BIM
Realising the benefits

Balfour Beatty
Our BIM Centre of Excellence has trained over 200 staff through a structured, competency-based programme. This has been enabled by a substantial investment in technology and global agreements with Bentley, Autodesk and Dassault Systèmes. We also work closely with our supply chain to help them refine their BIM plans, sharing expertise and best practice to deliver excellent customer outcomes.

Our end-to-end BIM Methodology is applied to all phases of the delivery and operational lifecycles – from design and construction to operations and maintenance. During the business development, work winning and pre-commencement phases, we use BIM to optimise the proposed solution. This ensures that it is built correctly during the project delivery phase. Once completed, our customer benefits from the operational efficiencies designed into the lifecycle of the project from the start.

Dedicated to the provision of Level 2 BIM as defined by the UK Government’s BIM Task Group, we are also committed to delivering Level 3 BIM where our customers require it, and support the continued development of this highly integrated approach.

At Balfour Beatty we deliver customer value by being industry leaders in Building Information Management (BIM) and the use of the digital toolset. We go Beyond Delivery by using an integrated approach to the whole asset lifecycle.

**£589m**

Work won through BIM support

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**WE BUILD IT ONCE AND BUILD IT RIGHT**
Our commitment to BIM required us to find partners that clearly understood our new direction and ambition. By investing £9m with the world’s leading technology providers, we now have unrivalled access to the latest innovations ensuring our continued position as a global leader in the development and integration of BIM.

Committed team of experts

Our in-house specialists understand digital construction and, more importantly, how to leverage the benefits of this approach. The team includes professionals from a range of disciplines and they have been involved in delivering over 300 projects. This level of experience in using BIM tools and processes allows us to push the boundaries of project delivery.

Working closely with each customer the team creates a BIM execution plan for their project that is specifically designed to deliver the benefits and outcomes most applicable to that customer’s business needs.

The Integration Suites

We have invested in two purpose-built spaces, known as Integration Suites, one in our London HQ and one in our Manchester Hub. Each space consists of the latest technology and is also home to a 4.7m x 2.53m immersive 3D screen. This allows our customer and project teams to virtually ‘walk’ around their project before any construction works have begun.

Within this environment we can clearly understand how to best approach each project and investigate various solutions to our customer’s individual requirements. Our initial investment has now matured and is enabling us to deliver real value to all our customers via an optimised, transparent and co-ordinated solution that results in an accurate body of asset data to aid future operations.

Supply chain integration

We are a forward-thinking contractor working across a variety of markets in the UK.

As a proven leader in key areas such as sustainable construction and lean project delivery, BIM allows us to harness and integrate the skills of our supply chain partners more effectively to provide a higher level of service and greater benefits to our customers on all projects.

£200k

Efficiency savings on M25 Section 5

BIM at Balfour Beatty
A wide range of BIM projects brings a multitude of benefits

We are currently working with over 100 customers on projects and tenders requiring BIM. These range from traditional building projects to those featuring linear assets such as road and rail.

BIM is sometimes thought of purely in terms of clash detection. Or simply that it is about COBie data; with many customers regarding it as not relevant to them because they have a specific FM package.

We believe that BIM can improve projects across all sectors, scales and project types. With this in mind, we have identified over 60 benefits that using BIM can generate. More than 30 of these directly affect our customers whether they are a developer, owner, occupier, user or FM operator.

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14 COBie projects included within current bids

Owner investor benefits
- Improved outcomes through single source of data
- Greater accuracy of design outcomes through access to design and performance analysis tools linked directly to the models
- Ease of decision making improved due to increased understanding of the design information
- Reduces cost of construction through optimisation of design and delivery methodologies
- Asset data can be integrated into FM packages
- Ease and speed of making changes
- Greater clarity of design and package integration
- Ability to readily understand cost implications of design changes via cost data applied to models
- Aid to lifecycle planning through tagged assets and areas linked to lifecycle replacement schedules
- Higher return on investment through more efficient solutions
- Easier change management including greater transparency of change implications
- Attractive to potential tenants/occupants/purchasers who have ready access to asset data.

User and occupier benefits
- Ease of optioneering during design to help select the optimum solution
- Reduced energy and carbon impacts via linking to real-time building sub-meter and sensor data on electricity and occupancy
- Efficient space management – people/HR data, utilisation and FF&E management – all elements linked directly to FM schedules
- Easier change management – ready access to database of components giving location, quantities and specification
- Managing churn
- Ability to link to ‘public’ dashboard for user engagement and monitoring
- Easier to consider substantial changes without the need for intrusive surveys.

Operator and facilities management benefits
- Readily accessible data for operations and maintenance through asset data linked to design information
- Improved lifecycle outcomes via better data management. Real usable outputs can include lifecycle investment plans
- Increased predictability of performance through more detailed asset planning
- Offers intelligent lifecycle replacement planning with lifecycle capital replacement models and plans linked to design models (2D or 3D)
- Links equipment to metering and BMS
- Integrated real time condition assessment – via in-field condition surveys app linking to asset database and lifecycle plans
- Affordable, risk-based preventive maintenance – via linking maintenance to risks, criticality and quality of assets of specification
- Easier change management
- Delivering cost-effective refurbishment – existing buildings surveyed using point cloud surveys which feed into condition surveys and new capital work cost planning
- Improved accuracy of lifecycle cost forecast using BIM
- Can input FM data into design model from early stages of a scheme
- Enables more consistent data management across an entire portfolio
- Can include on-going operation and actual cost recording linked to the models.

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Applicability and scalability of BIM

The scope and range of digital tools available make BIM suitable for use in any project type within any sector. It creates a superb opportunity to unlock value and deliver higher performance throughout all stages of a project’s lifecycle.

We use BIM throughout the delivery phase of each project and this focuses on three key areas:

**BIM** Using the Building Information Models to generate the best design solution

**PIM** Using the Project Information Models to deliver the project efficiently

**AIM** Providing our customers with an accurate, functional Asset Information Model for use in the operational phase of the project

### Different customers – different business needs

Breakdown of where we’re using BIM across our sectors.

- **30%** EDUCATION
- **24%** TRANSPORT
- **12%** HEALTHCARE
- **7%** POWER
- **15%** COMMERCIAL
- **4%** LEISURE
- **4%** DEFENCE & SECURITY
- **4%** RESIDENTIAL
We help our customers to use the aspects of BIM that are relevant to their specific areas:

**Nuclear new build**
- Accurate co-ordination of critical equipment and piping to primary and secondary structures allowing visualisation, clash avoidance, and interface proving
- Use of a single model to collate the asset data (interfaced to procurement records and quality records) to support traceability
- Provide detailed design information to aid safety case work.

**Nuclear decommissioning**
- Accurate representation of existing asset for sequencing decommissioning and demolition
- Safe methods and engagement with owner and workforce.

**Energy from waste**
- Accurate co-ordination of critical equipment and piping to primary and secondary structures allowing visualisation, clash avoidance and interface proving
- Value engineering and cost impact evaluation including modelling of transit routes for waste.

**Transmission and distribution**
- In substation areas, accurate co-ordination of critical equipment and piping to primary and secondary structures allowing visualisation, clash avoidance and interface proving
- Stakeholder alignment (including operator and asset teams) for safety case, HAZID and HAZOP
- Show cost implications of design changes.

**Power**
- The key challenge for the power sector is how to integrate the traditional process plant modelling and asset capture via specific vendor platforms
- Integration of the model for overhead line transmission systems with other disciplines
- Show cost implications of design changes.

**Airports**
- Demonstrate safe methods of working, logistics planning and movement
- Integration of data into the customers’ asset database.

**Commercial**
- Provide linked schedules (area, FFE etc.) direct to models to ensure net lettable area is visible at all times
- Provide images to ensure no surprises en route to completion
- Provide robust demonstration of construction sequencing to provide confidence in programme.

**Defence and security**
- Improved user engagement through visual communication
- Provision of data to allow customer sign-off
- Link asset data directly with their current FM system.

**Healthcare**
- Improved user engagement through visual communication
- Make process transparent (ownership clear)
- Patient and staff journey planning (optimising travel distances and movements)
- Integrate patient (user) movement RFID tagging
- Link asset data directly with their current FM system
- Assist with optimisation of lifecycle costs including energy analysis/forecasts.

**Crossrail**
- Help eliminate interface and co-ordination challenges between packages/different teams
- Provide data into their asset register destined for TfL and Network Rail
- Developing 4D sequencing to ensure all works are simulated for safety, co-ordination and design completeness.

**Rail**
- Validation – the ability to interrogate design models in order to validate engineering decisions
- Demonstrate safe approach to temporary works
- Provision of data for the Handback File.

**Education**
- Validation of design requirements i.e. acoustic performance of spaces/materials
- Link directly with current FM system.

**Highways Agency**
- Integrate data into their asset database – IAMAS
- Demonstrate safe construction methods on long, linear highway projects. This applies to new build on greenfield sites and when working adjacent to live traffic i.e. widening. The visualisation capability of BIM is fundamental to understanding the safety risks and danger points.

**Retail**
- Design optimisation – clash avoidance gives comfort to the customer as planning back of house corridor routes and risers which will need to accommodate tenant services usually leads to a bun fight and delay
- Visualisation for customer engagement
- Ease of provision of data for FM. Typically a new FM package will be tendered six to nine months before centre opening. At this time a contractor never has all of the information ready to give across, therefore the tender package usually includes lots of assumptions. However BIM provides access to actual data and can be updated along the construction process with actual supplier/as installed information.

**Utilities**
- Demonstration of design completeness
- Optimisation of construction methodology
- Link directly with existing current FM system.
Operational Excellence through BIM

St Silas CE Primary School, Blackburn

Part of the Blackburn with Darwen BSF programme, the St Silas CE Primary School was one of ten schools in the area to utilise BIM.

BIM was used throughout the project to supply site and shop drawings and develop a methodology for construction. The BIM model was used to produce 3D images of the building and the different areas within it. Day-lighting and overshadowing was also simulated in the first two weeks of the design process. This allowed the impact of the design on the surrounding streets and classroom spaces to be assessed.

As part of stakeholder engagement, BIM made the process of explaining the school design and construction process, including the details of materials and structure, simpler and clearer. For example, the building model was displayed initially in skeletal steelwork format and then with cladding applied – helping to explain the sequence of construction to parents and community representatives. Helping stakeholders to understand the build process meant that the number of requests for information on the project was less than when using traditional design methods.

The modelling of the whole school and construction process, including the number of requests for information on the project received was less than when using traditional methods of communicating design. Other BIM tools employed included clash detection, the integration of furniture fittings & equipment schedules, planning (sequencing) of works, visualising of temporary works and site operations, and design analysis packages.

Because we were able to see exactly what it would look like, we were able to order the furniture in advance, which we would never have been able to do with the use of flat plans. A lot of consultation went on, I certainly felt more confident because we could actually see what it was going to look like.

Hillary Hinchcliff, Head Teacher, St Silas CE Primary School, Blackburn

Heathrow Airport, Terminal 2B

Terminal 2B is the largest ever airside project undertaken at Heathrow Airport, with the new terminal due to service around 10 million passengers each year.

BIM was used throughout the project to supply site and shop drawings and develop a methodology for construction. The BIM model was used to produce 3D images of the building and the different areas within it. Day-lighting and overshadowing was also simulated in the first two weeks of the design process. This allowed the impact of the design on the surrounding streets and classroom spaces to be assessed.

Balfour Beatty’s implementation of BIM during the civils stage improved construction efficiency. Working in close collaboration with the customer, Heathrow Airport Limited, and the supply chain, the project team achieved a £10 million saving and a reduction of five weeks in the schedule on the substructure package by using optioneering methods supported by BIM.

In line with the UK Government’s BIM Level 2 implementation criteria, 3D multi-discipline modelling was used to support the design and production stages followed by ongoing development of a 4D construction planning and modelling environment to support pre-construction planning and construction delivery.

With minimal storage available on site just-in-time construction methods, including the use of off-site fabrication, were vital. The use of BIM, including for conflict detection and resolution between various design disciplines, helped ensure that just-in-time construction was possible. BIM also proved to be highly effective in assessing the impact of design changes and ensuring the efficient off-site fabrication of components and their subsequent timely installation on-site.

BIM played a key role in the installation of two 100-tonne air handling units. Through using 3D models to support off-site prefabrication and 4D construction planning simulations, on-site constraints, including dimensional clearance issues, were detected. The 4D construction planning simulations also provided an effective visual media that was used as part of health and safety briefings.

At Heathrow Airport we’re tackling some of the world’s most challenging and complex construction projects. We see BIM as being a key enabler for making these improvements and are delighted to support Balfour Beatty in this approach. They are proactive, forward looking and collaborative in their approach and have set the bar high for other suppliers to follow.

Julian Foster, Project Director, Heathrow Airport Limited
University of Reading CHP energy centre

The combined heat and power (CHP) energy centre at the University of Reading distributes power to a network of 18 buildings and replaces an existing steam generated heating system with a new low temperature hot water (LTHW) system.

M25 DBFO widening initial upgrade sections

The M25 London Orbital Motorway is one of the busiest highways in Europe. To reduce congestion, the UK Government has put in place a construction programme to increase capacity from three to four lanes in each direction.

Balfour Beatty utilised BIM to evaluate and reorganise the plant room to provide a better layout for maintenance as well as providing flexibility for future changes. The team also extracted all of the pipe lengths from the 3D model and reduced the amount of pipework required by 12% when compared to the initial concept design.

By adding details of all plant and equipment to the BIM model it became apparent that the proposed structure would not be fit for purpose as it could not support the weight of the equipment required. The BIM model was then used to adapt the initial design to include linear weights for the pipework, fittings and equipment, totalling over 50 tonnes, with a tertiary support system designed and put in place. This major change in design was completed early in the process removing the need for rework on site.

Within the energy centre all equipment and components were tagged and scheduled, including all fittings and pipework over 50mm. This enabled off-site prefabrication drawings to be generated and all assets were tracked throughout production and on to site. Data from the BIM model was also integrated with the customer’s facilities management software, Wren, to help plan future maintenance.

The Skanska Balfour Beatty Joint Venture and Atkins implementation of BIM on the initial upgrade sections of the M25 helped to achieve a design and construction rate which was twice as fast as previous comparable projects. This meant delivering £1 million of works per day to complete 1.6 km of highway per month, while maintaining three lanes of traffic in each direction during the working day with the project having to be complete in time for the 2012 London Olympics.

To achieve the required level of output the design and construction had to be fast and right first time.

This meant that each discipline had to work together to produce a design that was free from interdisciplinary conflicts. To do this, all existing infrastructure was modelled in 3D, to an appropriate level of detail, to allow each discipline to develop their design. The 3D models from each design discipline were then brought together in AutoDesk Navisworks and the automatic clash detection function was used to identify both physical conflicts and infringements of clearance zones. This allowed for the designs to be adapted before any work had begun – reducing abortive works and producing a design solution suitable for all disciplines.

Following on from the collaborative development of the design, the BIM models were issued to site for the construction phase, with 120 members of staff receiving training on their use. The models were then used by the site teams for daily briefings, assessing the impact of design changes, temporary works management, traffic management and for briefing Network Rail prior to a possession of the East Coast Main Line.

60 BIM projects across CSUK supported by our centre of excellence team

92 iPads deployed across M25, Sections 2 & 5
Talk to me about BIM.

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