Moving to BIM for railway infrastructure
BIM, A DIGITAL MIRROR FOR YOUR INFRASTRUCTURE

AN INTEGRATED COLLABORATIVE ENVIRONMENT THAT PROVIDES AN OVERVIEW OF YOUR INFRASTRUCTURE’S LIFECYCLE

BIM is a set of working methods and collaborative software applications. It is used to build structured digital models containing data for the entire project, invaluable for the efficient coordination of contributors. BIM creates a virtual representation of the infrastructure and its assets. This digital mirror can be used alongside the physical infrastructure.

BIM is applicable to all kinds of structure at every stage of the infrastructure’s lifecycle, from pre-project studies to building and operating. It accelerates and creates an infrastructure design that is robust, within budget and on time. It enhances your capacity to control schedules, despite major operating restrictions during construction. Combined with predictive maintenance solutions, BIM helps you deploy your asset management policies effectively.

THE 7 BENEFITS OF BIM

1. QUALITY
   - Enriched, reliable, coherent data
   - Simplified interface management between institutional stakeholders, the contracting authority, project managers, contractors and local communities
   - Robust design
   - Dialogue between project engineers, design and construction specialists
   - Concurrent engineering, based on fast turnaround and iterative modelling

2. DEADLINES
   - Improved simulation and anticipation
   - Secure deadlines despite major operating restrictions
   - Optimised construction phases

3. RISK REDUCTION
   - Forewarning of clashes and defect detection

4. BUDGET
   - Optimisation of lifecycle costs
   - Availability of digital data for subsequent maintenance
   - Reduction of operating costs
   - Closer control of quantities and budgets

5. SAFETY
   - Anticipation of site work condition

6. COMMUNICATIONS
   - Seamless, open information sharing between all stakeholders
   - Faster interaction between engineering specialists
   - Improved discussion and take-up by project staff

7. EASIER DECISION MAKING
   - Easier optioneering through simulations of potential infrastructure sites, to examine the practical and economic advantages and improve decision making
   - Help with choosing the best construction methods
Our most iconic projects around the world

On all of the following projects, our clients collaborate with us using BIM.

New lines for the Grand Paris Express and Toulouse Aérospace Express (France); Crossrail, London’s new East-West connection (UK); Ostlänken, first high speed railway (Sweden); metro lines in Bogota (Columbia); Singapore, Kuala Lumpur (Malaysia); Jeddah and Makkah (Saudi Arabia); Light Rail Transit for Batna (Algeria); Chacao bridge (Chile).
DIGITAL MODELLING

BIM ENSURES RESPONSIVE CONCURRENT ENGINEERING

We use BIM to transform the way we design, build, operate and maintain your transport infrastructure.

AT DESIGN STAGE

- BIM optimises data sharing, interaction and interfaces between all engineering specialists. It also clashes detection between civil and systems engineers, before the design summary. Smooth transitions between design phases ensure robust, reliable design processes and coordinate external interfaces. As a result, construction remains on schedule.

- 3D visual displays portray the structure in its urban environment and within the overall project. They facilitate exchanges between the project manager and institutional and economic stakeholders, urban project promoters, local administrations or authorities.

- To promote faster project take-up by all stakeholders, such as project staff, external project managers, representatives of the contracting authority and institutional partners.

- Ease cooperation via realistic structures visualisation at any track alignment location.

SYSTRA’S SPECIFIC SKILLS

- Over 60 years’ experience of railway engineering
- Lessons learnt from international requirements and best practices
- Maintenance engineers who anticipate the data required for operations and maintenance
- BIM IN ONE CLICK, a unique solution for linear railway infrastructure, including viaducts, tunnels and access ramps

Ostlänken HSR (Sweden)
DURING CONSTRUCTION

- Data provided by the model can be used to control quantities and the progress of construction activities.
- Contractors which are keen to use BIM for railway infrastructure can benefit from the model to help them choose the best construction methods, and make best use of on-site tools and machinery.
- BIM is particularly effective for managing cost and schedule on construction sites with restricted access.
- The model can stimulate daily toolbox talks, to protect staff on site.
- As discussions of the model intensify, the project managers use the BIM model to illustrate their weekly project reviews with contractors and monthly reviews with the contracting authority. This helps keep everyone aligned and on track.
- Operation & maintenance constraints and data are managed more efficiently thanks to the single source of information and the preparation of the Asset Information Model.
- Environmental impacts are better addressed at an urban level through enhanced capacity to analyse the project integration in very dense surroundings especially with regard to local heritage (preserving listed buildings, blending into the landscape).

SYSTRA WINS THE “HYPERLOOP STATION DESIGN COMPETITION”

Between 26th and 28th September 2016, the competition organised by the Dubai Future Foundation and Virgin Hyperloop One attracted 67 teams from universities, transport engineering and architectural firms in 26 different countries.

Using a BIM collaborative platform, teams had two days to design a 130km prototype Hyperloop for passengers and freight, serving three stations, and cutting the journey time between Dubai and Fujairah from two and a half hours to just ten minutes. For Dubai, the goal was to anticipate challenges and explore future investment opportunities.

Saif Al Aleeli, chief executive of the Dubai Future Foundation who organised the competition, announced at the prize giving: “We chose the Möbius team for the quality of their design and technical skills, as well as their studies of the social and economic consequences. We were impressed by the quality of the presentations. Hyperloop technology is unique and unprecedented, so we are still in an exploratory phase, but we are delighted to see contestants imagining how this technology will transform all of our lives.”

SYSTRA drew upon a wide range of skills from architectural to BIM management in order to create a coherent and comprehensive project. We delivered a convincing technical solution at short notice, including:
- architectural models of sustainable designs for three stations,
- simulated passenger flows,
- layouts for these three stations, with elevated and underground profiles,
- calibration studies for technical premises,
- perspectives and visual displays of the project,
- 3D modelling and a 4D project schedule.
A STEP-BY-STEP GUIDE TO BIM MANAGEMENT

1. Set the project’s BIM targets, based on the client’s requirements

2. Define the organisation, allocate the roles and responsibilities, set the boundaries, establish production standards

3. Define the BIM EXECUTION PLAN, together with collaborative working methods.

4. Choose the best tools for the use cases and disciplines involved

5. Choose the interactive working platform, data management and exchange, with the associated workflows

6. Check that objectives and deliverables are aligned correlate perfectly throughout the entire project lifecycle

THE BIM MANAGER, A VITAL ROLE

Working with BIM entails the creation of new working methods that include processes, production standards and shared protocols. A protocol to encourage collaboration is required before starting to collect input data. The BIM manager plays a vital role in the creation of this BIM Execution Plan (BEP). They set the process rules for building the digital model, at each phase of the project.

At the start of design for a complex project, the BIM Execution Plan deals with all interfaces, identifies the responsibilities of each contributor, and creates the decision process. During construction, they guarantee collaboration between the project management consortium and civil engineering contractors, by creating BIM Execution Plans with the head of each work package, who as a result plays a key role, providing and organising data for completed structures.

Collaboration between project team members is underpinned by the production guide, modelling guide, project templates, grid model file and geolocation data.

Practical collaboration between the project management and contractors is covered by a convention that defines model submittal methods between participants.
SYSTRA has developed a unique software solution, **BIM IN ONE CLICK**, which generates linear models faster and more simply than any other software on the market.

As a result, metadata is more easily managed from a database that can be updated using smart objects. This automated model is compatible with Information for Construction (IFC) and can be displayed on all the BIM platforms currently on sale.

**BIM IN ONE CLICK**

**GIVES YOU AN OVERVIEW OF INFRASTRUCTURE IN ITS ENVIRONMENT ALONG THE ENTIRE LINE, AND THEREBY SIMPLIFIES DESIGN.**

SYSTRA has developed a unique software solution, **BIM IN ONE CLICK**, which generates linear models faster and more simply than any other software on the market.

As a result, metadata is more easily managed from a database that can be updated using smart objects. This automated model is compatible with Information for Construction (IFC) and can be displayed on all the BIM platforms currently on sale.

**PRELIMINARY DESIGN**
- Presentation of the project
- Visualisation of the project in its environment
- 3D renditions of structures and architecture

**ADVANCED DESIGN**
- Technical interfaces with other projects
- Collaborative work on a BIM platform
- Supervision of design
- Clash detection (existing structures and utilities networks)

**CONSTRUCTION AND MAINTENANCE**
- Supervision of construction
- Monitoring construction interfaces
- Tracking tool for Project Management Consultants
- A tool for managing maintenance

**MODELLING AND THE CONVERGENCE OF BIM & GEOGRAPHICAL INFORMATION SYSTEMS (GIS)**
- Tunnel structures
- Viaduct structures
- Tunnel equipment
- Viaduct equipment
- Quantitative
- 3D geological model, to chart progress by the tunnel boring machine, and locate tunnel segments in their geological environment

Preliminary work options - SYSTRA, FDN and Empresa Metro de Bogota.
CONFIDENCE MOVES THE WORLD

The Group assists growing towns and regions that need reliable, fast, clean transport systems, to make a lasting improvement to their residents’ living standards.