

AUTOMATION OF THE BUILDING INFORMATION MODEL BREAKDOWN STRUCTURE

Leonardo Rischmoller¹, Ning (Tony) Dong², Martin Fischer³, and Atul Khanzode⁴

1 BACKGROUND

The existing BIM tools emphasize more on the information (e.g., properties, attributes, parameters, etc.) attached to each piece (e.g., the part, element, component) of the model and on the level of detail or level of development (LOD) of the BIM pieces. They are less concerned with how the pieces are arranged into a Model Breakdown Structure (MBS). Some BIM tools offer limited functions of grouping different model pieces by location, elevation, discipline, or other criteria. These attempts however provide a number of "fixed" ways to organize a federated model (also known as integrated model), which either has no relationship with a project's WBS, PBS, or OBS; or makes it too difficult to obtain a MBS that matches any project breakdown structure.

2 CURRENT CONDITIONS

It has become a common practice for a general contractor to provide standardized model naming conventions, which facilitate the use of filter features that allow isolating and visualizing pieces or groups of pieces of the federated model. BIM coordinators normally save these visualization scenes as viewpoints (or snapshots) so they can be retrieved rapidly during a coordination meeting.

On-the-spot-requests to query parts of the federated model for which saved viewpoints are not available, lead model operators to take minutes to find the right model contents relevant to a topic. In this process, it is observed that meeting participants lose interest in models quickly, thus making the introduction of BIM unsuccessful and the benefits of BIM are not realized in these meetings.

Additionally, the current practice of grouping and organizing building information models from multiple project participants does not reflect different project breakdown structures well (e.g., WBS, OBS, PBS, etc.). This gap renders it a challenge to introducing Building Information Modelling (BIM) to on-site meetings in the construction phase, such as daily subcontractor huddles and pull planning sessions, in which on-the-spot-requests to query federated models are prevalent.

3 RESEARCH AIM AND METHODOLOGY

The research aims at developing and testing a tool and method to allow project team members to easily identify BIM models contents relevant to their needs through flexible MBS configurations reflecting different project breakdown structures. Specially during on-site meetings in the construction phase, such as daily subcontractor huddles and pull planning meetings, in which on-the-spot-requests to query federated models are prevalent rendering a challenge to introducing Building Information Modelling (BIM) at the last planer project development stage.

The CIFE MBS automation tool was developed and tested in two case study projects in two different years. The first case study is a multi-billion-dollar power plant megaproject. The second case study is a multi-million-dollar data center project. When testing the model, both projects had just started the construction stage, in which BIM models had been created by designers and some

¹ DPR BIM Manager, DPR Construction LeonardoR@dpr.com

² DPR R&D Manager TonyD@dpr.com

³ Center for Integrated Facility Engineering, Stanford University, Director Fischer@stanford.edu

⁴ DPR Technology Group Director AtulK@dpr.com



fabricators, to be used for coordination. The power plant had several thousands of models available, while the data center had several dozens of models available. In each case the construction management was carried out by a main general contractor who managed a group of design-build subcontractors to execute the work. Approximately 35 subcontractors were involved in the power plant project, and around 15 subcontractors were involved in the data center project.

4 RESEARCH FINDINGS

In the first test case, finding the right model contents on-the-spot in a meeting was almost impossible due to the many models included in the federated model. After introducing the CIFE MBS tool a BIM coordinator was able to identify the model contents relevant to the topic of discussion in 15 seconds or less. After one-hour training sessions 18 project members (project engineers, project managers, planners and schedulers) eventually became the main model navigator leading their respective meetings. Before introducing the CIFE MBS tool these project members had little to no experience with the models. In the second test case, project engineers hosting different types of meetings were able to navigate and query the model to find the right contents in 15 seconds or less when using the MBSs created with the CIFE tool. Finding the right content had taken several minutes when the MBSs were not available. The latencies in resolving issues during the on-site meetings were reported to be significantly reduced (Rischmoller et al, 2017).

Within two weeks of the introduction of models with MBSs created using the CIFE MBS tool other meeting participants (e.g., subcontractor's superintendents and managers, owner representatives, planners, safety and quality managers, etc.) started to realize the "presence" of the IPMs and how the models "followed" the ongoing discussions. The participants started shifting their focus of attention from the screen displaying 2D documents to the screen displaying the IPM. After another two weeks, the meeting participants realized that they could not only expect the model to "follow" the discussions but that they could actually "require" the right model contents to lead the ongoing discussions with the confidence that they were going to get an answer, not in the next meeting several days or weeks later, but in the same meeting in most cases.

The simplicity to navigate and query the IPMs led several meetings' participants to believe that this was the "normal" way of working using BIM, which they had not been aware of previously. Furthermore, it was not difficult to find in each case study a tech-savvy field engineer ready to take charge of navigating the model during meetings rather than relying on the "model operator".

Without the introduction of The CIFE MBS automation tool the advantages and benefits of BIM could have stayed in the world of modelers and BIM coordinators in the construction phase. According to the case projects team members, the tool allowed on-site personnel to easily overcome their fear of technology and take the lead in using BIM to improve the efficiency of their meetings.

