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BIM AND LEAN FOR PROJECT PLANNING AND CONTROL

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Abstract: This case study features the combined use of BIM and Lean in the context of a complex mega-hospital project. Often featured as a conservative environment resistant to change, construction had not taken advantage from digital technology till very recently. This is about to change thanks to the adoption of BIM which serves as an enabler. Literature suggests that improved preconstruction planning and scheduling are one of the ways to improve productivity. This case study demonstrates that combining two powerful strategies (Lean and BIM) and working in collaboration with all project stakeholders leads to an efficient integrated construction process at a large Canadian General Contractor and Design-Builder C company. The synergy between Lean Construction and BIM results in improved communication and better productivity of teams.

1 PROJECT OVERVIEW

The Centre Hospitalier de l'Université de Montréal (CHUM) is a complex hospital project located in a dense urban area in downtown Montreal. After having constructed the new Research Center of the CHUM several years ago (as a part of a Joint Venture), at the end of 2017, Pomerleau was awarded the construction of the second phase of the mega hospital (execution time 3 years including the demolition of the old building). The fast-track Design-Build project is a challenge for all the project team. It is logical that all the design and the realization of the construction are performed in BIM in order to better manage the risks and improve productivity, quality and safety. Pomerleau is managing BIM for construction and for hand-over uses. The project team including the superintendents had previous BIM experience. They also have developed site scheduling techniques partially similar to those of Lean Construction.

2 BACKGROUND

The productivity in the AECO industry is recognized to lag behind in growth compared to the other industries during the last several decades. Often featured as a conservative environment resistant to change, construction had not taken advantage from digital technology till very recently (Teicholz, 2014). This is about to change thanks to the adoption of Building Information Modeling (BIM) which seems to serve as an enabler (Bock & Linner, 2015) (Poirier, Forgues, & Staub-French, 2016) (Bernstein, 2018). Literature suggests that improved preconstruction planning and scheduling are one of the ways to improve productivity (Naoum, 2016). However, BIM alone does not propose innovative project management principles and planning tools. That is where the symbiosis between BIM and Lean proves to be a powerful strategy (Sacks, 2018).

3 CONTEXT OF THE CASE STUDY

The case study is performed by a General Contractor's and Design-Builder company (Pomerleau), in the context of a mega-hospital project. It studies the impact on the project team performance of combining two powerful strategies (Lean and BIM) and working in collaboration with all project stakeholders. The monitored performance indicators are the quality of the communication between Design-Builder and the Trades, as well as the productivity of the construction teams in relation to the scheduled activities.

4 INNOVATION IN THE PLANNING, SCHEDULING AND PROJECT-CONTROL LOOP

Convinced in the positive impact of Lean Construction principles and culture on Pomerleau's activities, several years ago, the company started systematic adoption of Lean. This followed the success of the ERP implementation 6-7 years before, and the well-established BIM use from several years after. Lean is implemented in different ways in the various regions of the country, in compliance with the local culture or to better fit the specificities of projects and teams.

With the ambition to make some Lean construction techniques more attractive to superintendents who were reluctant to use them, the innovation team performed a comparative study on Lean Construction-based planning software (vPlanner, TouchPlan, BIM360 Plan, LeanKit). The conclusion was that they either do not fit the construction project needs, or are not user-friendly enough to be implemented in a real job-site context.

Therefore, the Innovation team, together with leading superintendents from the company, joined experience and forces towards an in-house developed solution. Based on Lean strategies and tools, it automates the links between widely used planning software (Primavera and MS Office), BIM models and job-site data (on a mobile tablet), to create a platform with user-friendly access for all participant stakeholders. Using three loops of planning, scheduling and control, it connects relevant data between the Master Schedule, CPM, Takt Plan, the BIM model, and the visual communication documents (2D sheets and Virtual Reality «UniPOM»). The integrated management of information through various forms and platforms is represented on the figure below.

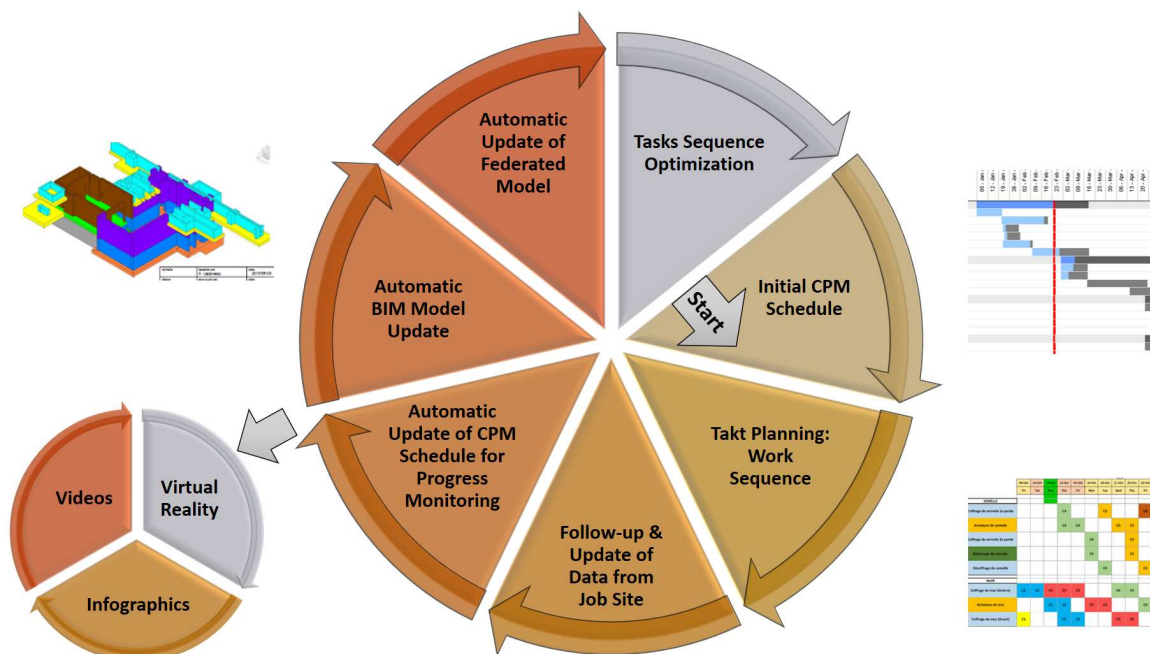


Figure: Planning, scheduling and progress monitoring sequence, together with the various forms of representation of the information used

The platform is used at the second phase of the CHUM, the pilot project being the demolition of the old hospital building at the same place, the excavation and the pouring of concrete for the foundations and the eight underground garage floors.

5. RESULTS

The interviews realized with superintendents and trade partners prove their very positive evaluation of the innovative method. In their opinion, the BIM-and-Lean planning and monitoring loop makes the optimization of the schedule easier and its communication to all stakeholders on the construction site clearer.

The regularly optimized schedule is followed very tightly and the project team considers that BIM and Lean together are a big contributor to the good progress of the works despite the challenging conditions.

The communication materials (the coloured Takt plan and the correspondingly coloured prints of the BIM model) are appreciated and used as daily and weekly reference by all stakeholders.

6 LESSONS LEARNED AND FUTURE DEVELOPMENT

This case study is a pilot project through which the Innovation team confirmed that custom-made in-house developed solutions can be a great fit for construction site use. The validation of the method continues through the next stages of the construction where more trades will be included in the innovative process.

The team is now preparing training material in order to be able to spread the use of this innovative method for BIM and Lean-based scheduling and control to all construction sites of the company.

Perspectives to integrate even larger part of the project stakeholders (including consultants) in the scheduling and monitoring are explored.

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