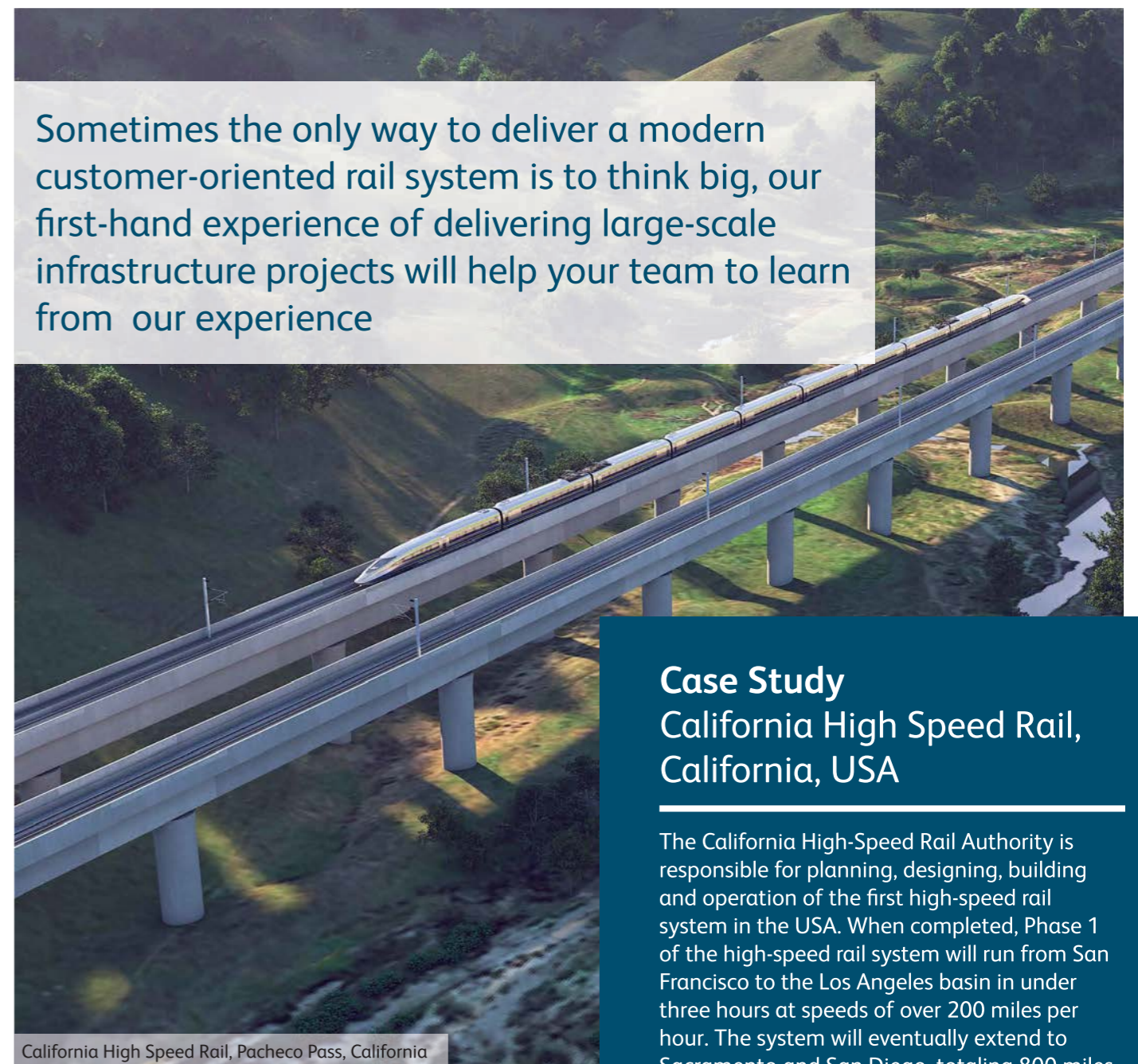
undertaken during night and weekend possessions, and during holiday periods, leaving weekdays largely unaffected. The planning for these possession periods is highly complex, requiring close project management. We have been very successful at maintaining services through optimising train paths whilst keeping our customers informed about disruptions.

Unlike some other consultants, we are experienced in operating in a safety-critical environment with multiple stakeholders, within a complex regulatory regime, delivering mega projects on time and within budget.

We can provide you with an integrated team who will manage the planning, design, procurement, construction, operations and maintenance of your projects. Our focus is always on safely completing projects on time and within budget to deliver an enhanced service to customers.



Trains Approaching Union Station, Toronto, Ontario



Sometimes the only way to deliver a modern customer-oriented rail system is to think big, our first-hand experience of delivering large-scale infrastructure projects will help your team to learn from our experience

Case Study California High Speed Rail, California, USA

The California High-Speed Rail Authority is responsible for planning, designing, building and operation of the first high-speed rail system in the USA. When completed, Phase 1 of the high-speed rail system will run from San Francisco to the Los Angeles basin in under three hours at speeds of over 200 miles per hour. The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations.

As part of the Rail Delivery Partner consultancy team, our Sacramento office is proposing standards for operations and maintenance, proof of concept operations, assisting the client in selecting a preferred bidder for different stages of the project and providing systems integration for the holistic engineering elements of the project.

California High Speed Rail, Pacheco Pass, California

Systems Integration

Technology is enabling huge improvements in the efficiency and capacity of railway networks, but it brings with it significant challenges in specification, design, implementation and delivery of the benefits for which it was purchased.

Railway technology projects frequently involve multiple suppliers and interact with multiple parts of the railway system and the railway company's organisation across complex interfaces. Realising the benefits of new technology often involves wholesale changes to the operation of the railway, affecting everything from long-term service planning to delivery of operations on the day. The roles and responsibilities of individuals are affected, with some tasks no longer required and the need for new roles to be specified.

Making the different elements of the technology work together, and more importantly, to work with your railway organisation to deliver the service you want, requires a combination of expertise, experience

and formal techniques. Whether it is operational performance modelling to disaggregate the reliability requirements of the engineering components of a new system, or an assessment of the degraded mode operating scenarios and how the technology and the people will operate under them, we have both the tools and the experience to help you set and manage your requirements.

As well as practitioners of systems engineering, we can add subject matter experts in areas such as operating rules, signalling principles and reliability engineering, who will work together so that your project will provide the benefits you set out to achieve.



Washington Metro, Washington, D.C.



Rail technology projects are more complex than ever before and therefore delivering successful technology projects requires a combination of know-how, experience and formal methods

Digital Railway System

Case Study Supporting Digital Railway, Sydney, Australia

The Digital Systems project in Sydney is part of the More Trains, More Services program to dramatically increase the capacity of the Sydney Trains network to accommodate anticipated passenger growth by 2030. The Digital Systems program is focused on investing circa A\$800m (US\$560m) in the implementation of ETCS level 2 digital signaling and Traffic Management, together with associated upgrades to the train Onboard units, Digital Train Radio System (DTRS) and Fixed Telecoms Network (FTN). The program is being delivered by Transport for New South Wales on behalf of Sydney Trains, who will be the end user and operator.

Network Rail Consulting was appointed as Digital Systems Integrator in 2018 and is responsible for the system specification, system integration, system assurance, system integration testing and technical oversight of the program.

Rail Operations

We run one of the busiest and fastest-growing rail systems in the world. And, despite the pressures of managing a bustling system in a turbulent real-world operating environment, we've succeeded in increasing capacity, enhancing safety and providing a better service for customers and staff alike.

Experience of the latest systems and operational practices gives us a unique perspective on how a modern railway can function. Our consultants can work with your people or as external experts to review the current status of your operations and develop strategies for optimising services.

We are currently creating a new control system for the British network, based on 12 new control centres. This will replace legacy signalling systems, some of which date back to the pre-war era.

The experience we have gained during major upgrades means that we can help you to plan, develop and safely integrate new signalling centres into your network.

These efficiencies will help you to achieve significant long-term savings.

We have developed a suite of modelling services that will enable you to analyse timetable efficiency and predict the impact of service disruptions. They enable us to advise you on the best ways to accommodate train services without sacrificing the performance of the network. These tools are in daily use as we work with Britain's train-operating companies to review their proposed service patterns.

By applying modern operating techniques, we have been able to run more trains on a smaller network, reduce operating costs, increase passenger numbers, reduce track closure times, extend component/system life and achieve better integration of technology, without compromising on safety.

Our experts have been at the forefront of this work, and we can help you to transition from inefficient practices to using modern technology and processes to drive cost savings and performance improvements.



Network Rail Control Room



SAR Passenger Train, Riyadh, Saudi Arabia

With in-depth experience of running a busy live network, we know how to get more out of your existing signalling systems, timetables and stations

Case Study New Passenger Services, Riyadh, Saudi Arabia

Saudi Arabian Railway's North-South Railway (SAR) is a 2,750 km mixed-use heavy haul freight and passenger railway. Network Rail Consulting, working closely with SAR, was responsible for leading the infrastructure asset approval process, including ERTMS operational readiness, overseeing and approving commissioning, safety assurance, and the introduction of standards and procedures all leading to the successful introduction of train operations under ETCS Level 2 signal control system.

Passenger services were introduced in phases to aid commissioning of the longest ERTMS Level 2 system in the world. In phase one, services ran from Riyadh station to the regional city of Al Qassim with a journey time of 2h 30min; phase two introduced services to Ha'il some 650 km north of Riyadh with a journey time of under 4 hours; and phase three we introduced overnight passenger services to Al Jouf some 920 km north of Riyadh with a journey time of 8 hours.

Maintenance

Whether you are looking to reduce maintenance costs, are constrained by limited rail corridor access or you want to get better reliability without spending more, we have the tools, techniques and experience to help advance your maintenance regime design.

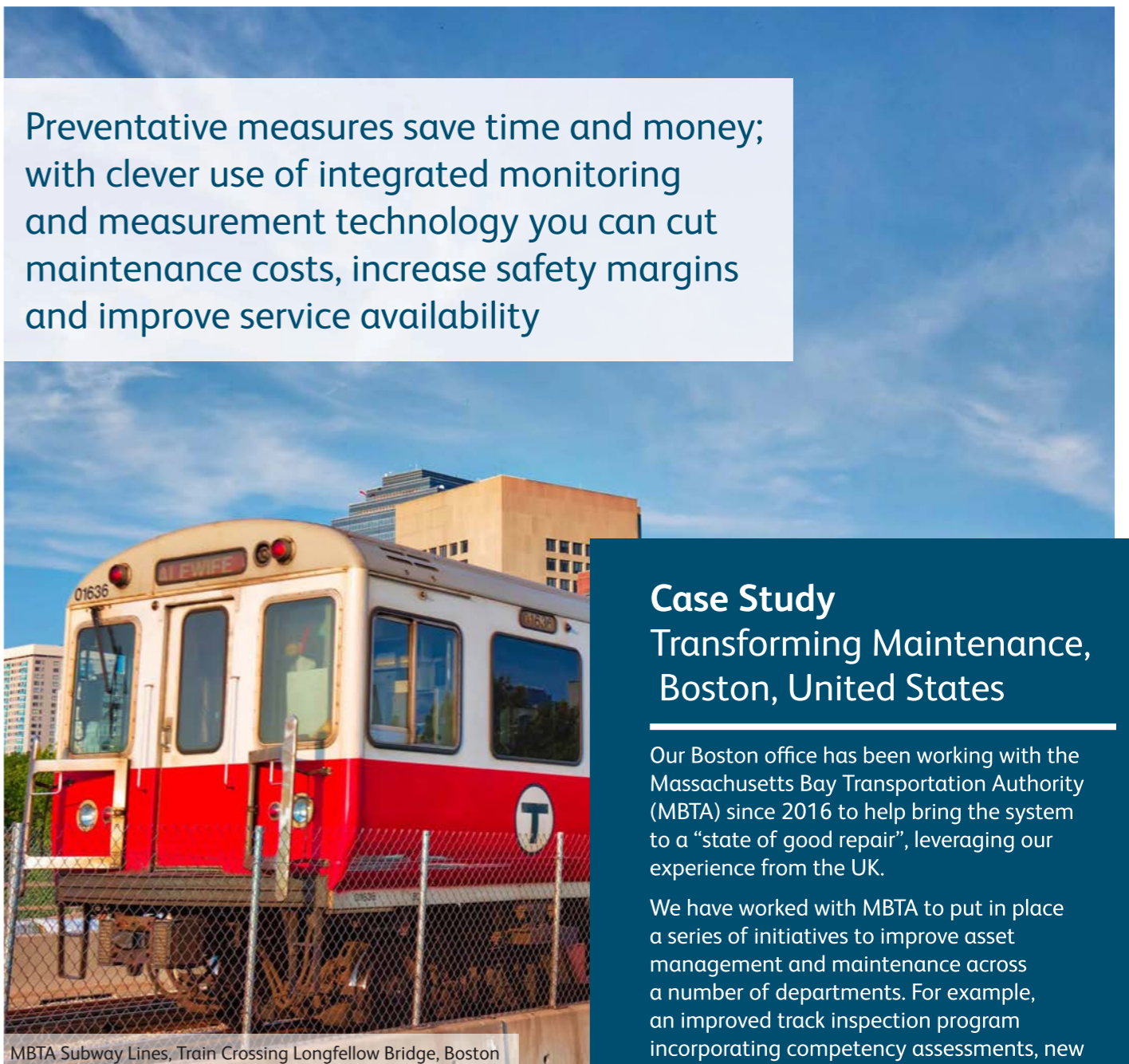
Reliability Centred Maintenance can help you optimise your maintenance, spending more time on tasks that drive reliability and less time doing tasks that add little value. With Risk Based Maintenance, you can evolve to build your maintenance plan to concentrate effort on those assets that have the biggest impact on your operation.

Technologies such as Automated Inspection and Remote Condition Monitoring can help you spot defects before they impact train services, allowing you time to plan an effective repair, saving you downtime and reducing your unplanned corridor access, meaning your staff can undertake the work more safely.

Network Rail has two decades of history not just in the technical aspects of advanced maintenance, but also in implementing changes in a unionised work environment. Our Plain Line Pattern Recognition Technology regularly inspects 4,800 miles of track, removing the need for staff to walk the line. Our Remote Condition Technology monitors over 40,000 assets from switches and track circuits to power supplies and rail temperatures and has resulted in fewer delays to train services saving millions of pounds in performance penalties. Network Rail Consulting has undertaken projects worldwide sharing our experience and helping railways like yours to deliver more effective and efficient maintenance.



Rail Track Maintenance Worker



MBTA Subway Lines, Train Crossing Longfellow Bridge, Boston

Preventative measures save time and money; with clever use of integrated monitoring and measurement technology you can cut maintenance costs, increase safety margins and improve service availability

Case Study Transforming Maintenance, Boston, United States

Our Boston office has been working with the Massachusetts Bay Transportation Authority (MBTA) since 2016 to help bring the system to a “state of good repair”, leveraging our experience from the UK.

We have worked with MBTA to put in place a series of initiatives to improve asset management and maintenance across a number of departments. For example, an improved track inspection program incorporating competency assessments, new guidelines, dashboards, training videos and a mentoring program has resulted in a 77% reduction in track-caused speed restrictions over a three-year period. By working side-by-side with track supervisors to improve track maintenance management and assurance of track repair work, we have also helped MBTA reduce the number of critical track defects, improve asset condition towards a state of good repair and reduce the risk of derailments.

Asset Management

Establishing effective asset management is the first step to achieving and maintaining a state of good repair. Our experience in renewing an entire national network has shown that a carefully planned and managed approach pays big dividends in reduced costs, improved service and increased passenger numbers.

This systematic approach has made us world leaders in developing and applying integrated tools and techniques to monitor and manage rail assets. The route from asset management theory to practice is a long one and it encompasses every part of the organisation from IT and HR to finance and operations as well as the traditional engineering disciplines. We have been independently assessed as one of the most mature asset management organisations in the rail sector and in the top quartile across all the asset-based utility sectors.

We have made marked improvements in our own asset management through an integrated program of enabling mechanisms. These include improvements to asset data specification and capture, decision support tools, investment in people and competencies, integrated processes, asset policies, strategic asset management planning, reliability modelling and whole life cost tools which evaluate the trade-off between cost, performance and risk.

We can help you understand your own asset management maturity, using internationally recognised assessment models. From there we can help you develop a roadmap to deliver the benefits that good asset management brings. Most importantly, we can bring you practical, implementable solutions based on our extensive experience.



Switch and Crossing Track



The Number 7 Line, Grand Central Subway Station, New York

Case Study Principal Systems Integrator New York, USA

Our New York office, working as part of an integrated team led by DXC, were responsible for the development of the asset information strategy and management framework for the New York MTA and its associated agencies building on the successful implementation of a similar system in Network Rail in the UK. The framework, guidance and standards produced align with ISO 8000, ISO 55000 and PAS 1192 to support MTA's goal to achieve ISO 55000 certification and BIM Level 2 as an organisation.

Our team also played a key role in the change management workstream, producing a benefits realisation strategy and framework to define, capture and track the ongoing financial efficiencies that are yielded from the business outcomes of deploying and investing in EAM tools and technology. We have also supported the 'piloting' of these systems to ensure end-users requirements are met and helped the development and roll-out of training modules.



Sydney Trains Pass at Central Station, Sydney, Australia



SAR Freight Train, Saudi Arabia



Acela Express at Washington, DC, USA



Amtrak at Moorpark, California, USA

Local presence - international expertise

Our approach is to provide the right blend of international best practice expertise coupled with local rail experts who are familiar with the local operating, regulatory and political context, so that we provide advice that is appropriate and implementable for local circumstances. We draw our core expertise from Network Rail, the owner and operator of Britain's rail infrastructure. Together with locally based experts a key part of our offer is our ability to reach back to our colleagues in the UK to access the latest advice, get access to world class expertise and provide additional technical resources during periods of peak workload demands.

Our local teams are able to provide rail owners and operators a wide range of advice covering:

Advisory and Strategic Planning

- ▶ Benchmarking, Auditing and Due Diligence
- ▶ Appraisal, Cost Benefit Analysis and Forecasting
- ▶ Institutional Advice
- ▶ Organizational Change and Transformation Management
- ▶ Performance Regime Design and Management
- ▶ Rail Franchising – Bidding, Specification and Evaluation
- ▶ Policy Development

Stations and Commercial Development

- ▶ Station Design Principals
- ▶ Station Scoping and Requirements Setting
- ▶ Operations and Maintenance and Asset Management Plans
- ▶ Retail and Space Optimisation
- ▶ Customer Information Development

Maintenance

- ▶ Access Optimization
- ▶ Design and Implementation of Training
- ▶ Design, Modification and Implementation of Maintenance Management Systems
- ▶ Design of Outsourced Operations and Maintenance Contracts
- ▶ Planning Maintenance Facilities
- ▶ Systems Automation

Major Projects

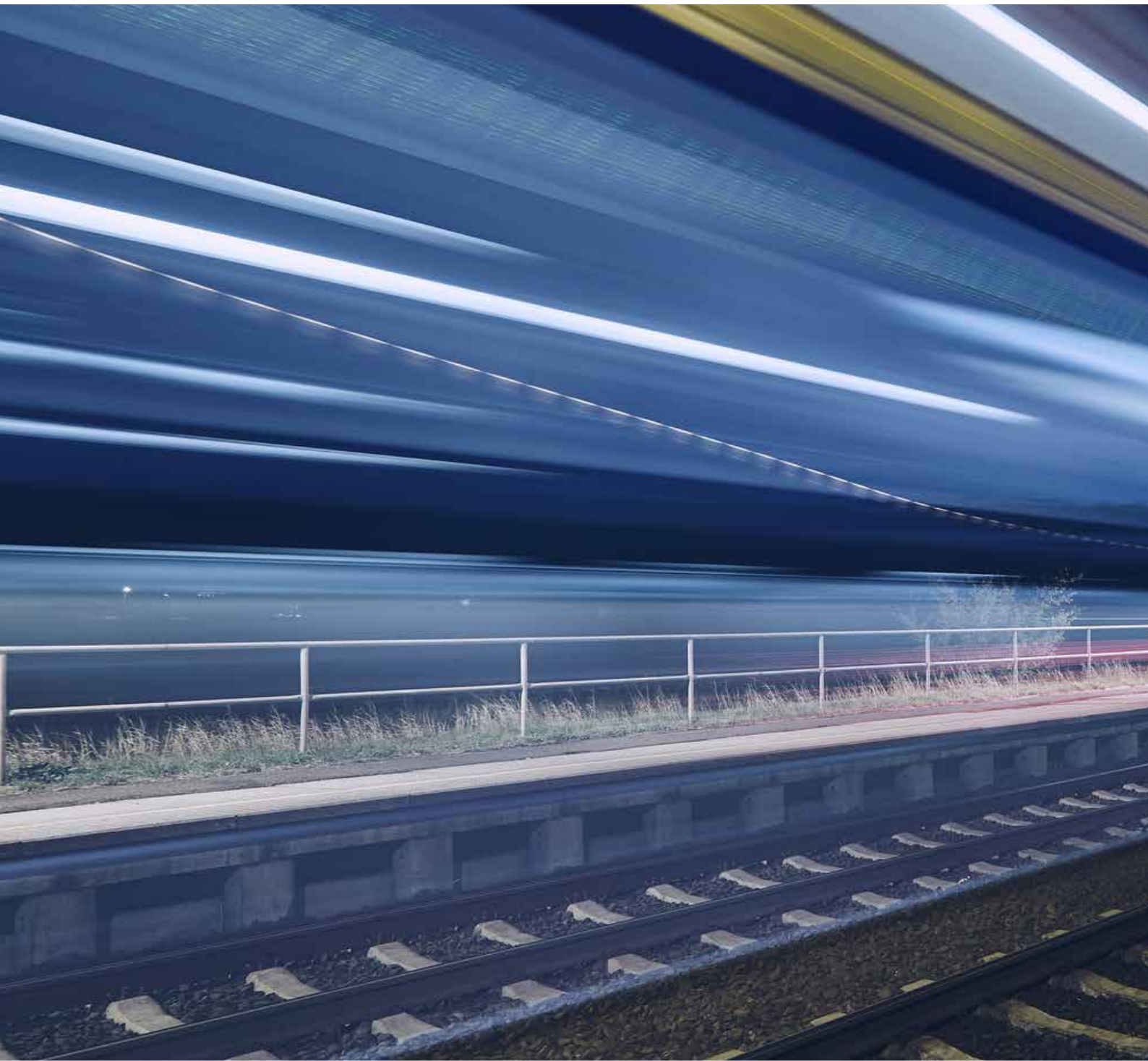
- ▶ Access Planning
- ▶ Client Side Delivery Partner
- ▶ Construction Management & Operations Planning
- ▶ Development and Roll Out of New Digital Train Control Systems
- ▶ Project and Program Management
- ▶ Reporting & Documentation
- ▶ Risk Management
- ▶ Scheduling
- ▶ Stakeholder Management
- ▶ Systems Integration
- ▶ Value Engineering

Rail Operations

- ▶ Operational Infrastructure Planning and Optimization
- ▶ Operations Control and Management Systems
- ▶ Performance Analysis and Modelling
- ▶ Shadow Operator Services
- ▶ Simulation Modelling and Timetabling

Asset Management

- ▶ Asset Degradation Modelling
- ▶ Conceptual Design of Asset Management Plans
- ▶ Data Capture
- ▶ Enterprise Asset Management Systems
- ▶ Remote Condition Monitoring
- ▶ Risk Based Maintenance
- ▶ Route Asset Management Plans
- ▶ Whole Life Evaluation



International Presence

- ▶ *Boston*
- ▶ *London*
- ▶ *New York*
- ▶ *Riyadh*
- ▶ *Sacramento*
- ▶ *San Francisco*
- ▶ *Sydney*
- ▶ *Toronto*
- ▶ *Washington, D.C*

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