

Logic of Processes in Civil Engineering

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1 INTRODUCTION

Processes in civil engineering are characterized by specific peculiarities. Projects are executed individually, and principles of mass production are not applicable. Contracts are concluded in which companies act in different roles from project to project. Local conditions influence a project. Constructions differ in design and building technique. Different types of buildings are planned and constructed by specialists working at different locations in different companies. The specific peculiarities are considered in project preparation phases where work plans are written out and rules for coordinated project work are determined and documented.

A significant task in project preparation phases is the specification of schedules. Software tools are available for scheduling. However, the methods implemented in these tools do not support the development of processes. They are used to document the results: tasks can be subdivided into subtasks and ordered on a time scale with the option to specify interdependencies so that schedules can be specified.

The workshop discusses a different approach where processes in civil engineering are treated in two steps. The first step addresses the logic of a process (planning). The second step addresses ways to assign time and resources to a process (scheduling). Other disciplines like software engineering profit from this distinction. In the workshop, the necessity, the usability, and the consequences of this approach for projects in civil engineering are discussed.

2 THESES

The workshop covers three presentations, and three papers are related to the workshop, Huhnt (2005), Racky (2005), Holzer (2005). Each paper addresses one of the three theses that are formulated and presented:

Thesis 1: Methods in civil engineering are necessary to generate individual processes with a correct and consistent logic.

Present scheduling techniques do not make use of a distinction between the logic of a process and its schedule. The sequence of tasks is specified on the basis of human experience only. As a consequence, the logic of processes cannot be checked formally so that their correctness and quality in civil engineering projects need to be checked by human beings. This is prone to errors, and the effort of work is enormous. For instance, typical planning processes cover more than 1.000 tasks and 10.000 documents. Checking the sequence of tasks of such processes requires huge effort; tracing effects of subsequent modifications becomes nearly impossible; and the complexity of projects in civil engineering will increase in future so that methods are necessary that guarantee for logically correct and consistent processes. An approach for construction processes is presented where the sequence of construction tasks is determined based on a task-oriented approach.

Thesis 2: A correct and complete monetary valuation of construction work requires methods, which focus on the functional logic of all building elements.

Turn-key construction projects show an enormous number of interfaces between the different building elements and work packages. In the estimating process, all these interfaces have to be valued with costs. Often current practice in estimating shows, that structure and course of the estimating process are not derived logically from the object, i.e. the building, which has to be dealt within the process. This holds the risk of an incorrect process output, i.e. construction costs. In the workshop the idea of an interface-oriented approach to estimating is presented. This approach helps to prevent interface costs from being incompletely estimated and to control the complexity of the project in the estimating process.



Thesis 3: Weights of processes can be converted into costs so that the determination of processes and their sequence can be formulated as an overall optimization problem.

The main obstacle towards monetary planning and monitoring of a construction project is presented by the total lack of a mathematically formulated cost model. The basic problem is constituted by the fact that resource allocation, scheduling, and cost are not simply sequentially dependent on each other, but rather interlocked. An attempt will be made in the workshop to outline the basic mathematical model of construction cost generation, thereby opening the way to future cost control and optimization.

The need of new methods for process planning based on logical considerations is described in the workshop. The consequences of this new approach are discussed with respect to the work of construction managers and specialists in computer science in civil engineering.

REFERENCES

- Huhnt, W. 2005. Generating Sequences of Construction Tasks. Present publication. In: present publication, *Proceedings of 22nd W78 Conference on Information Technology in Construction*, Dresden, Germany, July 2005.
- Racky, P. 2005. Linking up versus Breaking down: Demands on Cost Estimating for Turn-key Construction Projects. In: present publication, *Proceedings of 22nd W78 Conference on Information Technology in Construction*, Dresden, Germany, July 2005.
- Holzer, S. M. & Geyer, F. 2005. Resources, Time & Money: Why project schedules simply don't work. In: present publication, *Proceedings of 22nd W78 Conference on Information Technology in Construction*, Dresden, Germany, July 2005.

