

IMPORTANT CONSTRUCTION CONSTRAINTS IN CONSTRAINT SIMULATION

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ABSTRACT

This paper identifies construction constraints for a constraint simulation of a construction flow. Therefore the construction environment and the methodologies of scheduling in construction are analyzed. Typical characteristics of construction schedules are classified. The relationship between different activities or between activities and building elements or between different building elements are examples for identified classes. With these characteristic construction schedules of real construction projects are analyzed. The results of this survey of construction schedules and the identified strategies of construction methods are presented in this paper in order to understand the process of scheduling. Based on that, the results of constraint based scheduling simulation can be improved a lot. Additionally, the reliability of construction schedules can be improved. Thru the productivity in construction can be increased.

1 INTRODUCTION

Eastman and Sacks (2008) explored that the productivity of the construction industry in the United States of America does not increase like the total productivity of the United States of America.

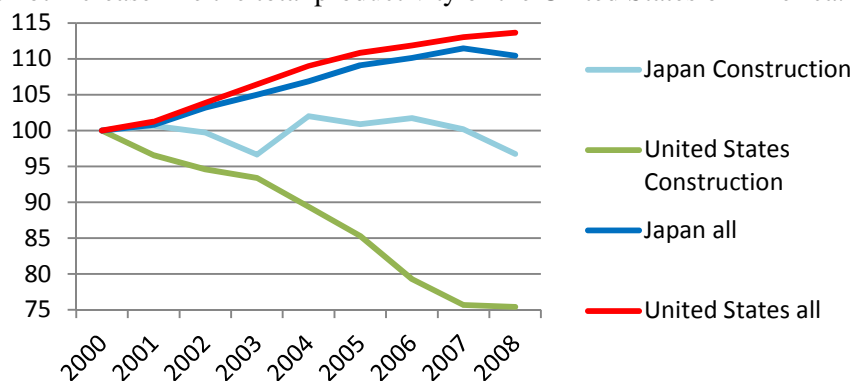


Figure 1: Labor productivity index (OECD, STAN Indicators)

Figure 1 shows that, although the total productivity and the productivity in construction sector in Japan differ like in the United States of America. New technologies such as computers are the mayor reason for this increase of productivity per working hour in the last twenty years. In the United States of America and in Japan the total productivity increases. However, the productivity in construction decreases in the United States of America. The productivity in construction sector in Japan has a smaller decrease, but seems to stay almost on the same level.

1.1 Building Information Model-based work preparation

Based on models of a construction project different reports or analyses can be done. By linking models together like the multi model container presented in the mefisto research project (Scherer and Schapke 2011) more detailed information of a project are in a consistent way available for reports and analyses. These linking of models are the idea of Building Information Models (BIM). The Industry Foundation Classes (IFC) already includes the object-oriented product model and the time schedules.

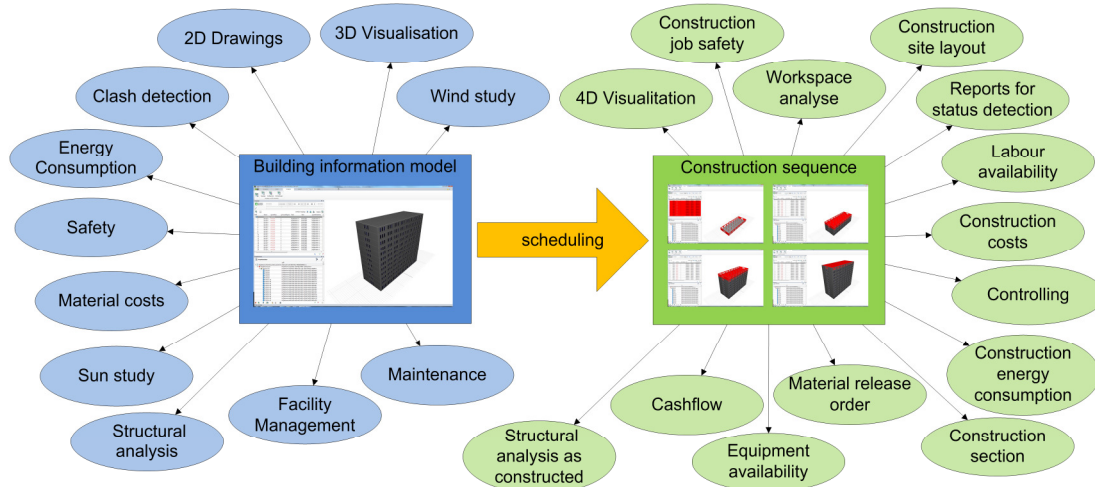


Figure 2: Project management based on a Building Information Model (BIM)

Many reports and analyses like structural analysis, bill of material costs, sun studies, 2D-drawings and clash detection are based on the object-oriented product model (Figure 2). If the Building Information Model is linked with the construction flow model more analyses and reports can be done. Figure 2 shows, that reports and analyses of 4D-Visualisation, construction site layout, labour and equipment availability, construction energy costs and construction costs needs information about the product **and** the schedule. A lot of reports and analyses as shown in Figure 2 are based on the relationship between building elements with each other, processes with other processes and building elements with processes. Therefore, the relationships in the construction flow of real construction projects should be identified, analyzed and graded.

2 CONCLUSION AND OUTLOOK

This poster shows what relationships in construction projects are common. Furthermore this paper gives an overview how schedules are structured today. In today's construction schedules only 0,65 dependencies per activity are modeled. Most of the real dependencies are not modeled. For a constraint based schedule simulation of a construction project much more dependencies has to be modeled. This paper identifies geometric and technologic relationships as dependencies which have to be added and considered in a constraint based schedule simulation for a construction project. In a next step the schedule survey and expert interviews will be extended to more schedules from projects all over the world to identify more in detail which relationships are important, how to formalize the generation of constraints and whether there are differences between countries or project types.

REFERENCES

- Eastman, C. M. and Sacks R. 2008. "Relative Productivity in the AEC Industries in the United States for On-Site and Off-Site Activities". *Journal of Construction Engineering and Management* 134(7): 517–526. DOI: 10.1061/(ASCE)0733-9364(2008)134:7(517).