Project

Bridge Academy

Oliver Plunkett (M), Civil and Structural Engineer, Director, BDP, describes how BIM added value and efficiency to the design of this complex structure

Background

BDP structural engineers in London have been using Building Information Modelling (BIM) in the form of Bentley Structural to model all new projects since 2004, and having mastered the technology it was apposite that it should be used to drive the design of a new City Academy. Working with a fully inter disciplinary BDP team, the scheme required an elegant and efficient structural solution to the re-development of what is a small and constrained brownfield site in Hackney, London.

Brief

The brief was challenging – to create 10 250m^2 of internal area and 5500m^2 of external area on a site of only 6000m^2 and an expressed desire by the sponsor for an inspiring and flexible, low energy building – all delivered within government cost constraints.

It was clear from the outset that a multi-storey structure would be necessary and, although playing fields were to be provided remotely, some spaces for on site recreation would be still be required. It was also clear that a successful scheme would be one that provided spaces that could be flexible in their use, both in the operation of the school from the outset and also in the future, since the opportunity for extensions would be limited.

Concept

Following interdisciplinary workshops that included the sponsor and client team the 'Sound Shell' was selected as the favoured option from five concepts with the main academy building 'croissant' shaped in both plan and section and oriented to the north east to minimise solar gain.

With this concept set, work began defining the geometry and finalising the structural philosophy. While BIM is an important tool in the definition of geometry, BDP structural engineers still place a high value on the definition of a structural philosophy through sketches.

Three key aspects of the geometry and structural philosophy released space.

- The library structure above the open and flexible central heart space is suspended from an inclined truss or 'hoop' on the inner perimeter of croissant.
- The main academy building is convex and increases in size as it rises through the use of a raking frame.
- The structure ziggurats down towards the canal creating external areas at each level.

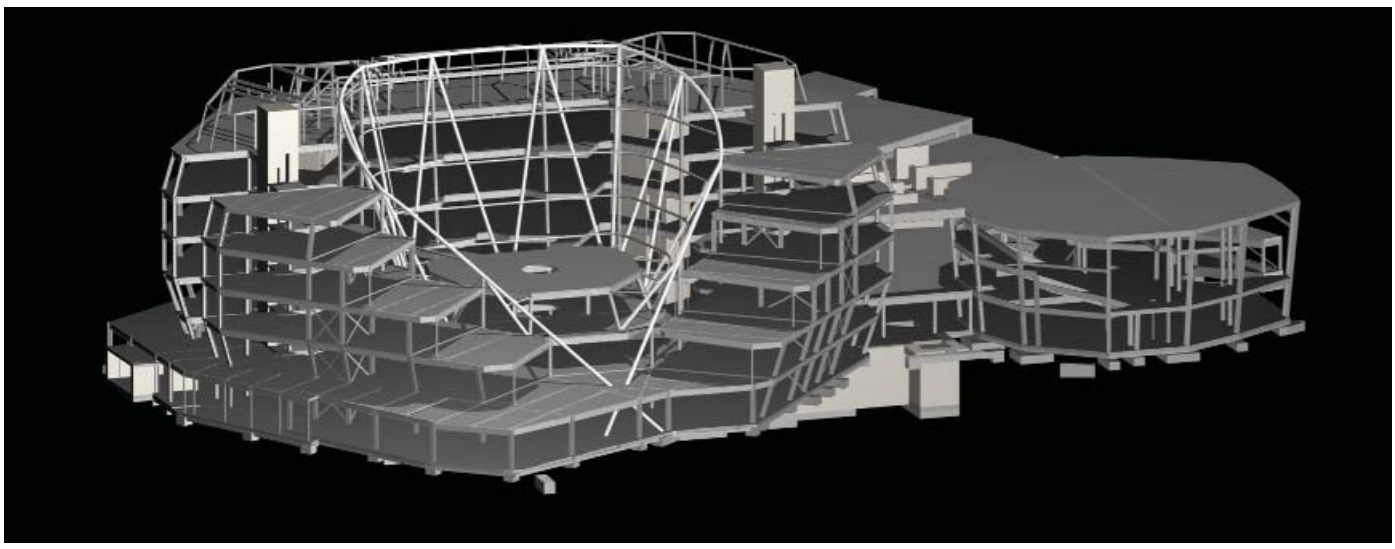
With such a geometrical puzzle to solve, the BDP structural engineers' BIM model was central to enabling this release of space and ensuring that all disciplines accurately understood how the form and layout changed around the building and the implications of those variations on structure, architecture and building services.

BDP's collaborative interdisciplinary approach assisted this, as the structural engineers were able to 'take control' of the geometry and drive the development of the scheme in close liaison and working proximity to the architects and environmental engineers.

Detailed design and delivery

With the concept firmly established, the benefits of the BIM model became focussed on assisting the efficient detailed design and delivery of the scheme. The key benefit of a BIM model to all projects but in particular the Bridge Academy scheme, is the opportunity for instant understanding and review of the implications of design development on all aspects of the fundamental concept. If these are adopted, the affected plans and sections generated from the model are automatically updated and this enables a fast and accurate response to the inevitable evolution of the scheme in detailed design. Visualisations of the scheme for client and planning purposes were created using the structural engineers' BIM model as a starting point, saving time and increasing the accuracy of the visualisation.

There were also a number of ways in which the model delivered added value and efficiency to the scheme.



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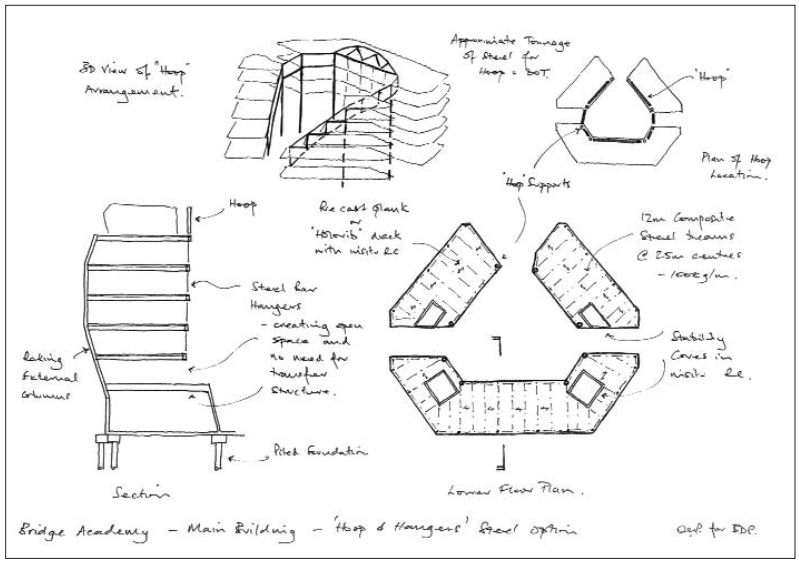
1 BIM model for the Academy



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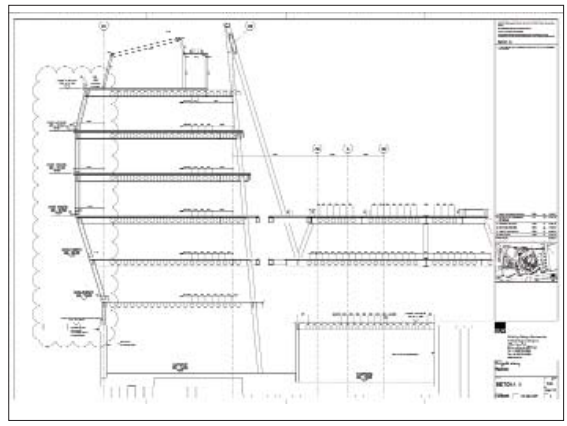
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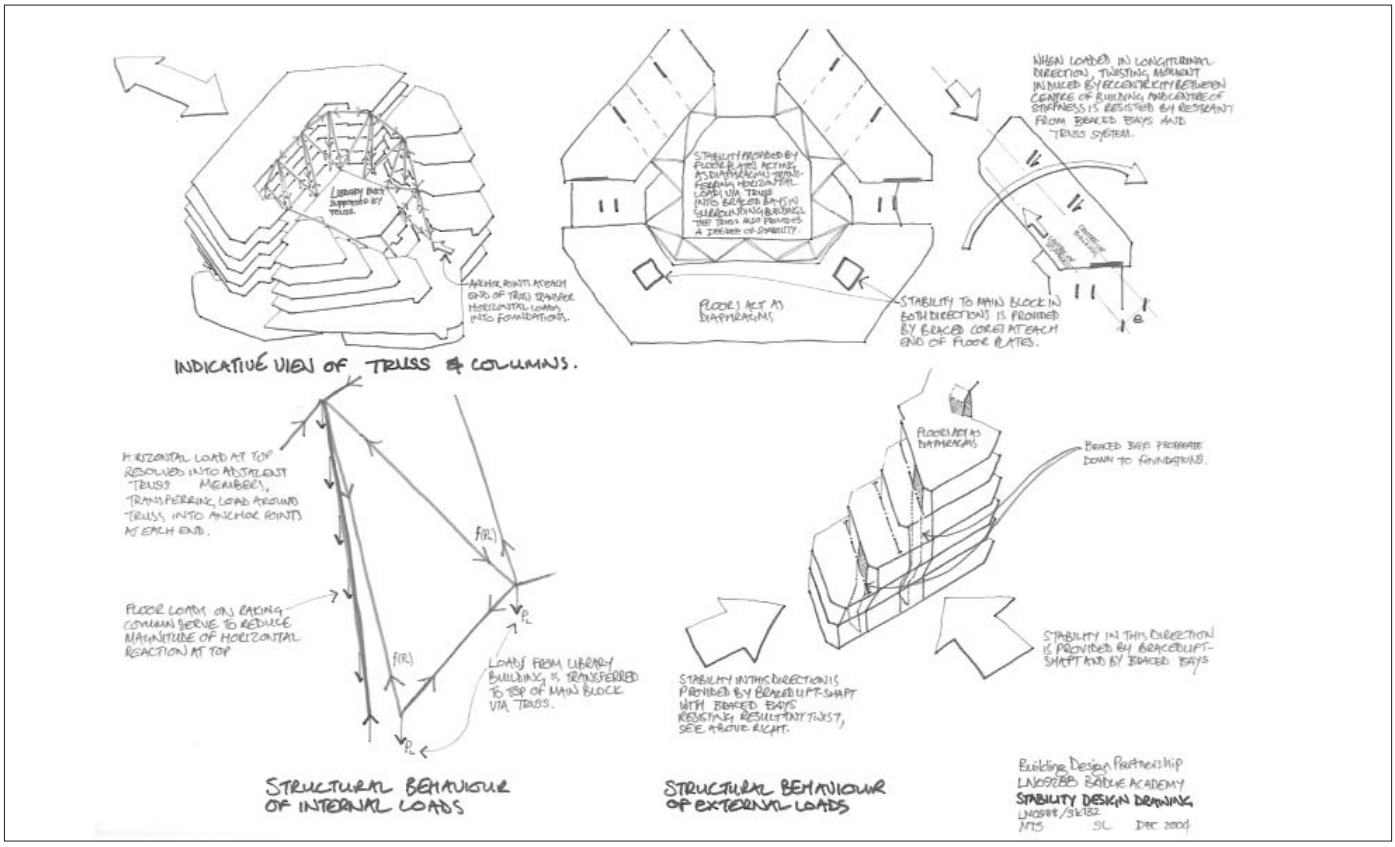
2 Structural concept sketch
3 Section
4 Stability sketch



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1. Two-way intelligent interoperability is possible between Bentley Structural and STAAD Pro. This enables the static and dynamic structural analysis to be carried out using the geometry and scheme design information. Any resultant changes in section size can be fed directly back to the model for review with the other disciplines and drawing update.

2. The routing of building services within such a tight site and in the context of the scheme required careful planning and coordination and the environmental engineers were able to use the structural engineers' BIM model as the basis for their own 3D modelling of the services in and around the plant room.

3. In a similar way to the structural analysis the final design information from the model can be electronically passed to the fabricator. This was particularly useful with this scheme where the traditional approach of the fabricator, re-creating the three dimensional geometry from two dimensional plans, would have been inefficient and potentially inaccurate – and is ultimately unnecessary within the BIM environment.

4. The constrained nature of the site – bounded by roads and a canal – required a 'just in time' approach to steel delivery with erection commencing in the north west corner adjacent to the canal and building outwards in a logical manner. This sequence could be accurately modelled with the BIM model to ensure an efficient and workable solution.

5. Finally, the exposed and dynamic nature of the structure may be used as a learning tool for the academy curriculum specialism of mathematics. How better to understand the real value of trigonometry than by studying the geometry of your school building?

Conclusions

The use of Building Information Modelling on the Bridge Academy Project by BDP structural engineers has enabled the team to deliver a unique and inspiring learning environment.

It has enabled space to be released in an elegant and refined response to a complex brief and constrained site at the same time as confidently delivering efficiency and process benefits to the overall development, integration, coordination and communication of all aspects of design and construction information.

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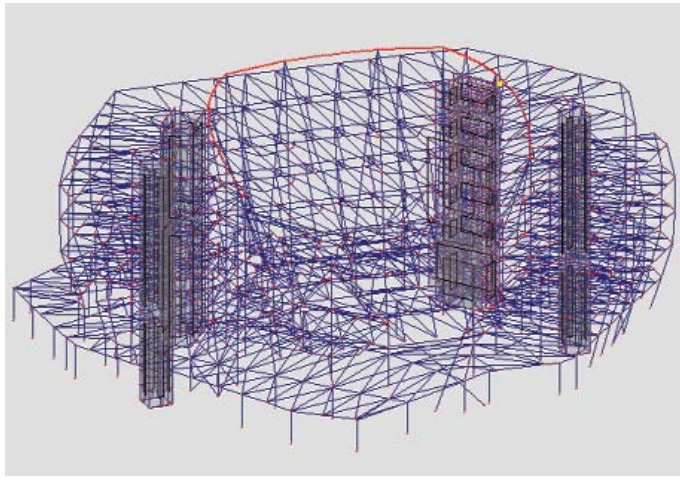

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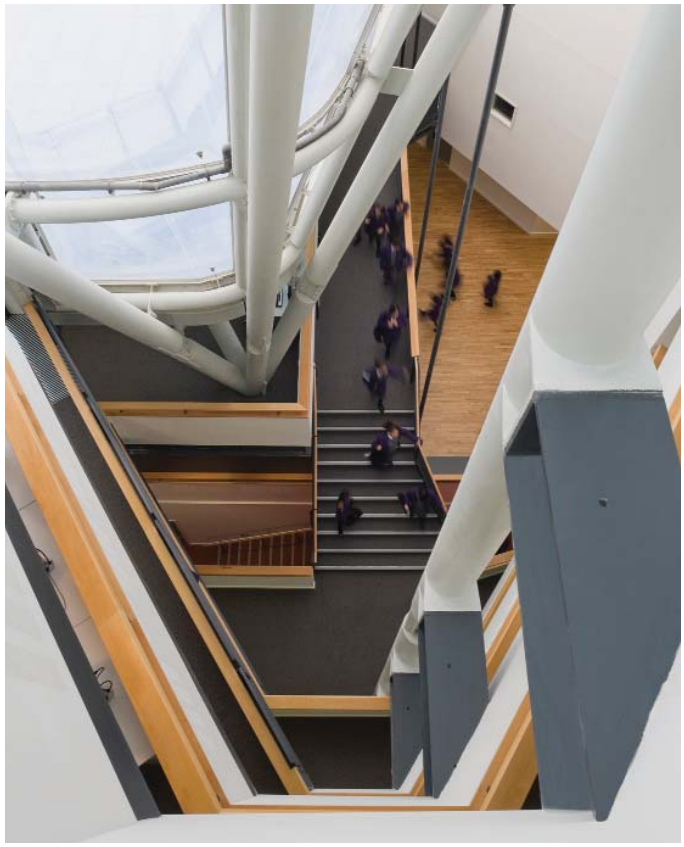

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5 Image of early sound shell physical model
6 STAAD Model Snapshot
7 Visualisation image
8 Ziggurat structure under construction *(Photo: Sanna Fisher Payne)*
9 Interior view *(Photo: Martine Hamilton Knight)*
10 Aerial view of the Academy: *(Photo: Commission Air)*