STRUCTURAL DESIGN LEADS THE WAY IN BUILDING INFORMATION MODELLING

By: Tekla Corporation, Finland

Building Information Modeling (BIM) is a new collaborative, model-based way of working in the building industry, leading to a faster, higher quality and richer design process. For over a decade, the BIM concept and its benefits have been thoroughly validated in select segments such as mechanical and plant design and steel construction. The latest advances in BIM are now taking place in the field of structural engineering. Structural BIM, incorporates the entire structural design process from conceptual design to detailing, fabrication and erection, under the umbrella of one advanced, fully comprehensive solution.

With BIM, design information covering the entire building process is produced and managed using a single 3D product model. The intelligence of the model keeps all of its components reliably up to date. Current information is available to all project parties at all times, work duplication is minimised and lower-level information tasks like analysis and design and document generation are automated. As a result, the entire building process value chain achieves a faster, higher quality and richer design process.

The idea behind BIM can be traced back to the expectations associated with CAD, which revolutionised drafting in the early 1980s and led to several useful discoveries concerning practices within the building industry. Stakeholders in the building process started to share information by exchanging drawings in electronic format. Drawing-level collaboration provided the means to detect changes in individual drawings, and various players could down-stream them onto their own. Information management, however, has remained a problem without a solution, despite a few advances made possible by the evolution of the Internet. Information is scattered across numerous drawings where it is subject to misinterpretation and ambiguity that results in low efficiency and costly building mistakes.

TIME FOR PRODUCT MODELING

Over the years it has become increasingly apparent within the building industry that the only solution for truly efficient building information management lays in 3D product modeling. Modeling-based solutions have already been pioneered in niche fields for over a decade, with impressive gains. With the development of telecommunication infrastructure, IT and industry-specific standards, the entire building industry is now reaching the key prerequisites for adopting comprehensive BIM applications.

The modeling-based solutions available on the market today can be divided into two main categories. The 'bottom-up' modeling technology – driven particularly by mechanical and plant design – creates parametric models of individual pieces. With this technology, building models are based on tightly integrated but independent models of individual objects. As a result, individual objects and the output generated from them are well managed, but managing models that include a large number of objects with complex relationships is problematic.

In contrast, 'top-down' modeling technology has been created especially for modeling buildings that incorporate thousands of objects. The basic objects are first modeled without details, and the logical relations between building objects are created with connections that also define the objects' final shapes. When changes occur, the related building objects automatically adapt to the new situation. The 'top-down' concept keeps building object libraries compact and makes the management of the entire building extremely easy and effective. The power and benefits delivered by this technology have been proven during a decade of everyday use in the steel construction industry.

INTEGRATING THE BEST OF BREED

The current structure of the building industry is characterised by localisation and segmentation. Processes consist of small islands of automation on which the parties involved work co-dependently but by using their own particular tools. At present, change management is a costly bottleneck due to an inefficient information flow. The adoption of modern modeling technology on one island has an effect on the performance of individual units, but it doesn't do much to improve the overall situation since the value chain as a whole is unable to exploit the results.

Three possible roads provide the means to move from the current state of affairs into BIM. The most obvious one is the integration of existing tools. The main challenges in this approach are the management of the fragmented information and support for the information roundtrip. All solutions in the industry should speak the same language and use the same terminology – a goal still very far in the future despite huge efforts towards standardisation. The second alternative is to integrate the entire BIM under the umbrella of a single CAD software package. The use of one CAD platform would facilitate superior interoperability. However, the depth of information would suffer as the capabilities of existing CAD-platform-based solutions are far from the best-of-breed applications available on the

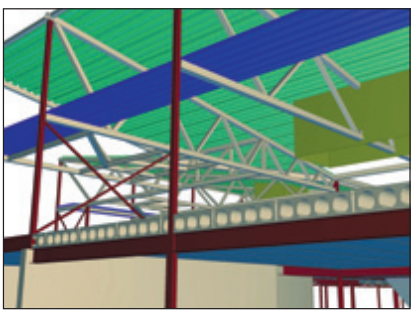
market. The effort needed from software vendors to bring CAD-based solutions to the same level is not realistic.

The third option is to create subsets based on best-of-breed solutions and integrate them with standardised interoperability tools. Among the islands of automation, areas such as architecture, plant design, HVAC and structural design form clearly discernable island groups characterised by intensive, diverse internal information traffic. Communication between such island groups, however, is more standardised and scheduled. Island-group-specific, highly-integrated solutions connected to other BIM subsets and to the outside world via open interfaces make it possible to integrate the whole archipelago and hold onto the best-of-breed benefits.

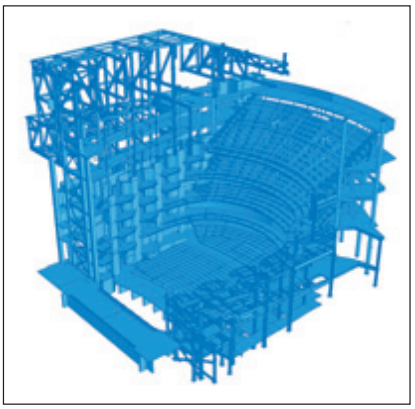
TOWARDS MORE EFFICIENT STRUCTURAL DESIGN WITH STRUCTURAL BIM

Structural BIM is the subset of BIM that covers the building process from conceptual design to detailing, fabrication and erection. As most of the design information is produced during these stages, the integration of this part of the process is essential to the development of any comprehensive BIM solution.

With Structural BIM, engineering professionals and steel and concrete detailers can work with the same design at the same time in order to find the best solution in efficient collaboration. A Structural BIM model includes all the information needed to build the actual structure. The model starts to evolve during the engineering stage, when



Building and Structure Modeling



conceptual decisions concerning the structural system are made. All objects, regardless of the material, can be managed with the same system, which also takes care of many previously unassociated tasks such as analysis and design. Further on into a project, detailers work on the same model with no need to recreate the geometry or building objects.

Working on the same intelligent model facilitates efficient change management and information storage for all stakeholders involved in the structural design process. All output, from drawings and technical documentation to fabrication data, can be produced from the same model throughout the process. Revisions are made automatically as changes take place, and conflicts are detected and resolved as they appear. Intelligent change management like this is essential in today's building process where stages can overlap quite heavily: projects proceed in phases, some of which may still be in the engineering stage while the first are already constructed.

The model-based way of operation also significantly benefits various processes parallel to Structural BIM. Using interoperability tools, the same model can easily be made available to closely related functions such as plant design, HVAC or electrical design. Tasks like cost calculation, project management and ERP can also be carried out based on the information stored in the building model. The entire alliance at work on the same project can follow the project's status in all participating organisations. ■