Technical Information Sheet P407

BIM and 3D Modelling in Light Steel Construction

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In Building Information Modelling (BIM), a virtual model of a building is created digitally, and is shared with the parties in design, construction, management and operation. The BIM models contain precise geometry and data needed to support the construction, manufacture and procurement activities through which the building is realised.

BIM is readily utilised with light steel framing because 3D models are commonly used in design and digital information is used for production of the individual components used in light steel framing systems.

Key benefits

The benefits of light steel construction in connection to BIM and 3D modelling are:

- Light steel framing can readily be incorporated into BIM models.
- Specialist BIM software for cold-formed light steel frame systems is available. Software can provide wall and floor panel fabrication drawings, structural layouts, cut lists, and other material reports.
- Light steel framing utilises seamless interaction of structural design packages with architectural 3D models. The same models are also used for fabrication and manufacture of the light gauge sections.
- Manufacturers' light steel profiles are readily availability in 3D format from the National BIM Library for easy inclusion into 3D BIM models.
- Adopting a BIM approach can increase predictability to the whole construction process of a building, and benefit its operation.
- Integrated BIM enables savings in drafting, material reporting, data entry, manufacturing, and correcting differences between separate models.
- BIM can be utilised to aid integrated planning and construction sequences for all aspects of the project.
- BIM can be utilised to highlight clashes in models at an early stage. This aids removal of the risk of conflicting information originating from individual models.

Government endorsement

The *Government Construction Strategy* was published by the Cabinet Office in 2011. The report announced the Government's intention to require collaborative 3D BIM (with all project and asset information, documentation and data being electronic) on its projects by 2016.

Essentially the UK Government embarked, with industry, on a four year programme for sector modernisation with the key objective of reducing capital cost from the construction and operation of the built environment by 20%. Central to these ambitions was the adoption of BIM technologies, and collaborative behaviours that will unlock more efficient ways of working at all stages of the project life-cycle.

BIM model with 'warm frame' construction

Components manufactured using automated roll-forming machines

3D model for light steel framing in educational centre

Building Information Modelling

BIM levels

Outline descriptions of the different levels of BIM are presented in Table 1. Exact definitions of the levels are debatable so the information presented is for guidance.

BIM Level 2 is the method of working that has been set as a minimum target by the UK Government for all public-sector work, by 2016.

LEVEL	DESCRIPTION
0	Preparation of 2D CAD drawings for design and production. No collaboration of electronic models of separate parties.
1	Mixture of 2D and 3D CAD produced by the architect and design teams. Electronic data transfer among the design team and specialist suppliers.
2	Collaborative working with each party using their own 3D CAD model. Use of common file formats such as IFC (Industry Foundation Class) or COBie (Construction Operations Building Information Exchange). Detailed requirements to achieve BIM Level 2 are outlined in PAS 1192-2: 2013.
3	Full BIM collaboration between all disciplines, using a single shared project model. All parties have access to the centrally held model and may modify it. Management of the BIM process by the client's team or main contractor. Known as 'Open BIM', set as a minimum target by the UK government for all public-sector work, by 2019.

Table 1 BIM level definitions

Advanced BIM

In addition to the levels outlined in Table 1 the following advances in BIM are also possible:

- 4D BIM - The use of BIM to analyse time e.g. construction sequencing.
- 5D BIM - The addition of cost management to project models.
- 6D BIM - The extension of BIM to facilities management.

BIM process for light steel framing

The following stages for preparation of design and manufacturing information are typically followed by light steel framing manufacturers.

1. A 3D model is transmitted and shared in IFC format from the project architect to the light steel framing supplier. The light steel frame supplier digitally creates the light steel frame structure in the same model with integrated structural design information.

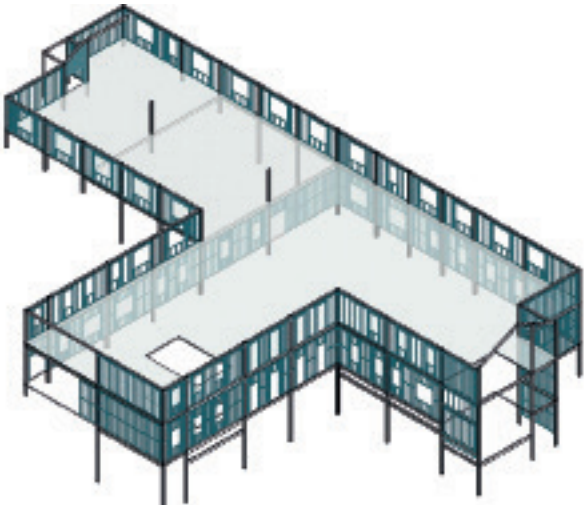

Figure 1 Revit model of hospital development with light gauge steel panels

2. Structural design software (e.g. *Trimble's Tekla Structural Designer*) is used by engineers to determine the loads on a building. The 3D BIM model can then be exported to a separate package (e.g. *Autodesk's Revit* or *Tekla Structures 3D*) to continue the detailing process of the light steel sections and subsequent CAM file export to send to the light steel section manufacturer.
3. The light steel supplier produces 2D panel information. 3D software packages (e.g. *Revit*) are commonly used by light steel suppliers, together with their connected architectural and structural information. The software links to specialist modules (e.g. *Strucsoft*) which enables the preparation of detailed 2D panel information.
4. The light steel supplier produces a detailed model showing the panel arrangement. Light steel section sizes are identified through a colour coding schedule indicated on plan, together with steel beams and columns.
5. A schedule of sections and quantities is produced by software, which can be compared with the original tender.

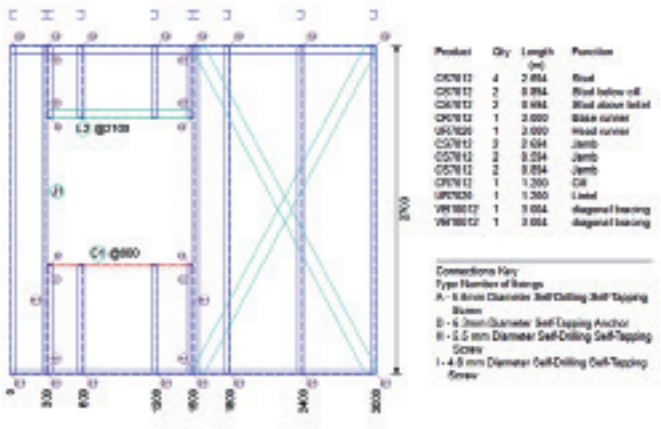

Figure 2 Typical 2D panel drawing with schedule of parts and fixing information

1. After confirming the basic structural arrangement of the panels and C sections in software (e.g. *Strucsoft* or *Tekla Structural Designer*), this information is then transferred to software (e.g. *Framecad*, *Tekla Structures* or *Autodesk's Advancesteel*) which creates data in a form suitable for manufacture of the 2D panels. This interface between software packages is currently often a manual process, and may require some rearrangement of C sections, windows and doors, and it can also be used to identify any 'clashes' with services or structural steel members.

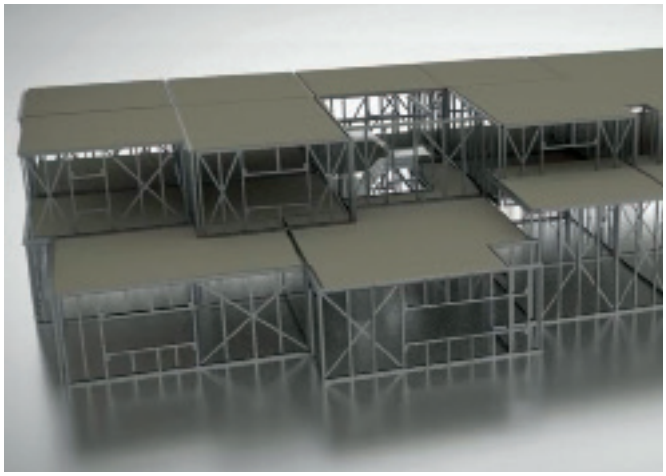

Figure 3 Typical 3D model of steel structure

2. 'Shop' drawings for manufacture are then produced by the software. Generally, all the C sections within one panel are the same size and thickness. Bundles are scheduled with colour coding for the installers so that one colour is located in one area on the building.

The light steel frame supplier will determine appropriate panel sizes based on the following criteria:

- Storey height - usually fixed for a given floor and typically 2.7 to 3.0 m.
- Width - typically less than 3.0 m or as determined by transportation restrictions.
- Weight - less than 100 kg for manual handling in the factory and on site.

The software used by the light steel frame supplier is partly dependant on the roll-forming machines being used.

3. The 3D model (e.g. *Revit*) produced by the light steel supplier can then be integrated into the Architect's 4D project management information (e.g. *Navisworks*), which also identifies 'clashes' with services, etc.

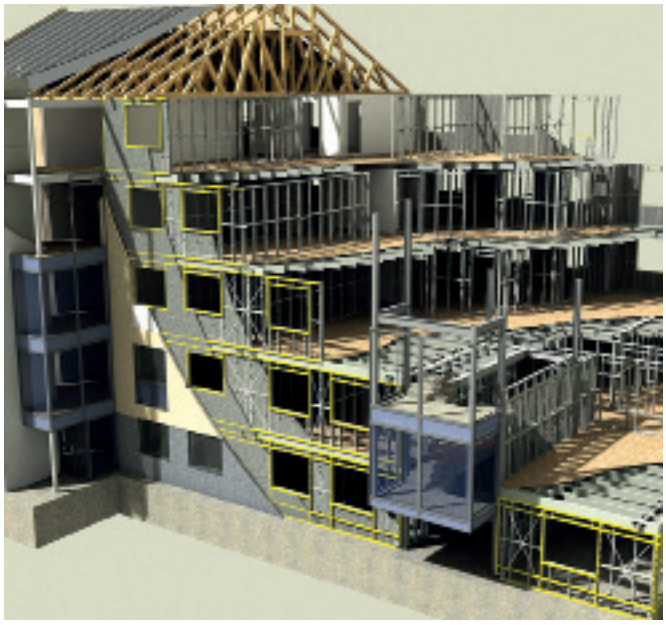

Figure 4 3D model of light steel frame residential project

Currently, it is unusual for the client/main contractor to manage the BIM model and to integrate it with other client management information, which would be classified as BIM Level 3.

A more common process is for the project architect to manage the BIM information at a design level. *Revit* has become an important tool for the coordination of design information among the design team.

The BIM model can be updated to include any variations required on site, and then it can be made available to the client as a record of the as-built construction.

Sources of Information

Other technical information sheets

The following technical information sheets give further details on specific topics related to light steel construction.

- ED010: Light steel solutions for all applications
- ED011: Light steel residential buildings
- ED012: Light steel framed housing
- ED013: Light steel infill walls
- ED014: Light steel modular construction
- ED015: Acoustic performance of light steel construction
- ED016: Fire safety of light steel construction
- ED019: Thermal performance of light steel construction
- ED020: Sustainability of light steel construction
- ED021: Robustness of light steel construction
- ED022: Durability of light steel construction
- P408: Light steel load-bearing walls
- P409: Value benefits of light steel construction

Best Practice Guidance

The Light Steel Forum have produced a series of information sheets which provide guidance on best practice in light steel framing. These cover four key areas of the design and construction process:

- ED027: Design and construction
- ED028: Pre-start requirements
- ED029: Installation
- ED030: Follow-on trades

Bibliography

The following publications may be referred to for more information on BIM and light steel construction.

Government Construction Strategy.
Cabinet Office, 2011.

Saxon, R. G.
Growth through BIM.
Construction Industry Council, 2013.

Lawson, R. M., Way, A. G. J. and Yandzio, E.
Building design using cold formed steel sections: Residential buildings (P402).
The Steel Construction Institute, 2014.

Dave, B., et al
Implementing lean in construction: Lean construction and BIM (C725).
CIRIA, 2013.

PAS 1192-2: 2013
Specification for information management for the capital/delivery phase of construction projects using building information modelling.
BSI, 2013.

National BIM Library - www.nationalbimlibrary.com.

Manufacturers

The following manufacturers are members of the Light Steel Forum and are active in the light steel framing and modular construction sector and may be contacted for further information.

Ayrshire Metals Ltd - www.ayrshire.co.uk
BW Industries Ltd - www.bw-industries.co.uk
Fusion Building Systems - www.fusionbuild.com
Hadley Steel Framing Ltd - www.hadleygroup.com
Kingspan Steel Building Solutions - www.kingspanpanels.co.uk/sbs
Metek UK Ltd - www.metek.co.uk
Saint-Gobain - www.saint-gobain.co.uk
Sigmat Ltd - www.sigmat.co.uk

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www.lightsteelforum.co.uk – Light Steel Forum

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