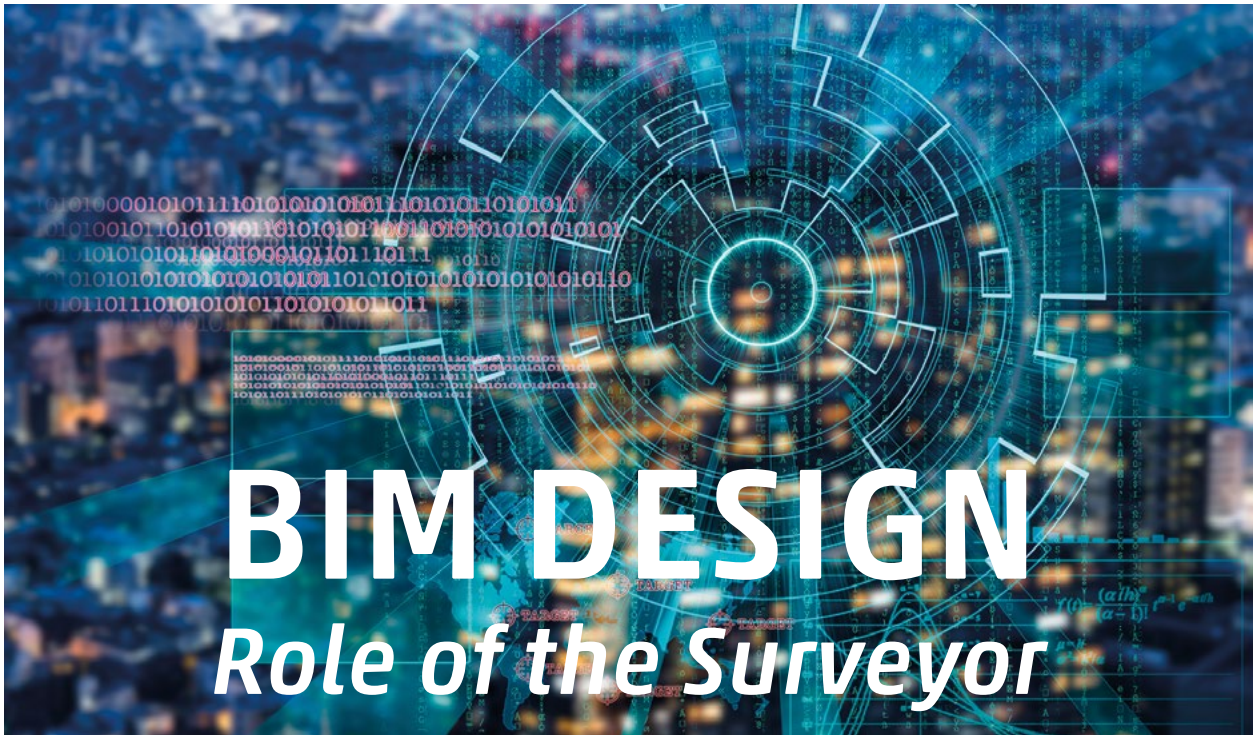

BIM DESIGN
Role of the Surveyor

Sam Wells

Surveying has evolved considerably over time. From vintage chain and plumb-bob stories through to digital modelling and automation, technological change and innovation have had a huge impact on how we collate information and connect with our clients.

The adoption of laser scanning into day-to-day workflows is an excellent example of innovation in action. Laser scanning enables surveyors to produce incredibly accurate 3D models of site environments, and align these with BIM (building information modelling) tools to align project design across different engineering disciplines.

The surveyor's role in BIM further ensures core principles of control and verification are maintained, and contributes to ongoing career development and enrichment through increased proficiency in a host of modelling software.

Building services will frequently deal with complex site environments including plant rooms and high-rise structures. The ability to scan these environments enables key site features and information to be collated into highly detailed 3D models, as shown in *Figure 1*, of a modelling plant on a factory tower. The 3D model can be freely incorporated into design models, creating opportunities for survey as a primary data source for BIM. The survey process however, still requires adherence to core principles to ensure accuracy.

Surveying in the workplace

At Beca, surveying has long been closely associated with transport and infrastructure, providing topographical models, cadastral legalisation and road design. The evolution of laser scanning has expanded our relationship beyond infrastructure to include building services, architecture and structural engineering. These disciplines, through technological advances, have become more competent at working with large 'point cloud' datasets, once a key scanning data limitation.

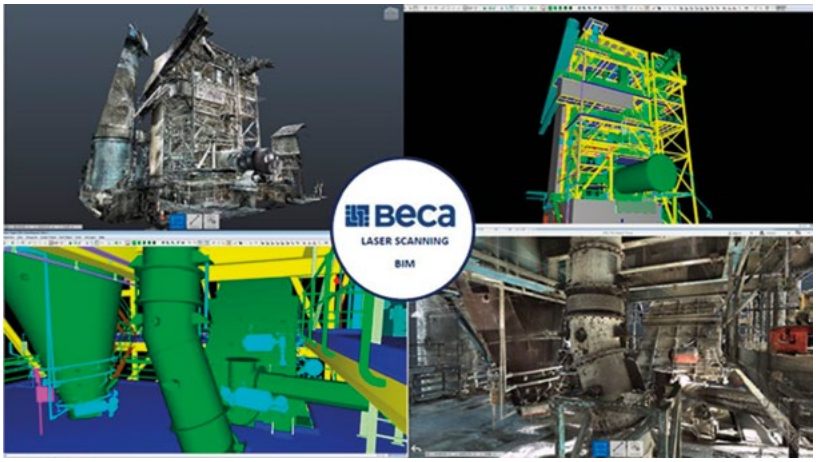

Figure 1: BIM deliverables from 3D laser scanning.

Not forgetting the fundamentals

To ensure scanning accuracy, a control network is always installed and connected to the local geodetic datum through the traversing and levelling of the project environment. The scanning dataset is then related to the control on-site through fixed targets or post processing. The accuracy of the dataset is therefore determined by the accuracy of the control.

Methods to capture point cloud data may change, however the fundamentals of ground control cannot be overshadowed. The same applies to verification, a process staged through control, point cloud processing and deliverables, to ensure potential errors do not carry throughout.

Survey fundamentals also apply to point cloud capture and processing. Point cloud data can be captured by various methods, including engineering-grade laser scanners, UAV, LiDAR and small scanners with generic point cloud functionality.

Basic workflow means anyone can truly capture a raw point cloud, however, the importance of using appropriate tools and understanding their limitations cannot be emphasised enough. This domain is where surveyors will always be valued, for our ability to question the methodology and provide certainty in the delivered model.

It is essential the correct tools and software are applied relative to the output requirements. Software such as Leica Cyclone or Autodesk Recap all have their place in delivery (see *Figures 2* and *3*). It is up to the surveyor to determine how each are applied in the reduction process to achieve the best output.

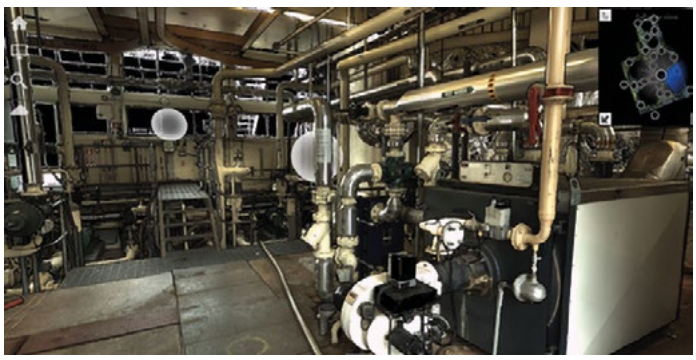

Figure 2: Autodesk recap model of a plant room – internal perspective.

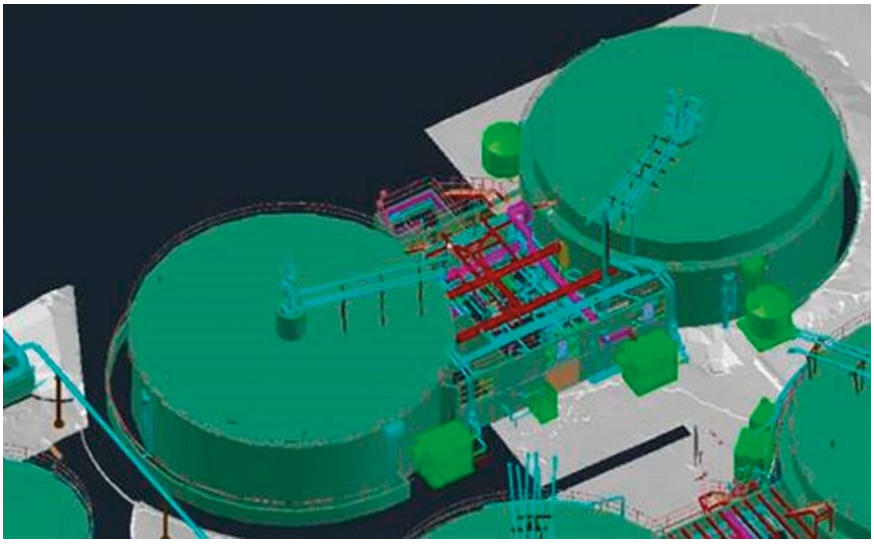

Figure 3: AutoCAD solid 3D model of the same plant room – external perspective.

Areas for future growth

How we as surveyors are involved in BIM is an ongoing development. More common is the management of data between sub-consultants, project management and the client, including the distribution of large datasets and providing advice or feedback on the deliverable.

An area of growth we must embrace is model verification. It is our responsibility to ensure the model reflects both the captured point cloud and the specified level of design for delivery.

We are starting to use the functionality of packages such as Autodesk Revit, Navisworks and 3D Reshaper in order to:

- understand feature modelling and shared coordinate systems
- verify the accuracy of the geometrical model against the point cloud
- improve client interaction on the received dataset.

Increasing our knowledge of modelling software will not only improve the control that we as surveyors have over the BIM output, but also enhance our connections with the engineering designers.

BIM as a modern workflow in design has created opportunities for surveyors to develop in the 3D spatial world. The door has opened to grow our profession through digital modelling and align more closely with building and structural designers.

As technology continues to improve, data capture such as laser scanning and UAV will change alongside, however the survey principles of control and verification will always remain. The imperative is to ensure control of the model and have processes in place to maintain confidence in what we deliver.