BIM Outreach

09 Surveying for BIM

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BIM IN PRACTICE

CONSULT AUSTRALIA

Australian Institute of Architects

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09 *Surveying for BIM*

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INTRODUCTION

Over the last decade both the Land Survey (Survey) discipline, and the Design Consultants (DC) disciplines have changed significantly through the introduction of new technologies and processes such as Building Information Modelling (BIM). These changes now require all stakeholders to both reassess the opportunities technology provides, and consider changes to traditional processes, if the maximum value is to be realised.

In order to achieve additional value through BIM, stakeholders should increase their level of understanding about the capabilities and requirements of other stakeholders, in particular those who depend on the direct input of others. Key considerations relate to an understanding of the benefits and limitations of tools, data types and the levels of detail possible or required, when data is required, and the optimum outputs and deliverables required to support the project.

This paper explores the interface between the Surveyor and DC disciplines, the processes and outputs required to facilitate BIM. The paper further suggests key elements to be included in a brief to hone the potential efficiencies offered by BIM.

BACKGROUND, DATA SOURCES AND ACCURACY

The role of the Surveyor has evolved over the last decade. The use of tape measures, theodolites, dumpy levels and staffs is increasingly giving way to total stations, GPS, GIS and laser scanning technology. New technology has broadened the potential scope of the Surveyor into areas that were previously handled by other disciplines. Surveyors still mainly focus on the geospatial information of positioning the site and recording the levels. At the same time some firms are developing their BIM capabilities and the technology they specialise in. This approach can help them to gather existing conditions data (such as detailed internal and external building data, and in ground services) in more detail and faster than the traditional processes used by DC.

On the other hand, for DC, the use of publicly accessible Geospatial Information Systems (GIS) data is becoming more common, and with the relative decrease in the cost of survey equipment, some are now developing their in-house skills to avoid the need to engage Surveyors for anything more than the bare minimum of service. There are risks associated with this approach as some aspects of the survey work related to site establishment are covered by legislation, and prosecutions for breaches are not uncommon. The fidelity of diverse data sets and the nuances of geospatial systems also add legal and insurance risks.

Due to this ongoing transition, the demarcation lines between services offered by Surveyors and DC become increasingly blurred, which in return may result in missed opportunities. Both scenarios fail to acknowledge the highly skilled and increasingly technical aspects of both fields.

BIM has brought some of these issues to the fore. What worked for manual drafting or CAD is no longer adequate. Instead, BIM is based on a rich and robust data set to resolve design problems “in the office” through detailed coordination. Simply knowing that there is a tree, wall, or light pole is no longer enough. Each element will either impact or be impacted upon by the design.

Without quality existing conditions data the BIM will be compromised as the DC will need to make assumptions where detail is not available. The second-guessing of conditions data reduces its reliability and value by limiting design brief and statutory compliance, and constructability analysis functionality.

FIELD TO SIM

There are a number of BIM authoring software applications in general use in Australia. Some provide more options than others when importing survey data, but where the option is provided they work similarly across applications. Regardless, the creation of an accurate and reliable "existing conditions" Survey Information Model (SIM) is vital to support the design process in BIM.

SURVEY DATA AND FORMATS

The data collected in the field by the surveyor is manipulated in specific surveying software to generate items such as Digital Terrain Models (DTMs), Triangulated Irregular Networks (TINs) strings and point cloud files. Software typically is the variable as the checking and maintenance of the accuracy and integrity of the data sets is constant no matter the data collection method and file format being used.

TOPOGRAPHY

BIM applications, by definition, focus on the building or site elements, and it is important to note that the topography and planting in the BIM is only indicative and not as detailed as the DTM.

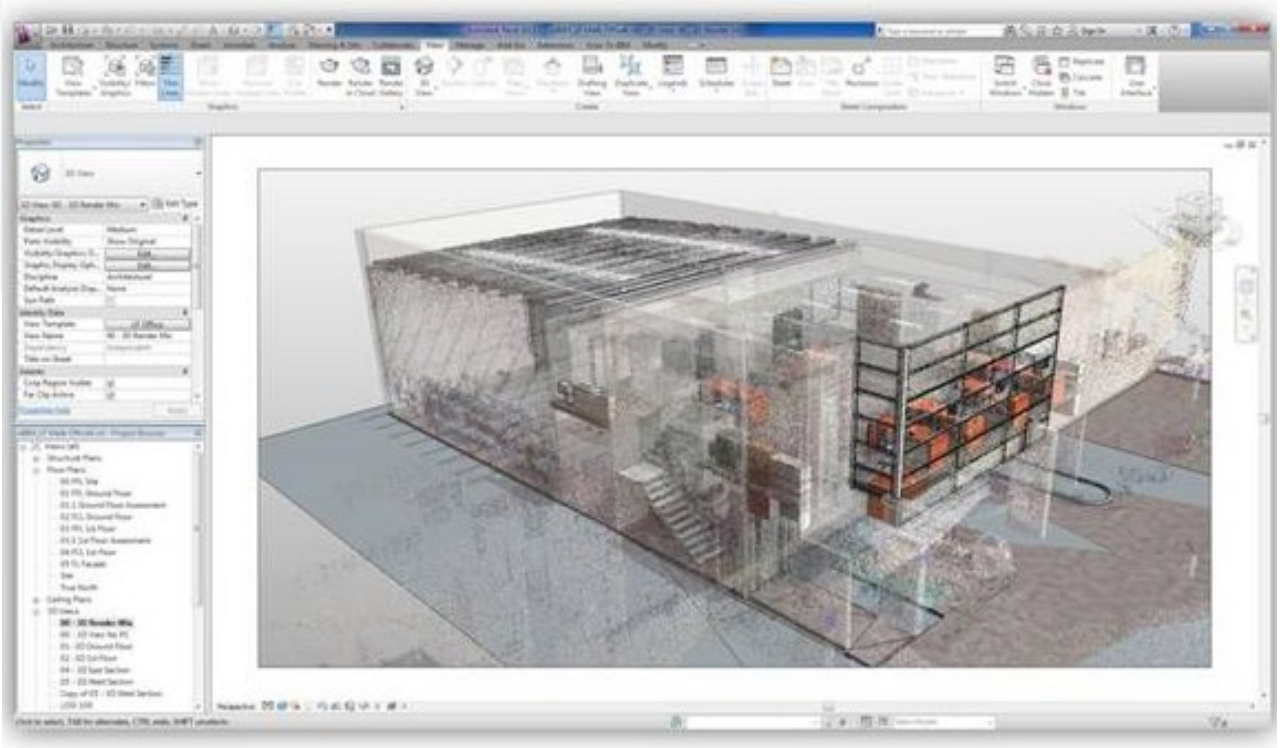
The most common methods for data transfer into a BIM are via 3D CAD files (.DWG, .DXF, .DGN, .SAT or .SKP) or Point Files (.csv, .pts or .pcg). Once the CAD file is imported into the BIM, the relevant "layers" / "levels" are selected, and the RL data from them is transferred to create the topography. As a CAD file is typically used as a drawing rather than a medium to transfer RL data, problems like randomly incorrect Z values for points, "flattened" files, and inconsistent use of layers and layering systems have hindered the process.

An alternative is the use of a Point File (PF) which contains comma-delimited X, Y and Z values for each point and is much smaller and produces topographic surface more quickly when loaded directly into the BIM. Useful for simple surfaces, this method lacks the fidelity of a TIN or DTM as during the creation of these the point data set undergoes a process involving a mixture of point filtering and cleaning; break line data inclusion and quality checks through the use of applications such as LISCAD, Terramodel, Civil 3D and 12D Model to name a few.

FEATURES

Having created the topography in the BIM, the features need to be located and CAD files remain the most effective method. The DC needs to be aware that Surveyors use different methods for locating features depending on required accuracy. Failure to specify accuracy requirements at the outset can greatly diminish the quality of the data delivered.

The creation of point clouds through laser scanning present further options to enhance data exchange while improving accuracy levels. Managing the data effectively and using a combination of techniques has the potential to add considerable value to the collaborative effort between DC and the Surveyor.



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WORKFLOW

Currently Architects transfer survey data into a BIM to generate the topography. If however the Surveyor data creators / gatherers format their data to meet the DC requirements, then the Surveyor could create the geo-spatially located SIM file so it can be loaded directly into the design BIM (to then be manipulated by the DC). In return, the risk of the DC "interpreting" the Surveyors data incorrectly would be reduced.

Challenges remain with the above approach: For Surveyors to create a SIM file, they not only need to be across their traditional core areas of expertise, they also need to develop more detailed working knowledge of BIM, the various authoring tools, building construction and services planning.

BIM knowledge by the Surveyors as a prerequisite presents a quandary as no one group in the value chain has all the required expertise to gather and structure the existing conditions data in a highly efficient way. Therefore collaboration is required and the management of these interactions in the BIM world is now widely handled by means of a BIM Management Plan (BMP) (refer to the 'P' series of documents that form part of this publication). By planning the collaboration methods and resolving the data exchange protocols in the early stages of the design / documentation process, the broader team can more easily provide reliable data at a suitable level of detail in a timely fashion.

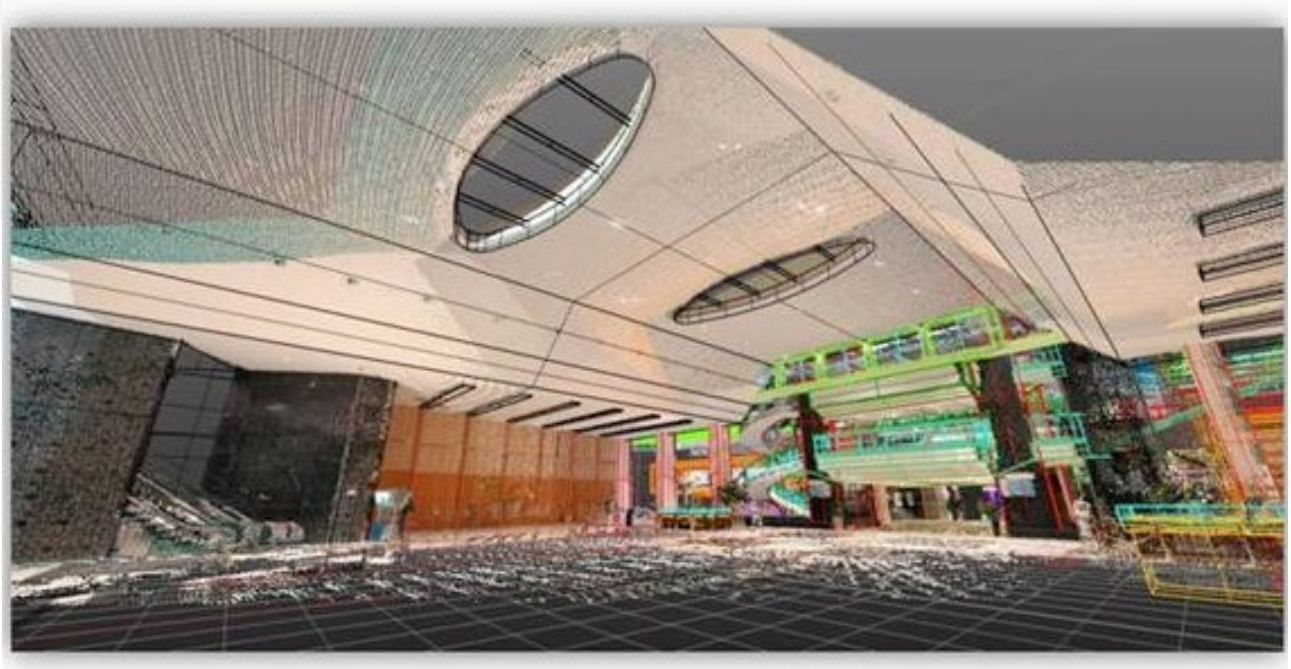
The dilemma with the work of the Surveyor is twofold. Firstly, unlike the majority of the rest of the consultant team, the property and topographic survey work may be complete prior to most, if not all, other consultants having been appointed. The second is that traditionally, once the initial survey has been done, there is no allowance for additional or follow up work.

PROCESS CHANGE DUE TO NEW TECHNOLOGY

New technologies are being used by both Surveyors and DC, and this can extend the role of the Surveyor into a more ongoing one through the entire design and construction phase of the building lifecycle. They can identify and locate the site at the outset, and make major contributions to increased efficiency of modelling / documenting the existing structures and services. This, in tandem with the ongoing utilisation of BIM can increase accuracy and decrease building tolerances. Further, with the rapid uptake of BIM during construction, Head Contractors (HC) are utilising BIM data for digital set out, resulting in reduced costs and improved site safety. Surveyor engagement, however, is often done along traditional obligation lines meaning Sub Contractors (SC) and HC engage their own Surveyors for one project in an effort to manage their risk / liability. The result is duplication of effort which in turn prevents the full potential value that BIM and Surveyors can provide being realised.

The workflow changes described here require a paradigm shift in thinking and a new way of communicating. In this context it needs to be considered that not all Surveyors or DC are at the same level of their adoption in BIM and the industry is still undergoing a learning process. If Surveyors are approached by clients directly they need to understand the client's data objectives and encourage a closer interaction with the DC. At the same time clients and DC need to consider in detail how the surveyors' new processes and technologies can benefit their workflows. Such changes to traditional ways of collaboration are more likely to succeed in an environment that encourages innovation and that respects the notion that the cheapest fee does not always represent the best value.

DC and surveyors should foster strategic relationships that encourage the sharing of knowledge to reduce the learning effort by both consultants on every new project.



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BRIEFING REQUIREMENTS

The survey brief generated by the DC for the surveyor should contain a detailed description of all the BIM-related data requirements to be met. The brief will be based on the DC data requirements and it typically includes: format, benchmark locations, units, coordinated systems, etc., as well as a clear definition of the survey extent - what is to be surveyed and to what level of detail. The data set may even include intangible site conditions like site height restrictions and zoning. It should also include opportunities for the surveyor to propose alternative processes to achieve better outcomes.

As part of the BMP process, the project team will carry out a downstream value chain analysis to determine all possible uses for the BIM data. Currently, this process occurs too late for most, but not all, of the surveyors' work. DC's therefore should engage with surveyors to understand the nuisances of file format and data interoperability considerations prior to the surveyor briefing phase to ensure "best for project" outcomes are achieved.

Readily available data in the public domain, which may seem cost effective, can vary greatly in accuracy making its use inappropriate, unreliable or problematic. The accuracy of field work can also vary depending on required levels of detail. Without a clear direction surveyors will assume minimum standards and budget accordingly, which makes it even more important for DCs to communicate the specific project requirements.

CONCLUSION

The development of the BMP must include input from all DCs including, where possible, the surveyor. By utilising the collective skills within the broader project team and by identifying needs and responsibilities of all stakeholders involved, the most appropriate technologies can be applied. This ensures the gathering and formatting of data to solve design issues is to a high level of accuracy, and may also extend to the construction phase to incorporate the requirements of the builder.

In order to facilitate the workflow changes described previously, surveyors need to develop and maintain capability statements that manage expectations, communicate their technical and process requirements and outline their value proposition. These statements should accompany fee proposal letters to assist clients / DC to understand the varied options to increase value for the project.

Technology alone will not solve all the challenges that project teams face when gathering existing conditions data. New tools such as 3D laser scanning rely on "line of sight" technology. Where required data involves non-visible building elements embedded in walls, ceiling spaces or underground the laser technology's shortcomings are evident.

Historically surveyors were not necessarily seen as part of the consultant or construction teams. New technology and processes allow them to provide critical, valid and ongoing services throughout the design and construction phases of the building life-cycle.

From a qualitative perspective, surveyors can add significant, ongoing, value to the project, which suggests that their input should fall under the supervision of the lead consultant, similar to other consultants. Surveyors should be directly engaged in the BMP development. This is where the majority of the decisions on data requirements, flow and format control are determined, and where the greatest positive impact can be implemented.