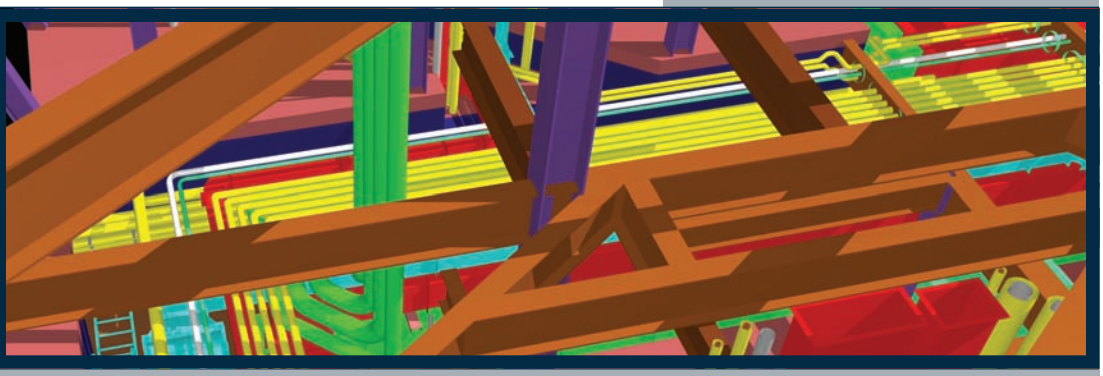
Bentley
Sustaining Infrastructure



WHERE MUSIC AND MATH MEET

BIM HELPS INNOVATIVE NEW SCHOOL BREATHE NEW LIFE INTO LEARNING AND THE COMMUNITY

PROJECT SUMMARY

Project:
Bridge Academy, Hackney

Organization:
Building Design Partnership Ltd.

Be Awards Category:
BIM for Multiple Disciplines

Project Objective:
- Design a school for 1,150 pupils – including sports facilities and a 450-seat concert hall for use by the wider community outside of school hours – within a small footprint with little potential for expansion

Software Used:
STAAD.Pro®, Bentley® Structural, Bentley Building Mechanical Systems

FAST FACTS

- Due to the small footprint of the site the vertical school is more than seven stories high.
- Includes a 450-seat concert hall for community use.
- Bentley tools made the definition of the complex geometry fast, accurate, and efficient
- Improved collaboration with 3D visualizations developed with Bentley Structural and Bentley Mechanical Systems.
- Integration of BIM with STAAD.Pro reduced the time required to test design options by about a third.

The Bridge Academy will be a new secondary school offering outstanding educational opportunities for pupils in Hackney, a multicultural borough in East London, England. The London Borough of Hackney approved the planning application in April 2005, and the school is scheduled to open in September 2007. In its first year, the Bridge Academy will admit 180 students and by 2013 it will be able to increase its enrollment to 900.

The school is being constructed on the site of the former Laburnum Primary School, a derelict Victorian school adjacent to the Regent's Canal. The new school will enhance the local environment and be part of the general regeneration of the area.

Music and mathematics will be specialist subjects of the school, inspiring pupils of all abilities to learn individually and to work creatively in cooperation with others. Research shows that music and mathematics complement each other and promote learning and development in other subjects.

The building will have a suite of music rooms on the ground floor and each level will have dedicated learning areas for different subjects. A 450-seat performance theater, 180-seat lecture theater, and new sports hall will form part of the state-of-the-art facilities. Technology will be used to tap into the creative abilities of all children attending the school.

NOT OLD-SCHOOL

Building Design Partnership (BDP) was appointed as architect, structural engineer, and building services engineer for the Bridge Academy project. The primary challenge for the design team was to fit a school for 1,150 pupils, including sports facilities, on a site with a small footprint. This challenge was exacerbated by the boundary formed by the Grand Union Canal on one side, mitigating any opportunity for expansion. BDP's design solution was to build upward, creating a vertical school more than seven stories high.

The project is rather like a piece of origami, with elements folding over each other on this small site. "The team designed a building without columns, dispensing with dark corridors and corners reminiscent of schoolhouses of old," explained Michelle McDowell, director of civil and structural engineering at BDP. "Teaching spaces are accessed from open balconies that look out over the canal and sit behind an ETFE wrap, allowing light to flood through the building – improving the sense of community and security."

Three building elements form the basis of the design: the "sound shell," performance hall, and sports hall. The sound shell houses almost all of the main teaching spaces and is wrapped around the social heart of the school. A play deck and learning resource center are suspended from the sound shell and are located above the Central Square, which opens out onto the café with views to the canal.

Another challenge was the 450-seat concert hall for use by the wider community outside of school hours. The design places the performance hall as a pavilion set among the "hanging garden" – a music box surrounded and set within the elements of nature. The sports hall has been sunk into the ground to reduce its height and provide the opportunity for glazing at street level to enliven the urban edge of the site. Separate access is provided for off-hours use of the sports hall and fitness room for local clubs.

A small parking lot for staff is situated between the performance hall and the sports hall, covered by the hanging garden. This provides outdoor social and play space for the academy in addition to terraces at each level of the building, allowing for a continuous stepped landscape from the top of the sports hall down to the canal.

DESIGNING IN 3D

The 3D animation, created by 3DW, was particularly useful in the early briefing stages of the project as the model was viewed around the world in various offices of client and sponsor organizations; used as a tool for the local population of the London Borough of Hackney to see the building in context and take a virtual tour of the building's internal spaces; and uploaded to the Bridge Academy's Web site as a virtual model at every design stage.

Building information modeling (BIM) was critical to realizing this design efficiently and clearly. The entire building is organic in form and BIM made it easy to generate the building form, adjust it to suit the internal space requirements, establish the setting out of the floor plate edges, and accurately define the geometry of the ETFE envelope cladding.

"The building form was easily established and defined for use in the structural engineering, building services, and architectural packages"

ABOUT BENTLEY

Bentley Systems, Incorporated is the global leader dedicated to providing comprehensive software solutions for sustaining infrastructure. Architects, engineers, constructors, and owner-operators are indispensable in improving our world and our quality of life; the company's mission is to improve the performance of their projects and of the assets they design, build, and operate. Bentley sustains the infrastructure professions by helping to leverage information technology, learning, best practices, and global collaboration – and by promoting careers devoted to this crucial work.

For more information, visit www.bentley.com

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The north and south halves of the sound shell are arranged on half levels so that adjacent teaching spaces are reached by 10 steps in the staircase, providing stronger links across the different academic departments. BIM eloquently articulated this blueprint for use and manipulation by the design team.

The benefits of BIM for this project enabled:

- The ambitious nature of the structural system and its relation to the architecture to be developed with BIM and analysis working together
- Testing of the key coordination issues relating to routing of services around the building in conjunction with the structure and architecture
- The project team to see – using a combination of BIM and 3D visualization – and verify the outcome of the developed structural solution
- The project team to understand the steelwork connections more fully and develop simplifications where possible
- The ability to quickly check services distribution proposals through complex areas of structure

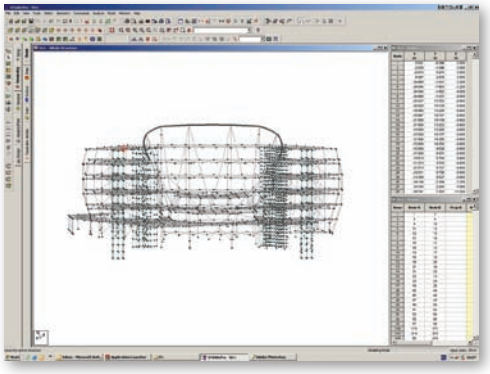
SURPRISE BONUS: IMPROVED WORKFLOW

The multiprofession BDP design team used Bentley products to deliver the design information for the project. The combination of 3D visualizations, BIM, and traditional 2D drawings cut from the model developed with Bentley Structural and Bentley Mechanical Systems enabled the team to inspire the client and investor and assist their understanding of the building form. These Bentley tools made the definition of the complex geometry fast, accurate, and efficient, and empowered the team to design a tight-fit building with architecture, structure, and building services fully coordinated before starting on-site.

The benefits BDP derived from 3D visualization of the building included the ability to:

- Identify those parts of the building that required further refinement
- Allow communication with people who could not read 2D drawings
- Create an excitement about the potential of the project among a wide group of people
- Play a significant part in reassuring the local planning authority of the setting of the building in its context
- Simplify the understanding of a complex spatial arrangement
- Allow further investigation of day-lighting within the building

"An unexpected result of employing Bentley's BIM solutions was the change in traditional workflow," noted McDowell. "With the structural engineering team taking ownership of the setting out of the building form, an aspect normally driven by the architect, the multidisciplinary nature of BDP made this transfer of responsibility possible. Moreover, through collaborative work on the model, the building form was easily established and defined for use in the structural engineering, building services, and architectural packages. As the structural virtual model took the lead



STAAD screen capture of analytical model

role in the design development, the architectural and services schemes were wrapped around and through the building model to ensure best fit."

BDP was able to export the entire BIM to STAAD, carry out structural analysis, and use the results in the Bentley Structural model. This reduced the time required to test design options on this complex building by about a third. By producing a single model, BDP also cut out the normal duplication of work required to produce a model for analysis and another for building definition.

BDP is now working with Bentley to bring efficiencies to the supply chain by handing the structural model to a steel fabricator. This will make traditional fabrication drawings redundant and will bring time and cost savings in the review of contractor's information. This approach also makes the transfer of connection forces for connection design simpler and more robust. BDP currently is carrying out a test on a simpler structure for another school and, if that is successful, will hand the virtual model of the Bridge Academy project to the successful contractor. Similar test cases are being undertaken around the Bridge Academy project with building services contractors and fabricators to further reduce the amount of information rework performed later on in the supply chain.

Bentley software now permeates the entire building process, giving BDP the competitive edge in concept forming, analysis, and design and adding value for the client and supply chain. "Bentley Building products provide us with the best tool set in today's market for architects, structural, and building services engineers to design and analyze complex buildings in the multiprofession environment," explained McDowell. "The software gives our designers the flexibility to make what-if changes as part of the design progression and the confidence that the solutions are workable."

Numerous man-hours normally spent on design feasibility studies at various stages of the project were streamlined to a report checking procedure and an interference check as the design progressed. In addition, due to the complexity of the structure and the services that were needed to fit within the available space, certain design iterations that would have traditionally taken weeks to complete were achieved within days with the Bentley suite of building design tools and the links to analysis software.

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