Implementing Building Information Modelling (BIM) at Gatwick Airport

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Building Information Modelling (BIM) has launched at Gatwick to deliver quality projects and improved project data for use in everyday airport operations. Read on to learn more about how BIM adds value across the lifecycle of a project, from conceptual design to construction to handover into use of assets and facilities.
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Acronyms used in this document

AR – Augmented Reality
BIM – Building Information Modelling
GAL – Gatwick Airport Limited
Meet the Graphical Data Team (GDT)

The Graphical Data Team provides an in-house service to effectively maintain Gatwick Airport’s valuable asset drawing and model repository. We supply complete, up-to-date design and asset data for our project teams and contractors; using enhanced design and construction information to perform quality design review at each stage of a project.

We perform regular audits of our data to ensure we offer the best information, thus lowering the costs of project management, additional risk spend, and disruption through rework. Further technological enhancements will allow us to expand the potential of our information to include integrating schedules, quantities and potentially providing data for downstream use such as work order maintenance execution.

Our aim is to be the leading BIM service provider, enabling GAL to access current and useful asset data through all stages of the life cycle, whether an internal or external project.

Introduction

BIM has been introduced at Gatwick Airport to create full design and asset visibility at each stage of the project design process with the aim of improving project design and construction execution. Gatwick comprises over 227 buildings, including two main terminal buildings, six piers and is spread over 950 hectares. Due to the magnitude of this infrastructure, it is vital that GAL and its numerous stakeholders receive quality asset information at all levels, with an ever-improving “rich” asset knowledge data set. This data can be integrated into future maintenance system solutions and meet other airport operational requirements.

Background on Gatwick Airport Limited (GAL)

Gatwick Airport is the UK’s second largest airport and the busiest single-runway airport in the world, having over 70 route operators. The airport was purchased from BAA by Global Infrastructure Partners in December 2009. At the time Sir David Rowlands, the newly-appointed Chairman of Gatwick’s Board, said, “Our plan is to gain a competitive edge by modernising Gatwick, providing more efficient operations for airlines and a better experience for passengers and to do this as cost effectively as possible.”

The development of Gatwick Airport had to overcome various challenges, from adapting to a new relationship with airline stakeholders to improving the quality of information which was being gathered and stored. Over time, GAL was able to upgrade the quality of information coming from our contractors and designers through improved contracts and investment in our asset data technology. These developments have led to projects which can optimise quality and integrated work flow.

The Capital Investment Programme (CIP)

Gatwick Airport Limited has a strategy to “Compete to grow and become London’s Airport of Choice”. The path to achieving this goal is through driving performance and demonstrating efficiency, offering better passenger service and experience, and growth into new aviation markets.
Implementing Building Information Modelling (BIM)

In terms of capital investment, this translates into delivering projects based on a clear scope, predictable with best costs, low risk, early buy-in from all stakeholders, and transparent process. The current term of capital investment (known as Q5) runs from 2008-2014 and consists of over 250 projects. In 2012, the status of these projects is at 63% complete.

Building Information Modelling (BIM) technology was introduced in 2009 to enhance management of the extensive capital development programme, valued at £1.2 billion. A BIM specialist was then appointed to identify and execute solutions for the challenges found within this upgrade programme.

Figure A. Some of the projects in the Q5 portfolio

BIM Solutions for the Airport

Building Information Modelling (BIM) is becoming the norm in construction project design with a growth of customer demand, largely driven by public sector projects and UK government policy. BIM practices are being standardized with government mandates and professional practice documents, such as BS 1192.

BIM methodology is designed to create efficiency using automated collaboration, coordination, simulation, and integration with project costs and schedules. Since Gatwick owns the entire lifecycle of an asset, we have a critical stake in retaining accurate as-built data. The improved quality of the as-built data will drive in the improvement and development of long-term asset management.

When used correctly and efficiently, BIM adds value to GAL projects. Some advantages include:

- Reduces cost and risk through automated coordination for multi-discipline models, which simplifies design checks and promotes collaboration between parties
- Simplifies the design for non-engineering stakeholders
- Ensures quality in engineering design without expressly needing an engineering background
- Design contractors are able to easily obtain correct and current project information
- Airport staff can view 3D models with constituent 2D drawings via intranet/mobile tablet devices for both context of design information and the ability to access the latest construction information
- Future opportunities for linking intelligence about assets, for activities like maintenance and surveys

One of the key factors in achieving successful integration requires accuracy, effective flow and intelligent use of information between electronic models and the people who use them.
Timeline

Following GAL’s selection of BIM, this timeline illustrates how it has been progressively integrated into the existing programme schedule to ensure that the procedures and protocol for BIM is fully documented.

**Figure B Timeline of BIM implementation at GAL**

- **2011**
  - First BIM standard released
  - Programme Visualisation Specialist role staffed
  - BIM standard updated to integrate with Documentum

- **2012**
  - Coordination of data with the Asset Management Centre (AMC)
  - BIM standard updated to integrate delivery, programme and quantities
  - All airport staff can see and use BIM models
  - Graphical Data Team established

- **The future**
  - Integration of 4D and 5D modelling
  - Mobile computing

Creating Quality Design

BIM at GAL aligns with the programme’s core principles around Zero Rework, or a requirement for quality design that is right the first time. The timeline below shows the four major project stages and the benefits that coincide with BIM. The asset data locked in the BIM model becomes more extensive and refined as the programme progresses, ultimately transforming the design and construction model into something which is operationally beneficial.

**Figure C Design for zero rework with BIM at Gatwick**

Work Flow and Integration

BIM is the structure of work flow that spans from existing site capture and simulation to survey, design, construction and operational maintenance. BIM is a holistic approach in that it spans over various functions in a project such as site alignments, structural, architectural/mechanical design, simulation, collaboration, model mediation, visualization and mobilisation on site. An example of this might be when a new pier is being built; it
will have mechanical and structural elements that need to be carefully planned and integrated. BIM can ensure that the design takes into account what needs to be built or installed first.

The Integrated Data Concept below visually demonstrates how BIM tools pull and interact with each section of the project cycle and uses integrated data formats output from the key processes at each stage. This data is fed into BIM processes and the information is translated to each applicable stakeholder in order to maximise use of the model.

**Figure D Integrated data concept model**
Challenges of BIM

As is the case with most new technology and work processes, there are clashes with existing work methodologies. However, the general attitude of construction industry designers and contractors appears to be embracing BIM, so companies which realise and adopt BIM potential have a real advantage as demand grows.

BIM requires full cross-functional support to work, all personnel on the project need to support and invest their time into supplying information for the BIM model. For BIM to work there is a need for a culture change within construction engineering at large. BIM could be described as handing engineering deliverables back to the engineers and designers, but it requires them to fully understand how to use BIM and its purpose.

Implementation Culture

Different parties within a contract can have separate and sometimes conflicting objectives. BIM is designed to align the goals, preventing the imbalance of traditional contracts, and therefore adding both clarity and benefits for both the contractor and client. With its inherent ability to comprehend and cost the full scope of works, BIM is able to alleviate many of these issues. This reduces the possible clashes and obstacles before the contract is signed, ultimately preventing scope changes and large, unexpected issues at project handover. The diagram below explains some of the complications of maintaining this relationship.

The Pragmatic Balance

![The Pragmatic Balance](image)

Future Opportunities

Strategies for exercising the full use of BIM are wide in scope and potential. Current ideas range from whether GAL should invest in further integration with other systems such as facility management and document control. BIM is able to give GAL advantage in experience for executing cutting edge technology systems, taking lessons learnt, metracing the cost advantage and building into the next GAL contracts as a true differentiator.

The guidance diagram below depicts the UK government’s goal of implementing BIM level 2 by 2016. The requirements for organisations to reach these goals are shown in the diagram, which explains how implementation is being seen as a future requirement rather than an ideal practice.
Augmented Reality

Augmented Reality (AR) incorporates Virtual Design Data (e.g. 3D models) on top of the real time physical environment set. This concept uses the photographed site environment to build into 3D models therefore BIM is able build a 3D model over the actual project landscape.

This Augmented Reality is able to bridge gaps between translating information and design data to people of varying degrees of engineering and design knowledge. AR can be used during bids and throughout the project process to visually demonstrate how the model interacts with the existing environment. As well as for GAL, contractors can use AR’s potential to be built into a portable device, so that the device camera is able to film a site whilst simultaneously superimposing the 3D model onto the site, showing on the screen what is planned to be built (refer to Figure G). This technology enables contractors to walk on site and match up the work being built and compare it to the BIM model. It also artificially “levitates” buried assets, making the design clearer.

At the planning stages, AR is able to reduce any unexpected constructability costs with early identification of site issues by showing any clashes, and to assist time scheduling of close proximity works. Photogrammetric building surveying enables fast survey of buildings. Time scheduling of works also feeds into increasing site safety and removes ambiguity on site. To keep communication between site and the office, AR is also able to interact with Documentum Mobile Link to view drawings issued for construction and as-built drawings.

AR is being piloted at GAL and the technology to explore the uses and benefits of the technology.
Integration

As shown in this case study of BIM on the Gatwick Airport programme, there are advantages to using BIM but these would be all the more valuable if BIM were to be executed at the start of the project through end-to-end BIM integration. As discussed, BIM and AR are useful tools to engage potential stakeholders with interactive bid presentations which can present the project plans to the client as clearly as possible.

BIM has the potential for models to store a variety of information relating to a site, such as asset tags, maintenance plans. In addition, it can provide a timeline and history of a project to show how the project changes from the beginning to end of works. This model can be output 2D print outs when required, reducing the need for large 2D drawing storage and back logs of revisions.

The models would be ideally readily available on all computers on a project to all interested stakeholders, creating an advantage for all persons to access the model so that the knowledge is shared between more than just a select few experts.

Figure H  Business challenges and tools

Conclusion

With all of the benefits of BIM already available, BIM is being implemented as a requirement on projects to demonstrate that GAL leads the industry in an innovative and forward thinking technology.