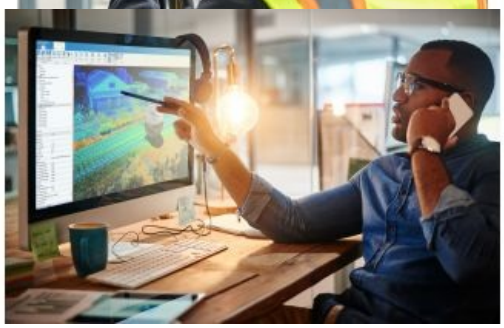
The Role of Surveyors in the Evolution of BIM






Building information modelling (BIM) is becoming more commonplace within construction sectors globally, combining technology with improved collaboration to better manage projects and give them the best chance of complying with time and budget constraints. However, the BIM life cycle and efforts to espouse it are almost futile if surveying is taken out of the equation or, more realistically, brought in too late. It can be good to have a structure that is successfully using BIM to be delivered on time and within budget, but if it or any of its components are in the wrong position the consequences can be catastrophic.

It sounds obvious, but all construction sites are situated on land, which naturally throws up topographical and positional challenges: the remit of a surveyor. If BIM is to reach its potential, surveyors – with their geospatial expertise and knowledge of implementing technology to provide ongoing, reliable and accurate data – should therefore be involved as early on in the process as possible. That is the view of Survey4BIM, a cross-discipline industry working group that Topcon has been supporting and sharing best practice with since 2015.

Location, location, location

Despite location being the fourth biggest decision driver for construction projects – behind cost, time and complexity – it can sometimes be taken for granted. However, the position of a building is actually its most valued attribute. Take The Shard in London, or the Empire State Building in New York, or the Burj Khalifa in Dubai; more people care about the view from the top, or how it looks from different directions, than what it took to build it. At its most basic level, that is exactly the purpose of surveying within BIM: it puts things in the right place. There is a lot more to it than that, though. Surveyors play a vital role in the successful management of construction projects, providing a continuous update of location-based information throughout the entire process, from conception to demolition. They use their specific geospatial skills and awareness of BIM to evaluate location data, guide clients through the latest technology and ensure the successful implementation of coordinates on a site to facilitate maximum precision. In turn, this means every part of a structure is where it should be, and expensive errors and inefficiencies are avoided. Not only that, but the integration of surveying within BIM also underpins the entire foundation of location-based models, which create digitally connected communities and are the backbone of the ‘digital twin’ concept.

The position of building is actually its most valued attribute. In the case of The Shard in London, for example, more people care about the view from the top, or how it looks from different directions, than what it took to build it. At its most basic level, that is exactly the purpose of surveying within BIM: putting things in the right place. (Image courtesy: Dronepicr / Wikipedia Commons)

Too little too late

One of the main factors hindering the evolution of BIM is the fact that surveyors are often not called in until halfway through the BIM life cycle. This is most commonly during the actual construction stage when, for example, it transpires that the coordinates are not working. Defining which coordinate systems to use at the beginning would have avoided such a predicament.

For BIM to perform as intended, a geospatial partner needs to be involved right from the start to validate and quality assure. By reviewing a client’s objectives, the surveyor can advise on how to spec out the tender and make sure that the client understands exactly what sort of questions they should be asking at each stage in terms of survey information. Such collaboration means all parties are aware of which factors can impact timescales and costs so they can collectively steer the project towards successful completion and beyond.

The best way to appreciate how surveying fits in with the BIM process is to look at the complete life cycle of a project from conception through handover to operation. At all stages of this cycle there is a necessary requirement for fit-for-purpose survey information. The following framework outlining the advantages of surveyor support throughout the construction process is an adaptation of the one set out

in Survey4BIM's guide called 'Survey and the Digital Plan of Works'.

The role of the surveyor throughout the BIM life cycle

1. Strategy: At this early stage, the surveyor is able to obtain a full overview of the project and provide broad-based survey data and information to be used as background to the project, as well as define the coordination scheme. The most important element for survey practitioners to advise on as part of this is the type of geospatial information that will be available to stakeholders so they can identify where coordination or mis-coordination can occur. By introducing a geospatial opinion at this stage, all available data will be appraised in a geospatial context and any missing geospatial data can be sourced.

2. Brief: As project objectives and the initial brief are developed, the surveyor can undertake feasibility studies, review site information and advise on survey requirements, supplying coordinated airborne, remote and terrestrial data to enable strategic decisions to be made. The survey will be carried out according to the brief, survey procedures will be correctly applied and data critical to the project's success will be made available. The quality of survey data will also ensure that plans fit well with the existing conditions on site.

3. Concept: The surveyor will analyse the preparation of the concept design – including the proposals for structural design, building services systems, specifications, preliminary cost information and project strategies – looking at any alterations to the brief. They will typically be consulted to clarify unclear data or look at gross errors resulting from field mistakes. At this stage, site coordination may also be refined and the surveyor should ensure the chosen coordinate system is suitable. Any issues resulting from initial contractor mistakes are highlighted, geospatial design flaws are detected, time schedules are updated and the granularity, scale and level of detail of the survey are clarified.

4. Definition: Once the concept is approved, the developed design will be prepared. Surveyors will be needed to ensure project elements are in a suitable format for survey tasks, and that survey data can be easily consumed in the common data environment and is fit for purpose for the end user. All of this means that gaps in survey data will be filled, the survey can be repurposed and carried out again if project definitions require changes, and any re-surveying to fix issues can be used to inform and update the project timescale.
5. Design: The technical design is then prepared in accordance with the design responsibility matrix, with project strategies including all architectural, structural and building services information, specifications and specialist subcontractor design. Surveyors will check and confirm that the technical data provided is suitable for survey work and that survey data collected can be used to update the technical design. This allows for a continuous as-built view as the site is prepared, meaning site control can be managed and maintained and design changes can be verified.

6. Build and construction: This is when off-site manufacturing and on-site construction begin in accordance with the construction programme, with any design queries from the site being resolved as they arise. To do this, surveyors will manage and maintain site control, supervise contractors on site to ensure correct coordination is used, and feedback regular as-built data to the common data environment to minimize design failure creep. This vigilant eye on survey quality means updates on site progress and any required changes will be given efficiently.

7. Conclusion and handover: Once the building contract is concluded and the completed structure is handed over, surveyors may have to re-establish suitable control points if the facilities manager is intending to work on site using geospatial data for navigation. The surveyor will highlight any shortcomings of the brief before validation and as-built verification work and make sure the site coordinates are clear and easy to understand.

8. Operation: While the building is in use, surveyors will be able to locate services in the site coordinate system and could be party to a service contract by providing data updates to maintain currency of site data. This means geospatial data will be consistent, holistic and used in the correct manner, and unbiased advice will be given on the survey strategy to suit data management.

Modern 3D software environments combine datasets â€“ civil, mapping, BIM and survey data â€“ from multiple mass data sensors.

Unleashing the power of BIM

Precise measurement is crucial in the life cycle of any structure, be it a building, a road, a bridge or a rail network, and that is exactly where the skill of a surveyor comes in. However, the role of surveyors goes beyond merely supplying and curating content; they are a fundamental contributor to a project's short-term and long-term success. Survey is a key driving element of the entire BIM process.

At the moment, surveyors are enabling useful information to be communicated with ease, making the feedback loop much quicker than it used to be. This results in increased efficiency, avoidance of error, more sustainable construction and a reduction of waste. However, the real opportunity ahead of us is to make national digital twins a reality which, in a construction situation, will enable even more efficient allocation and even fewer costly positioning faults. Surveyors simply need to be given the chance to show what they can do.

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Many surveyors use a robotic total station and scanner in one, which allows for quicker construction verification.