

# The Royal London Hospital

Our BIM approach for the new building

Existing Hospital

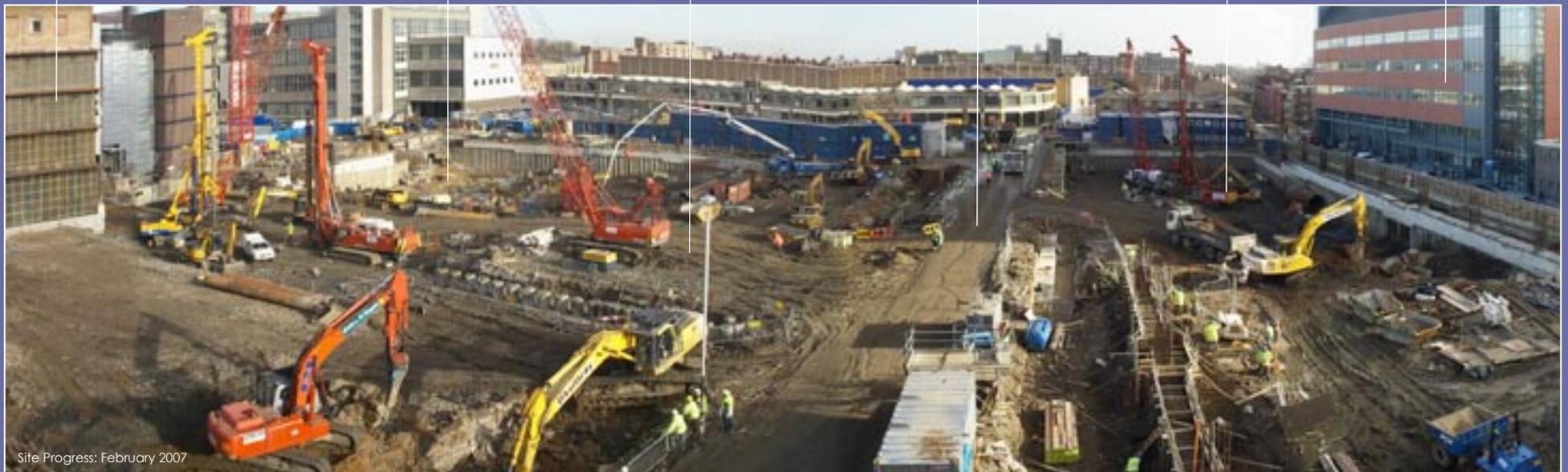
North Tower

Central Tower

Stepney Way

South Tower

New Pathology & Pharmacy



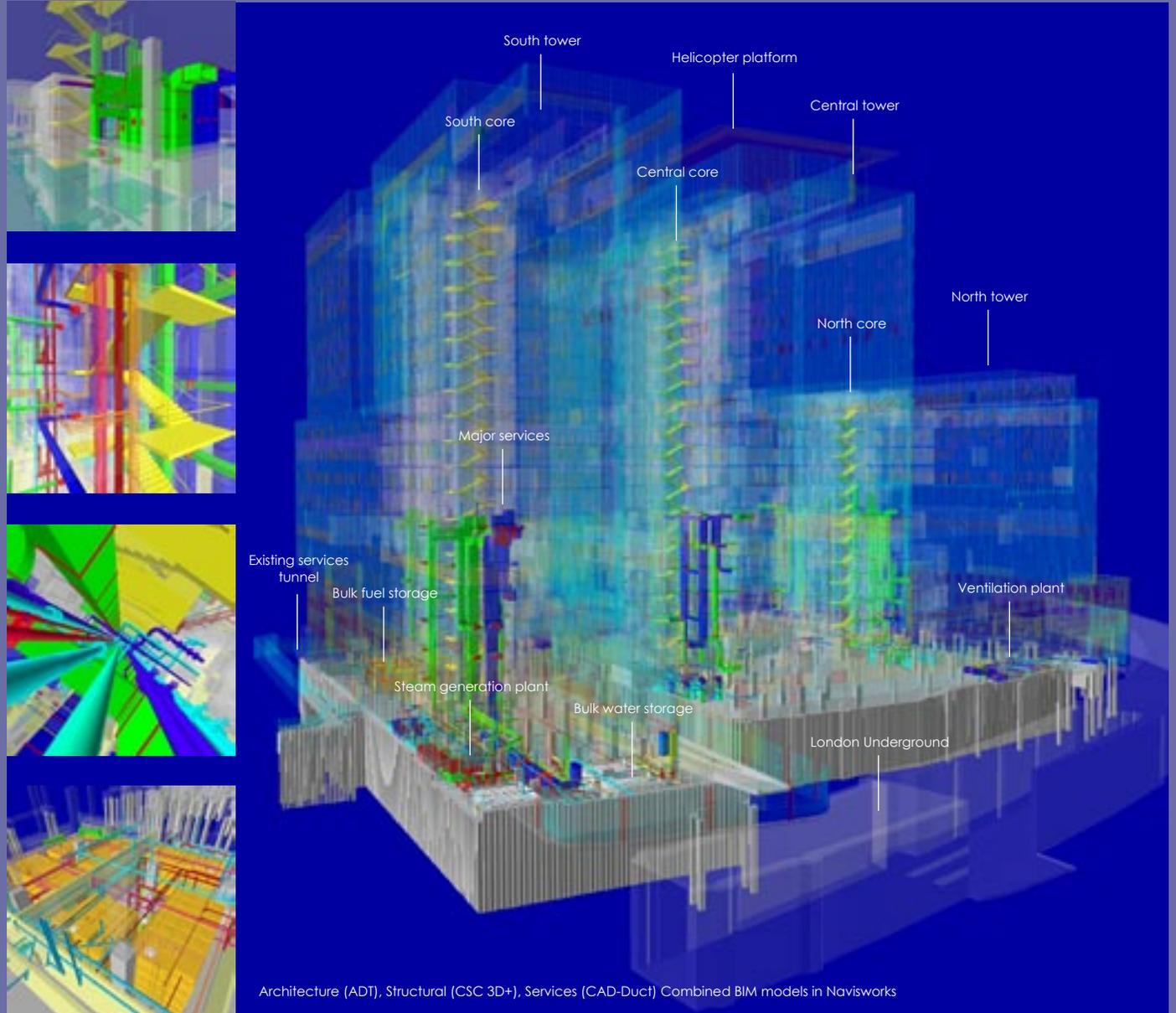
Site Progress: February 2007

## INTRODUCTION

When completed in 2012 the Royal London Hospital will be the largest new hospital in the UK. This 905-bed facility will provide London's principal trauma and emergency centre and the city's second largest paediatric unit, as well as 100 other specialist medical departments including the Helicopter Emergency Medical Service. The Royal London's new building is being configured as a pair of 20 storey towers containing 6,225 rooms across 1.2 million sq ft of floorspace.

The architects (appointed as a result of a design competition) are part of a design and delivery team led by a principal contractor operating under conditions specified by the UK government's Private Finance Initiative. The project is, therefore, politically and financially complex, as well as technically demanding. Highly coordinated computing systems based around interoperability and the principles of "building information modelling" have enabled this consortium to create a coherent design which minimises waste and duplication, reduces risk and allows different solutions to be explored quickly and robustly.

The technical systems, processes and protocols which lie at the heart of the delivery team's operation are designed to tackle two principal challenges: firstly, to design a building which embodies a dizzying number of coordinated mechanical, electrical, plumbing and (of course) medical systems; secondly, to create a set of spaces which are both humane and conducive to improving people's health and happiness.



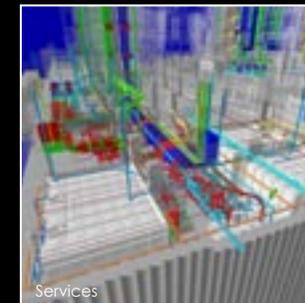
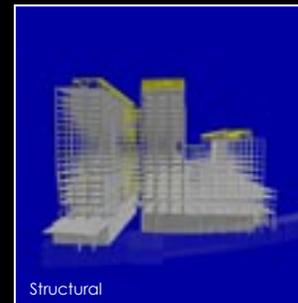
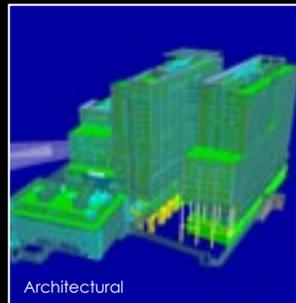
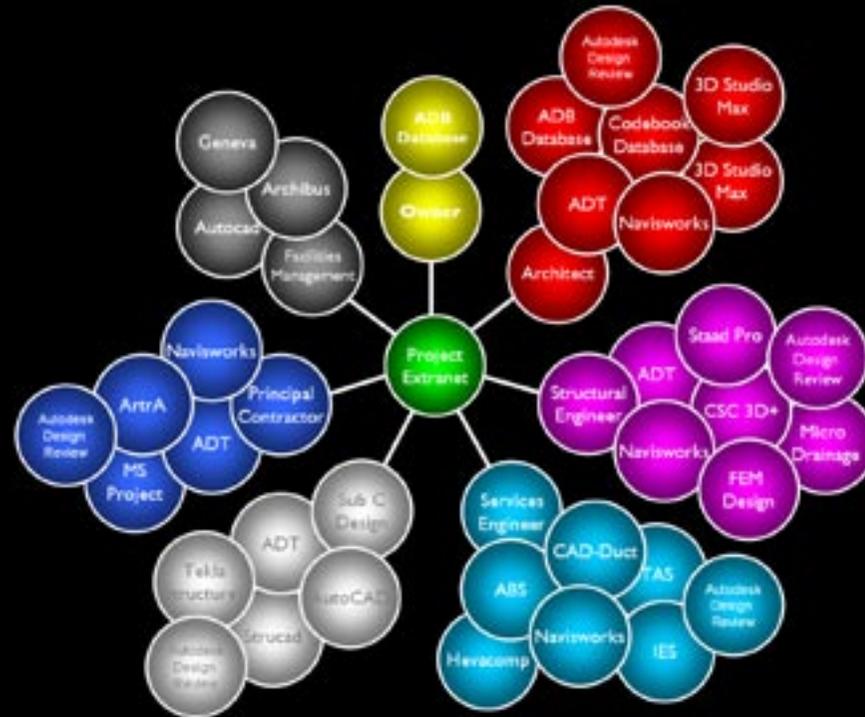
## ADVANTAGES OF BIM

Before any design was contemplated, the architects and the principal contractor established a working methodology based on sharing a "building information modelling" (BIM) dataset via a virtual "portal". The objective was not only to optimise and seek efficiencies during the design and construction element of the project, but also to provide a useful facilities management asset for the maintenance and operation of the hospital during its first 35 years of life.

Setting up a BIM-based working method entailed an element of risk - preparation for BIM required an investment "up front" which was not paid for by the customer (the UK's National Health Service). The business case for BIM, built around costs versus perceived value, shows that this working method should shave \$120 million off the total cost of this project for an investment of just \$3.5 million in additional costs.

Cost benefits are already starting to come through even though construction has barely begun. The business model forecasts that the simplicity of BIM data reuse will save \$460,000 on the cost of producing an operations and maintenance manual.

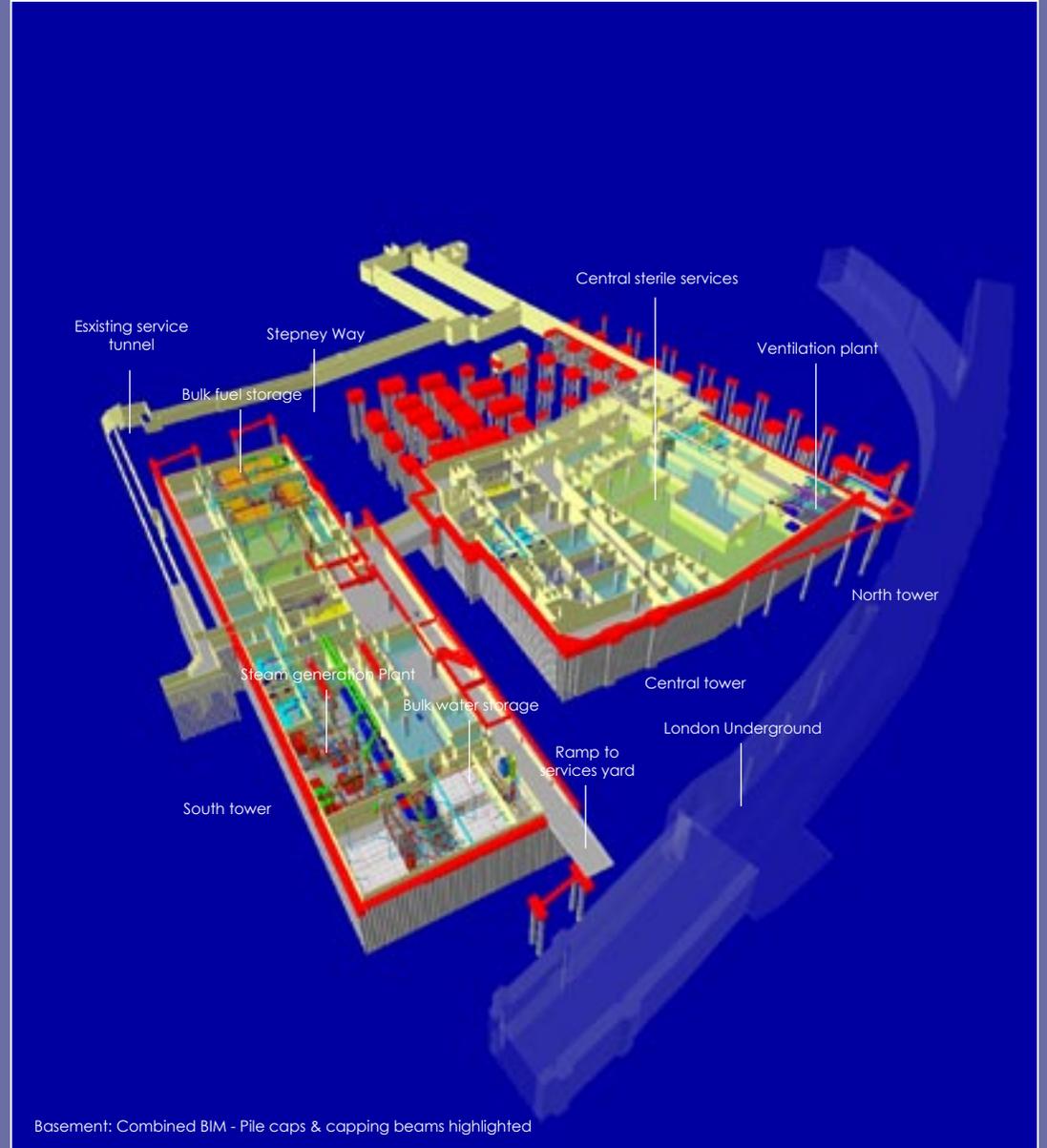
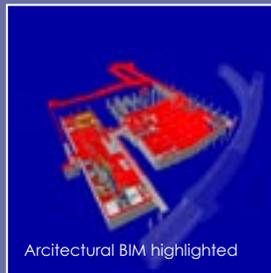
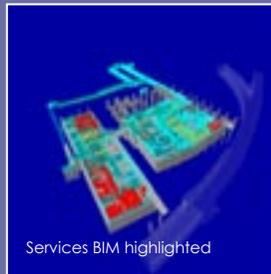
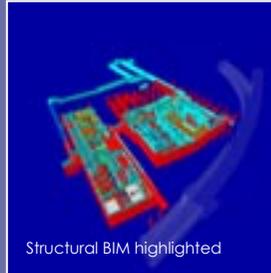
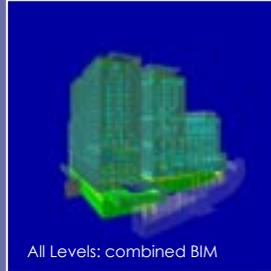
Integrated practice and interoperable data solution



## COLLABORATION

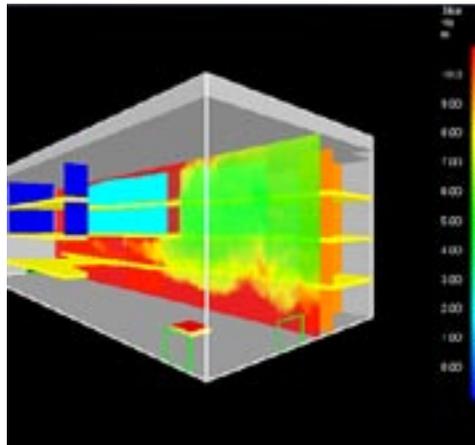
The large savings will accrue from avoiding post hoc construction issues - particularly in the mechanical, electrical and plumbing (MEP) realm - which traditionally arise through clashes and inconsistencies discovered on the construction site which were not anticipated or spotted during the design phase. It is the team's belief that the earlier problems are discovered, the simpler and less costly they are to fix.

The design and construction team agreed in advance to standardise around Autodesk's ADT modelling tool. All programs used by the key team members, as well as sub-contractors, are ADT compatible. Project participants (architects, engineers, contractor, FM team and client) have agreed to feed into, and off, a single portal set up and managed by a central 3D CAD and Data Management Group.

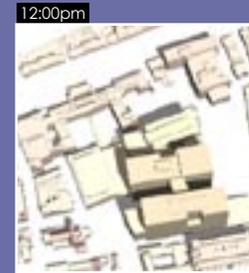
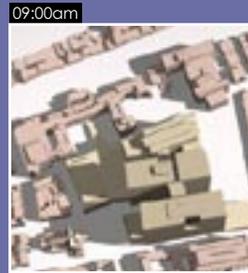


## ANALYSIS

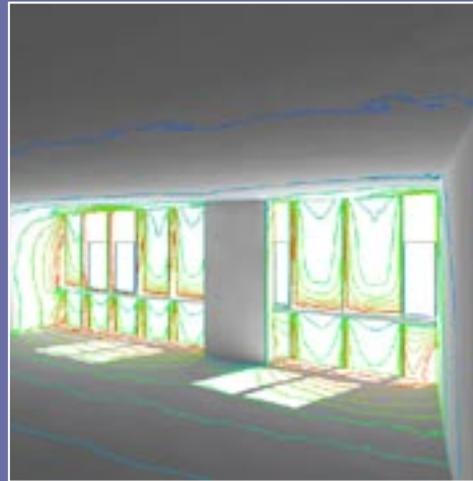
All computer packages used in the development, analysis, visualisation and management of the central 3D model have been factored into the Data Management Group's "road-map". The central model, therefore, contains all the data from which, for example, lighting and acoustic studies can be sourced, verified views generated, structures and cladding systems analysed and services mapped out.



Atrium smoke study



Shadow cast - June 21



Daylight study

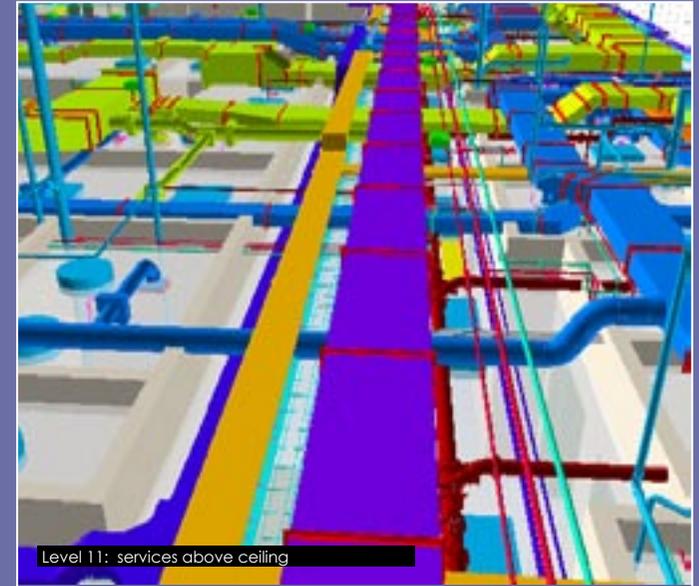
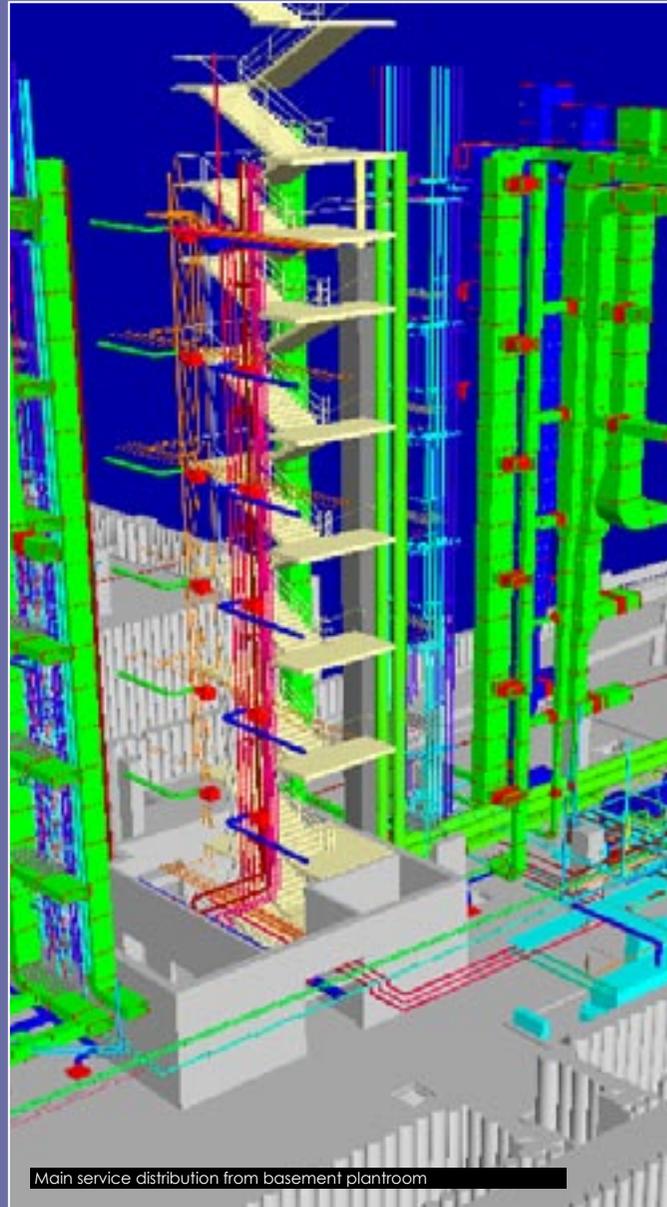


Verified views for planning approval



## INTEROPERABILITY

To reduce the risk of creating a cumbersome central model, the Data Management Group accepted that the portal accommodate three principal, parallel, models: the architectural model, the structural model and the MEP model. These models, enriched by links to documentation via the powerful ArtrA tool, are regularly combined through Navisworks for coordination checking, clash prevention, "virtual snagging" and construction rehearsal.

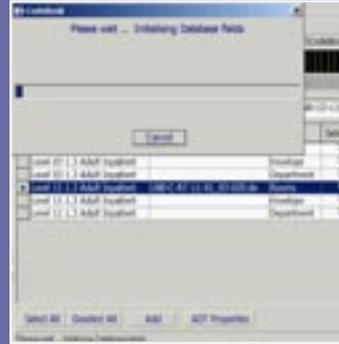


## USE OF BIM DATA

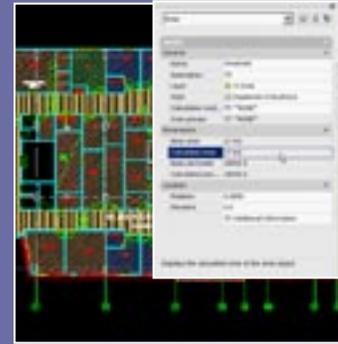
Crucially, the principal ADT models have been linked to Codebook, the software which encapsulates key government-sanctioned medical information and requirements. The links between ADT and Codebook do not generate designs automatically; the design of a hospital should embody more sensitivity, creativity and consideration than that made possible by a formula-driven approach. Instead, the Codebook links allow designers to constantly check that room layouts and services fulfill the requirements of medical need. This has saved a considerable amount of design and revision time.



(1) NHS brief received in ADB database format

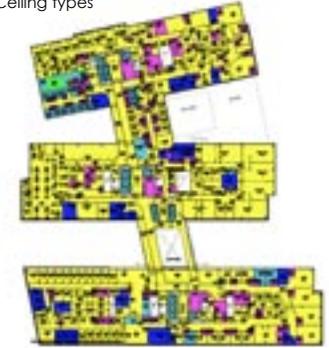


(2) NHS brief incorporated into Codebook and rooms and departments populated



(3) ADT rooms synchronised to Codebook

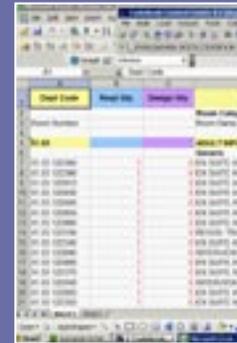
Ceiling types



(4) 1:50 medical equipment loaded from Codebook

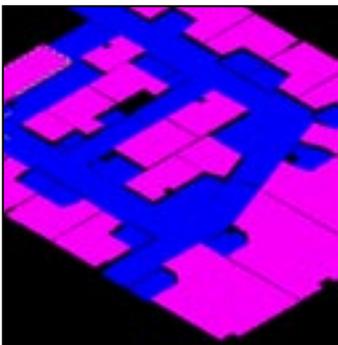
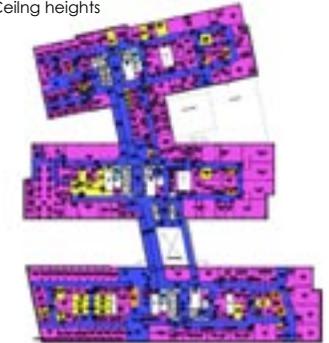


(5) Equipment synchronised to Codebook



(6) Design / brief comparisons and reports

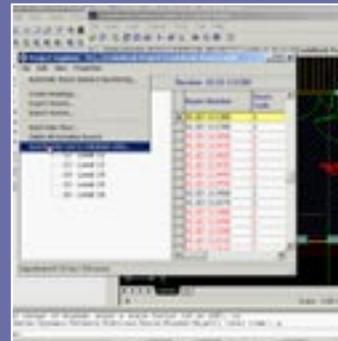
Ceiling heights



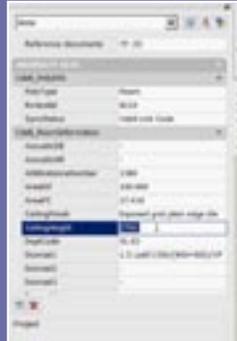
3D Ceiling "slabs" generated automatically with heights from Room data sheets for the architectural BIM



(7) Room data sheets generated from Codebook with design area from ADT



(8) Services MEP data added to Codebook data then synchronised to ADT



(9) Room data in ADT appears as property set data

Acoustic db levels

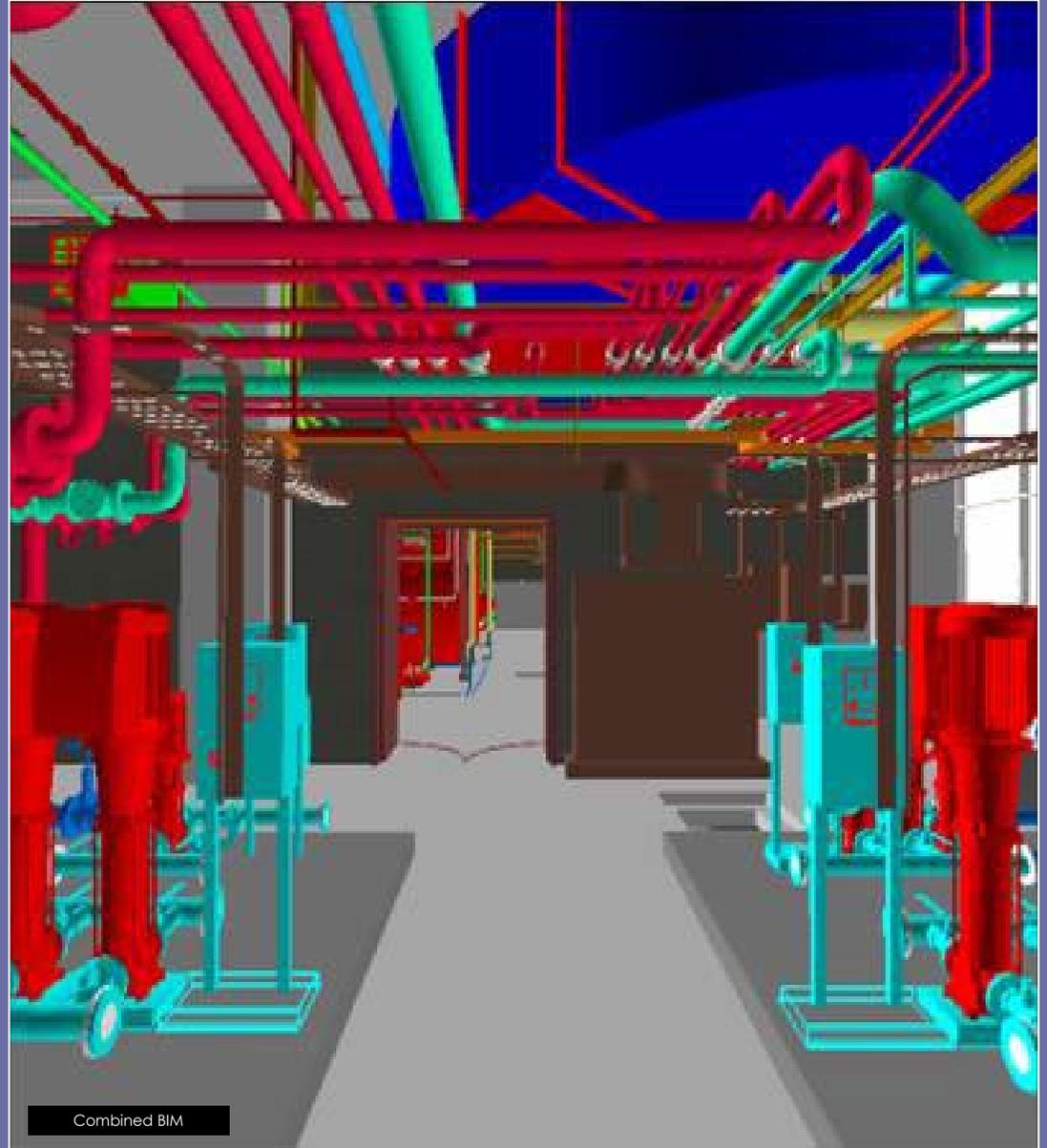
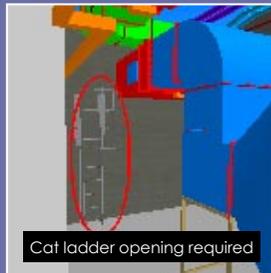
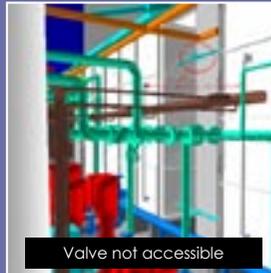
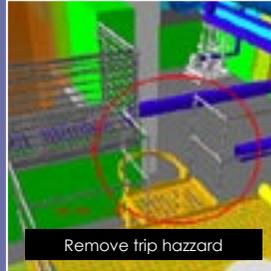
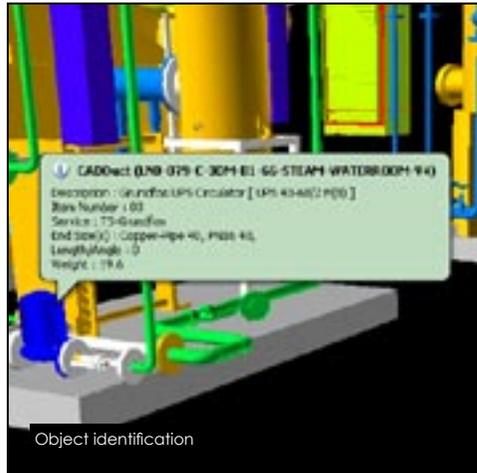


(10) Automatic themed views in ADT

## CLASH PREVENTION

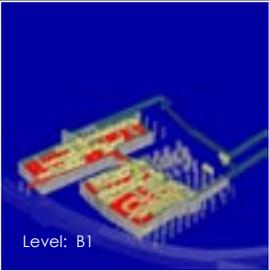
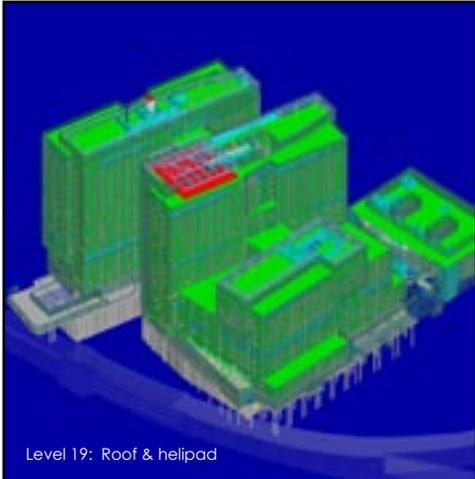
All design work is conducted in 3D and the two-dimensional drawings required by contractors (largely those in the MEP role) are generated as extractions from the central model. Traditional 2D CAD packages are not used at all. Even medical planners, who prefer to work in plan, operate within the 2D mode of the 3D program - their designs, therefore, are generated in a manner which is suited to their way of working while their drawings are "rich" in data and can be assimilated effortlessly into the central model.

The "clash prevention" and coordination functions of the central model have already highlighted a number of issues that would have become problematic later on. Indeed, the UK's Health & Safety Executive is impressed - the 3D model generated as an amalgam of the architecture, structure and MEP models has already uncovered potential safety "blackspots", especially for maintenance personnel, that would have been difficult and expensive to resolve once the build was complete.

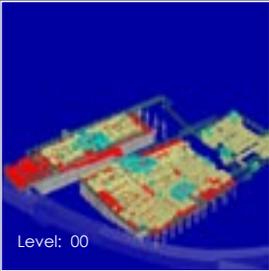


# DATA ACCESSIBILITY

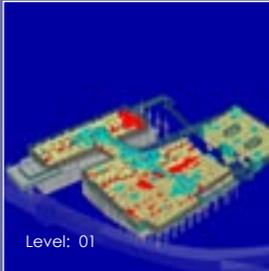
Considerable efforts have also gone into making the central models easily navigable by individual members of the design team. Through the project extranet, the hospital complex can be viewed as a series of images on a storey-by-storey basis - each image contains hyperlinks to the approved Navisworks model, key documentation and the latest drawing revisions.



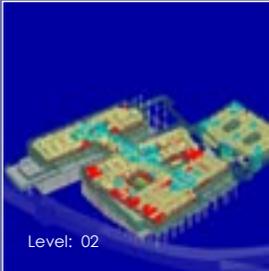
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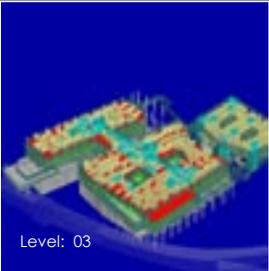
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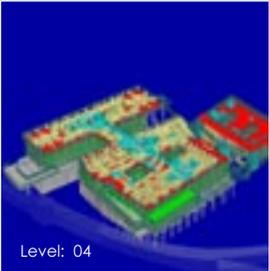
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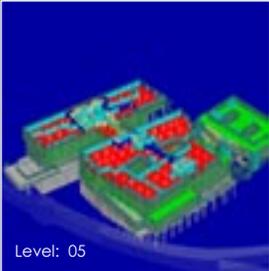
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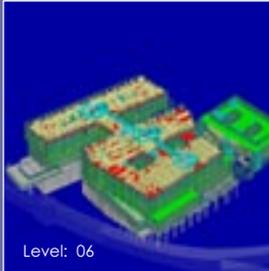
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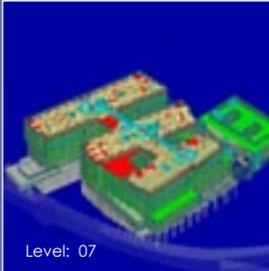
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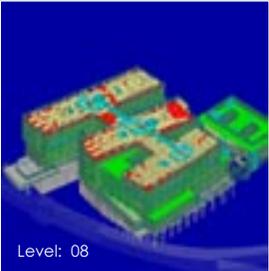
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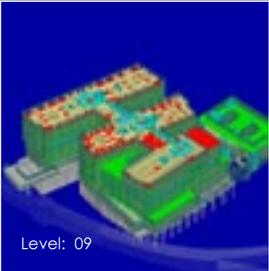
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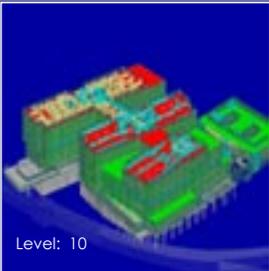
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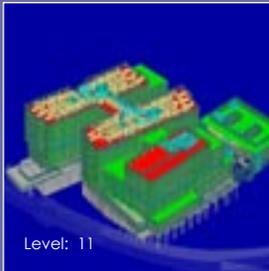
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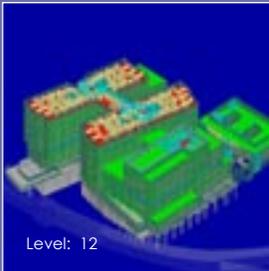
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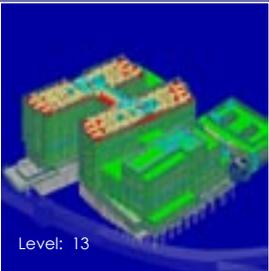
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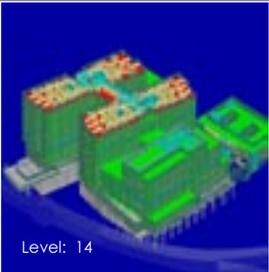
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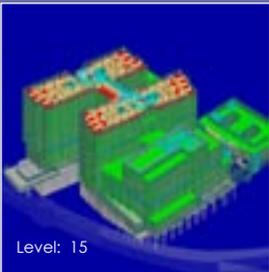
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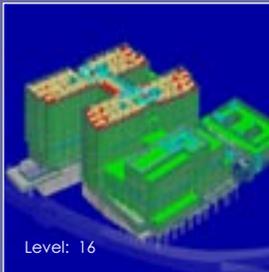
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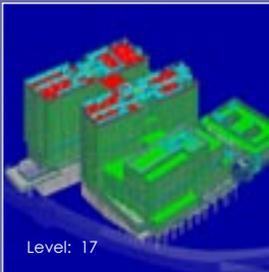
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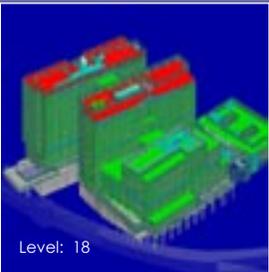
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Level: 16



Level: 17



Level: 18

## DATA FOR PROJECT LIFE

The client's long-term financial interest in the scheme has driven innovative thinking. We have taken advantage of new technologies to help us manage risk during both the construction and operation of the new building.

The data generated through BIM, therefore, is designed to be useful beyond the completion of the hospital. As a combination of design/construction and medical information, the model will provide a uniquely powerful resource for facilities management teams; a patient receiving oxygen will be participating in the same information system as the person who installed the oxygen delivery mechanism. Radio frequency identification devices and the embedding of IFCs within a central database (an issue currently being explored by the design team) will boost the value and "data life" of the BIM model to hospital managers of the future.

