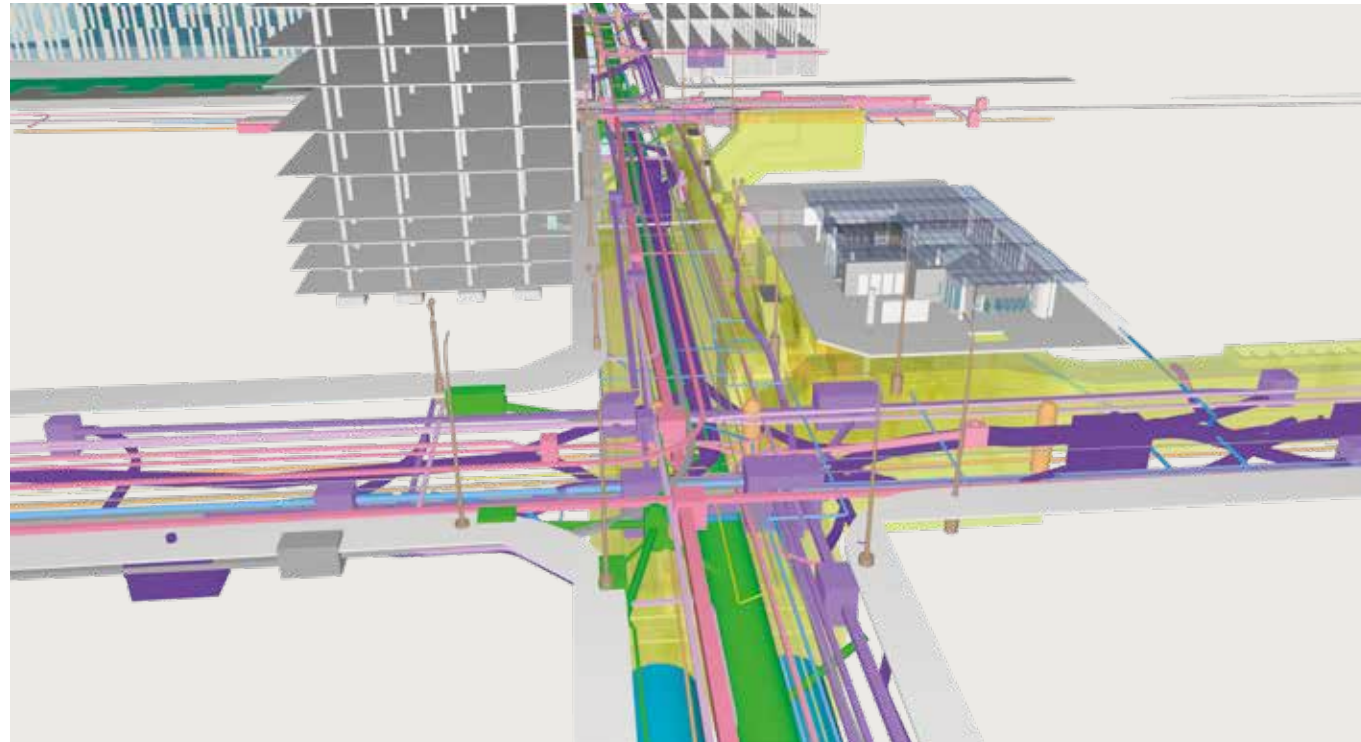


Art of the possible

Pushing project delivery
frontiers with BIM



Redefining the possible



“It’s all about adding value to information and the connection to people... Better information drives better decisions to meet evolving social needs while minimising waste.”

Building information modelling (BIM) has become a global phenomenon – a powerful focal point for those that recognise the strengths of its collaborative and outcome-focused way of working to maximise efficiency in asset design.

However, the benefits of BIM extend far beyond basic 3D models, and include a host of new and exciting applications. From prefabricated construction to virtual reality apps and the promise of smart infrastructure, BIM is a key enabler for the techniques and processes that will characterise the future of our industry.

It’s no surprise that organisations are now creating their own ‘beyond BIM’ terminology, using words such as ‘digital’, ‘smart’, or ‘industrial’ to try and capture the changes sweeping through the industry and to define their service offering in new ways. But while there is increasing divergence in the terms being used, the fundamentals have not changed, and two elements remain key to the way we use BIM today.

Firstly, it’s all about adding value to information. Making the right information available when and where it is needed, collaborating around a common data environment, and connecting to new live data sources are all essential elements of both the BIM and post-BIM worlds. Better information drives better decisions.

Secondly, it’s about the connection to people – our ultimate customers. In a world of limited resources, physical and digital infrastructure must meet evolving social needs while minimising waste.

The debate over ‘a better name for BIM’ will rage on, but the fundamental aims haven’t changed. In these pages you will find exemplar projects which showcase our ability to use the strengths of BIM processes to optimise outcomes for our clients and their customers. From developing strategies for those keen to embed BIM in their businesses, to creating models for whole-life information management, our expertise will help you make the most of BIM at all stages of your project.

Talk to us if you would like to know more about how BIM can be harnessed to benefit your business and your customers.

Richard Shennan
Digital business development director

Six reasons to choose Mott MacDonald

1.

Innovative, cost-effective projects

Don't just take our word for it – we win multiple industry awards each year, and our tally includes many of the leading BIM awards. Having the best people in our industry and leading-edge technologies is key, of course, but our 100+ years of experience counts too.

2.

Vast BIM expertise

We have created BIM models for some of the biggest and most complicated infrastructure projects in the world. Through our integrated model-based delivery method and a BIM object library comprising over 10,000 components, we have the resources and expertise to help you make the most of BIM.

3.

Engineers, not just managers

Working with us, you gain access to huge experience of buildings and infrastructure across sectors and regions, and skills in enterprise information management and the emerging field of data science. What that creates is a unique offer covering all aspects of the journey from BIM to smart infrastructure.

4.

Adding value to your information

We are primarily an information-based company, adding value to asset information to unlock efficiencies and enable better performance. Your data in the right hands can be harnessed in new ways to provide new insights, create new services, or simply help you make better decisions.

5.

Multidisciplinary expertise

We operate across all key infrastructure sectors. That matters because innovation and best practice are transferable. We track breakthroughs, understand what works and why, and have the imagination to spot when an idea, technology or practice can leap sectors and territories to benefit your project.

6.

Shaping smart infrastructure

We have developed new and exciting digital solutions to complement or even replace physical infrastructure solutions. Your project may start with BIM, but talk to us to see how much further we can take your asset information management.

Better information for enhanced outcomes

The benefits of BIM extend all the way through the asset lifecycle, unlocking efficiencies and enabling you to access new digital developments.

Project shaping

- Procurement strategy
- Through-life value
- Feasibility assessment
- Existing data capture
- Risk assessment
- Enterprise information strategy

Digital design

- Process mapping
- Collaboration platform
- Parametric design
- Standardisation
- Automation
- Design integration
- Supply chain interface

Construction efficiency

- Methodology modelling
- Fabrication planning
- Time reduction
- Waste reduction
- Safety
- Change control
- Digital transfer to owner

Smart infrastructure

- Performance modelling
- Condition modelling
- Analytics and reporting
- Assessment and feedback
- Real-time dynamic response
- Adaptation and repurposing
- Re-use and recycling

- Programme, project, cost and carbon management
- Information management and maintenance
- Data visualisation
- Optimisation of asset performance at all stages

Adding value by optimising design

Providing enhanced travel and improved connectivity for commuters on the Los Angeles Metro, the US\$927M Regional Connector Transit Corridor (RCTC) project will see over 3km of tunnels and three new stations added to the network. The rapid timescale combined with the need to co-ordinate over a dozen design disciplines made smooth collaboration a key requirement of the project.

A common data environment enabled 15 US-based Mott MacDonald offices, as well as the owner, contractors and project partners, to collaborate effectively. This was supplemented with regular BIM co-ordination sessions to keep stakeholders in constant communication and share best practice. Real-time updates to model data improved efficiency and quality of the final design, while the elimination of design changes during construction, thanks to the ability to identify conflicts and optimise the model, was a major advantage.

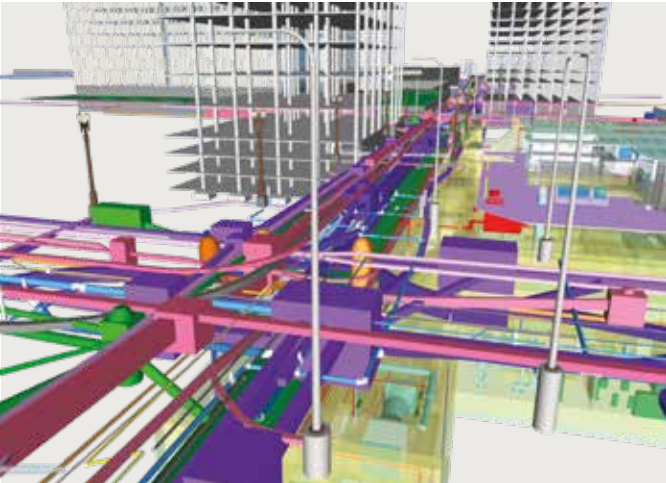
Project
Regional Connector
Transit Corridor

Location
Los Angeles, US

Client
Los Angeles County Metropolitan
Transportation Authority (Metro)

Expertise
Engineering design and
project controls

Project phase
• Digital design



Using BIM for better public transport

Project
Organisational BIM strategy and Clyde Junction pilot project

Location
New South Wales, Australia

Client
Transport for New South Wales

Expertise
BIM technical advisory

Project phase

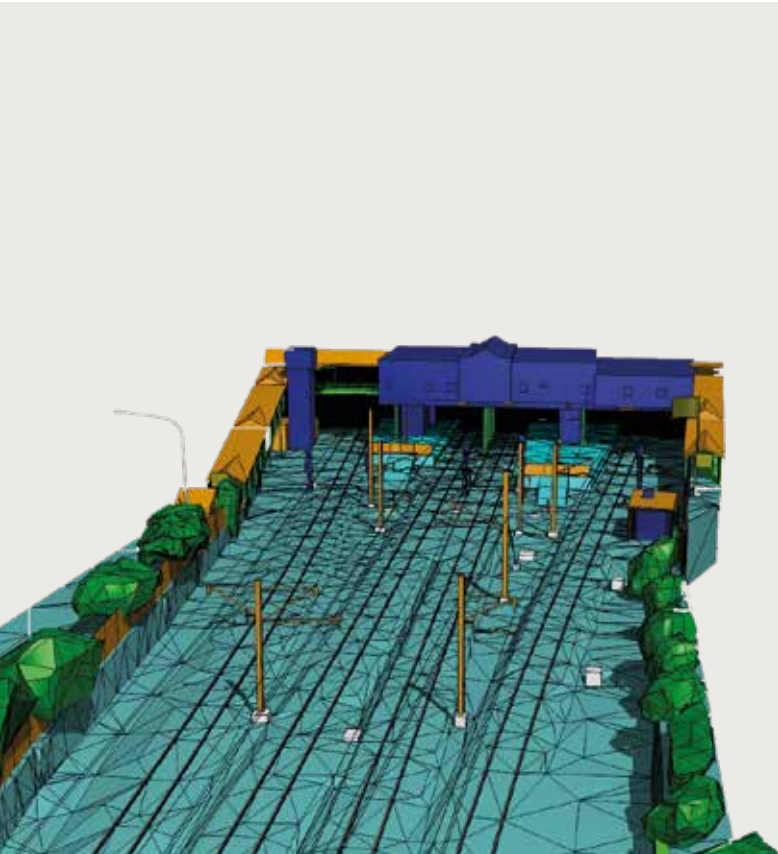
- Project shaping
- Smart infrastructure

Transport for New South Wales (TfNSW) identified BIM as key to achieving a step change in the way public transport infrastructure is procured, executed, operated and maintained. Our starting point was to look at their organisational information management and understand where they were best able to add value. We began by establishing key needs and objectives through an intensive period of workshops and interviews with internal and external stakeholders. We assessed the baseline capability and developed a bespoke roadmap to guide TfNSW towards through-life asset information management and resulting improvement in outcomes per through-life dollar.

Alongside these services we also delivered TfNSW's first pilot project, which demonstrated the benefits of BIM to stakeholders and helped to develop cost-effective solutions to key design and construction issues. We explored over 45 different interventions to bring BIM to life. Our client is moving through the roadmap, and is already seeing the benefits of embedding BIM across key business functions.

“Mott MacDonald’s use of BIM in the CJP pilot study sets the company apart from all other consultants... TfNSW is actively seeking ways to encourage the implementation of BIM as demonstrated by Mott MacDonald on all our programmes.”

John Templeman
TfNSW program director



Improved collaboration, better processes, bigger cost savings

UK Power Networks is responsible for 170,000km of power lines, bringing electricity to over a quarter of the country’s population. As a regulated business, UK Power Networks is seeking ways to realise efficiencies within their capital delivery programme and BIM was identified as key to streamlining the process, within an overall objective of achieving a 10% cost saving throughout the eight years of the current price control period.

We were appointed to develop a strategic roadmap to integrate BIM into UK Power Networks’ capital delivery programme, with the objective of reducing the time and improving the quality with which new assets are delivered. Our work began by examining existing BIM practice; we did this by engaging with over 20 stakeholders within the business and met with key partners to ensure our roadmap would work for the supply chain and newly emerging delivery teams.

To follow, we developed a suite of BIM protocols to enable application of BIM on live projects, better information sharing and improved collaboration.

As a result of our consultancy, the development of collaborative working processes based on organised data is integrated with other aspects of UK Power Networks’ business transformation plan. Internal and external processes are more efficient, and the company is well on track to achieving its aim to reduce costs, ultimately providing better value for money to customers.



Project
BIM consultancy services

Location
London, UK

Client
UK Power Networks

Expertise
BIM consultancy

Project phase

- Project shaping

“In a context of transformation such as the one UK Power Networks is going through, the team has been able to analyse and elaborate priorities, effectively aligning strategic objectives to an actionable high-level plan for the implementation of BIM best practice.”

Allan Ponsonby
Head of engineering design, UK Power Networks

Using BIM to maximise adaptability and cut waste

Project
Belmont House
Location
London, UK
Client
Confidential
Expertise
Structural and below ground drainage engineering
Project phase
<ul style="list-style-type: none">• Digital design• Construction efficiency

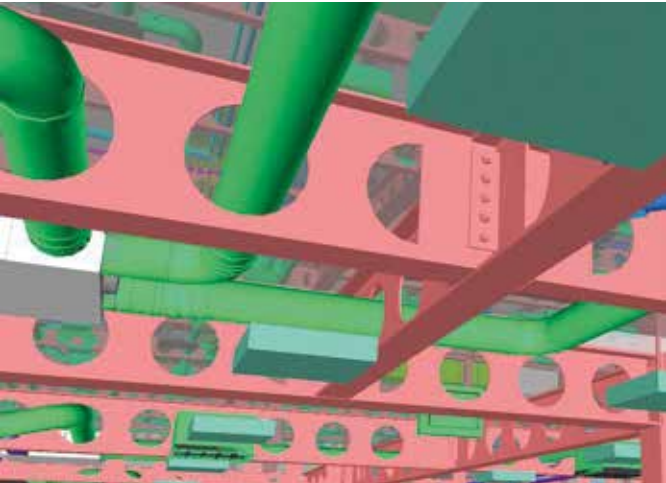
This £30M refurbishment of a 1980s concrete frame building included the demolition of a third of the original asset. This enabled two independent structures to be connected, creating a unified office space with floor area jumping from 14,500m² to 19,500m², making Belmont House the biggest commercial block in the Uxbridge area. Speed to market was essential to meet the developer’s requirements.

We recognised from the outset that BIM would be key to successful delivery of this project. Within three weeks we developed a 3D Revit model of the existing building based on archive information. This model was an invaluable tool for identifying discrepancies in the planning scheme. These included a 900mm vertical step between the two existing structures; the fact that the structural strategy did not allow for service distribution in many areas; and a large number of off-grid columns which impacted the vision of an open-plan space.

Our model used colour coding to highlight three phases of the structure (existing, demolished and new) and was a powerful presentation tool. It improved

understanding of the site and enabled us to maximise reuse of the existing structure. It also helped us develop bespoke solutions to achieve the required ceiling and service zone – a key requirement for the new office space. This was a particular challenge as the services had to transition between the existing concrete structure and the new steel frame.

Through our use of BIM we developed in-depth knowledge of the structure and constraints, enabling us to provide additional services, such as demolition drawings. The model became vital for planning the demolition, sequencing and temporary works to achieve the challenging 18-month programme and deliver on budget. It was also instrumental in enhancing the sustainability of the project by enabling re-use of approximately 70% of the existing structure. By capturing and using data relating to the existing structure and integrating it with the design for the refurbishment, we were able to reduce the risk of problems on site, optimise the adaptation of the original building, and reduce the amount of waste in the process.



Using the power of big data to cut two years off delivery

With a team of over 300 staff spread over multiple offices, the design delivery of this major sewer expansion project required an efficient means of sharing information.

We created an industry leading common data environment (CDE) – our first to be fully BS 1192-compliant – which combined product information, CAD, BIM and project controls on a single platform. The CDE brought together 12 technical disciplines, and within each one we empowered information champions to help build the culture required to effectively deliver the project. Weekly BIM meetings meant problems were quickly resolved and best practice shared widely.

Use of the CDE had very positive outcomes with vast cost and time savings. Altogether, 350 drawings were avoided across the project, with a six-month reduction in design delivery time that enabled an overall reduction of two years in the construction programme. The platform also enabled smart progress reporting, and our client was so impressed with our automated earned value analysis that it has been rolled out on other contracting joint ventures.

Project

Tideway Tunnel East

Location

London

Client

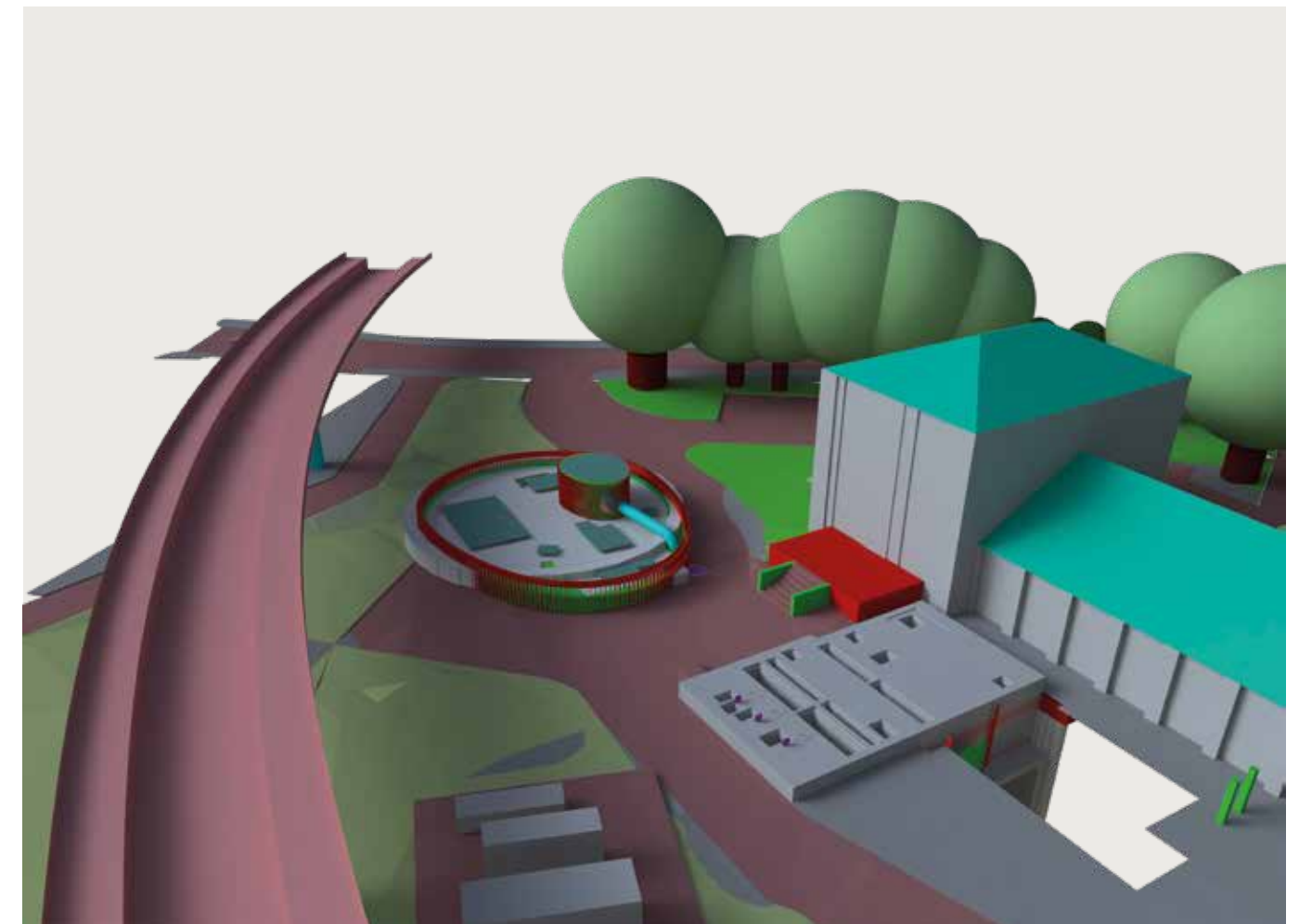
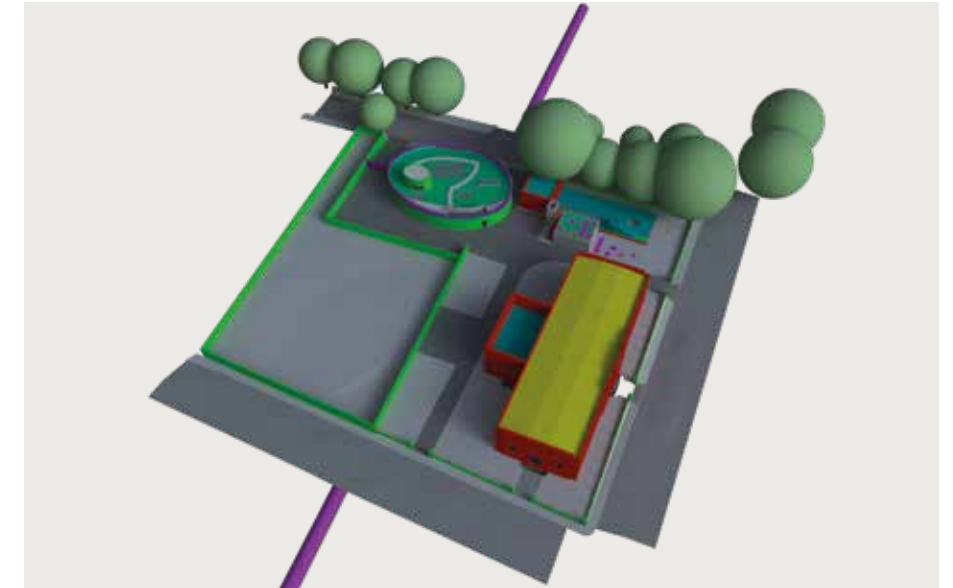
Thames Tideway Tunnel

Expertise

Engineering design and information management

Project phase

- Construction efficiency



A sporting success

A major international multisports event in Queensland, Australia, saw 6500 athletes and officials from 71 countries compete at 18 sports venues over 11 days.

As part of our engagement with the client, we provided a full-time BIM co-ordinator to oversee processes and identify new efficiencies. One focus was to overhaul the production of building services load schedules, which are used to estimate the amount of power that will be needed for an installation.

We devised a bespoke solution using AutoDesk Dynamo, a visual scripting language, to load information from an Excel spreadsheet onto an overlay design model and carry out the necessary calculations to produce load schedule summaries.

With traditional load schedules, the value is lost as soon as the design changes or new engineering information is received. However, our bespoke solution provided an agile and powerful tool to keep load data current as the model was updated. This automated process reduced the time it took to produce load schedules by more than 95% compared to traditional methods.

Taking into account the 18 venues and the continuous updates to designs between planning and the end of the event, our work cut several hundred working hours from the schedule, allowing public money to go further, while helping to deliver an efficient and successful event.



Project
Major international multisports event

Location
Queensland, Australia

Client
Confidential

Expertise
BIM co-ordination, event overlay design, transportation design

Enabling a step change in efficiency for Dubai’s transport authority

- Project**
RTA BIM Strategy
- Location**
Dubai, UAE
- Client**
Government of Dubai, Roads & Transport Authority (RTA)
- Expertise**
BIM consultancy
- Project phase**
 - Project shaping
 - Smart infrastructure

Dubai’s Road & Transport Authority (RTA) identified BIM as key to improving the way public transport infrastructure is procured, executed, operated and maintained. We were appointed to create the framework to facilitate this change, driven by the organisation’s asset management department.

Our approach looked beyond models as simply a 3D representation of an asset and instead focused on making better use of information within the RTA’s business processes, optimising them to deliver business goals through positive behavioural change as well as technology. The outcome meets international best practice, focused on greater efficiency for the long term.

Delivered across three phases, our commission began with in-depth study of the organisation to establish its baseline and to assess the size and complexity of the skills gap that had to be bridged. Interviews, online surveys and focus groups painted a picture of BIM understanding within the organisation and through the supply chain.

This allowed us to develop a BIM roadmap with a phased task schedule to raise the capabilities of the team and the supply chain over the medium term. The BIM strategy was implemented across capital delivery, with pilot projects enabling the development of cost-effective solutions that could be rolled out across all work streams.

Finally, we set in motion some of the mechanics needed to drive BIM across the business, including demonstration of two ‘proof of concept’ projects using as-built data from live assets.

Our training and education plan will inform future skills development, and our legal review of existing commercial documents enabled us to create an enhanced legal framework for future BIM projects.



Future Cities
BIM Award

Smooth collaboration for hundreds of users

- As one of Europe’s biggest rail projects, HS2 depends on the collaboration of a large, multidiscipline project team spread over a vast geographical area. Large quantities of information from numerous providers using different software systems had to be brought together, while an ambitious delivery schedule meant updates had to be comprehensive and available to others in real time.
- To overcome these challenges we created Apollo – a high-capacity cloud-based platform to enable collaboration and provide a means of sharing design and project information. Apollo makes high-quality geographical information available to over 500 users without the need for extensive training or additional software. Edits to information are shared across the system in real time, simplifying information transfer and ensuring all users work with the most up-to-date information.
- Apollo has since been used on a number of schemes including Crossrail 2, seven Highways England projects, Thameslink, Network Rail Anglia Level Crossing Reduction Strategy, Cumbria County Council Infrastructure Recovery Programme, National Grid North Wales Connection (Wylfa to Pentir) and Thames Water’s Counters Creek project.
- Altogether, our innovative solution has provided a collaborative platform for more than 2500 users from over 80 organisations, with many of those previously adverse to BIM or CAD saying they found Apollo user-friendly and rewarding to use. The efficiency of the system has helped to reduce time and costs throughout all stages of the projects.

- Project**
Apollo project collaboration system
- Location**
UK
- Client**
High Speed Two
- Expertise**
Information management and data hosting
- Project phase**
 - Project shaping
 - Smart infrastructure



An award-winner that shows the future of bridge design

Project
Northern Hub Ordsall Chord

Location
Manchester, UK

Client
Network Rail

Expertise
Multi-disciplinary design services

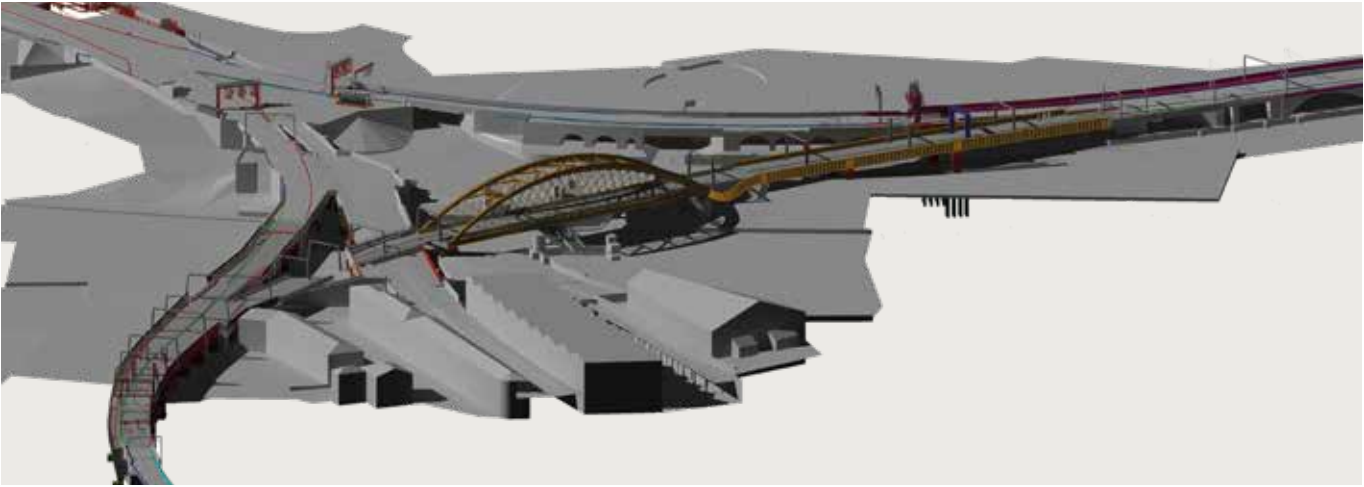
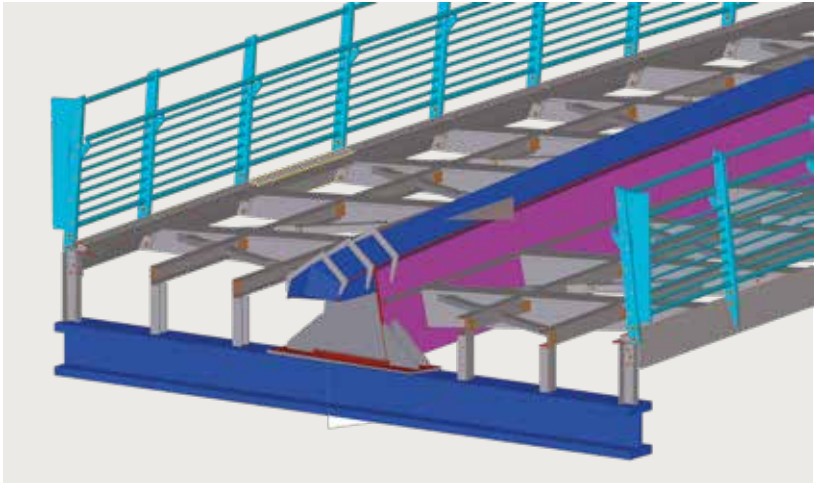
Project phase

- Digital design
- Construction efficiency

The Northern Hub programme is set to boost economic growth in the north of England by improving rail connectivity between key cities and towns. Faster journey times and more trains carrying millions more passengers each year will unlock over £4bn of economic benefits to the wider region with the potential for up to 30,000 new jobs. A key part of the project is the Ordsall Chord, comprising 500m of new track to connect Manchester’s three main stations for the first time and elevated on a complex series of new and replacement structures as well as the existing historic masonry arch viaducts that run through Manchester City Centre.



- Tekla UK Award for Infrastructure
- Tekla UK Award for Infrastructure (Public vote)
- Tekla Global Award for Infrastructure



A new approach to design

We undertook this project working as part of a joint venture with AECOM. In what we believe is a UK first for bridge design, we challenged traditional design roles, embedding the steel bridge fabricator’s modelling staff within the design team to prepare the design models and assist with design drawings. This benefited both the fabricator, who gained an early understanding of design content, and the designer, who was able to incorporate constructability improvements at a much earlier stage than usual. We adopted the steel fabricator’s modelling platform, Tekla Structures, and used this for the modelling of all structural steelwork. Although this presented some initial interoperability challenges, use of this software gave the designer confidence that they could accurately model what had to be built and eliminated the wasted time and potential risk associated with the need to reconcile design and fabrication models. This pioneering collaborative approach led to a significantly reduced volume of site queries, allowed early release of design, and cut the steelwork subcontractor’s normal fabrication lead-in time by half.

A landmark bridge project

The River Irwell Footbridge – part of the overall project – was designed and built without conventional 2D structural drawings, making it probably the first UK bridge to be fully designed in a 3D environment. This far exceeded the client’s BIM level 2 requirements and provides an example of best practice for the use of BIM in bridge design. By challenging traditional design deliverables and developing a bespoke technical approvals process, we reduced total design costs and achieved a four-week programme reduction.

The high-quality digital asset model will be passed onto the client to enable future asset management, ensuring this crucial new rail connection serves the people of North West England long into the future.

Opening opportunities with connected thinking.

For more information on our BIM and digital delivery services, talk to:

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