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Building Management Simulation Centre

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Abstract

A unique training centre for construction management has recently been built in the Netherlands. The aim when developing the BMSC was to have maximum control over the training circumstances and to collect as much data as possible about the trainee, during the training. A new centre was therefore built and a new course system was implemented. The centre consists of a virtual building site, a (real) site hut for the trainees and a control room. The course system intermediates between the trainee, the trainer and the building site. A central role in the course system is played by so-called transitions, which are composed of activities that have to be performed by the trainee. An activity is fulfilled by entering web-based forms with the right content and in the right order. Interaction with the trainee is also established through actors that interrupt the planned flow of activities. After a training session, the system can reproduce all actions that were taken; it can show the consequences for the building and present the construction management performance.
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When you enter the Building Management Simulation Centre (BMSC), it looks like a normal training centre with lecture rooms. However, the main part of the building is a huge simulation hall. It locates 10 site huts with a view on a large parabolic projection screen. Trainees walk to the projection screen to inspect the building under construction by navigating through the full-scale model. In the site hut, a computer system is available to access all project information and to communicate with the outside world. Actors are playing roles, which demand immediate action from the trainee. The whole process is coordinated from the control room that is located in one of the site huts (Fig. 1).

The BMSC is a new training centre in the Netherlands for construction management. Unlike traditional construction management training, it does not take place in practice but in a high-tech environment. Designing and developing such a new training centre with hardly any reference projects required new ideas and new solutions. In this article, we report on the BMSC project. The outline is as follows: First the motivation of the project is described and related researches are discussed. In the next paragraphs, the pedagogical and the technical principles of the course system are highlighted. In the implementation paragraph, the layout of the building and the system interface is presented. After that, a typical training

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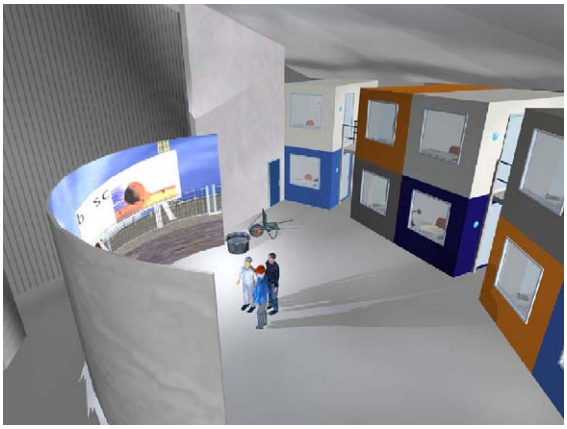

Fig. 1. Simulation hall.

session is described to fit all the components together. Finally, the exploitation of the BMSC, the adaptation of the system and the evaluation of the trainings are discussed.

1. Background

1.1. Construction management training

In 1997, the so-called RRBouw report [1] published in the Netherlands concluded that the traditional construction manager was primarily responsible for the building technology aspects, whereas the new generation construction manager also needs to become involved in the planning aspects of the construction process. The function description of the new construction manager was summarized as follows: (1) The manager should have proper knowledge and skills in planning and project preparation (project analysis, process analysis, contract plan), (2) the manager should be familiar with construction preparation (main construction plan, cost calculation, quality assurance plan, organisational plan, information plan), and (3) the manager should have detailed knowledge about construction as such (preparation of the work tasks, management of the work tasks, evaluation of the construction progress). The report also concluded that current training programs only addressed some of these topics and hence did not satisfy the requirements for this new kind of construction manager.

In response to these conclusions, the decision was made to develop a new training program. A shortlist of targets was formulated. New training programs should reduce the failure costs of the building process, improve construction quality, and stimulate proactive as opposed to re-active style of construction management.

Until then, construction managers were typically trained on the building site. The problems with this kind of training are evident. Firstly, the trainee is not responsible for his own actions. He knows that he can rely upon the master and thus the stress and strain that play a very important role in construction management reality are absent. Secondly, the trainee is dependent on the attitude of his master. Often the trainee is considered a burden. The trainer does not spend real effort to educate the trainee because of a lack of time and/or a lack of interest. Thirdly, the trainee may not be confronted with any severe problems. Depending on the kind of building project and the construction stage, construction management can sometimes be routine task and at other times a culmination of problems. Obviously, the training is intended to learn the construction manager how to cope with the most difficult situations. Controlled environments potentially are better suited to enhance the training and learning process. The success of such VR-based training facilities in the aircraft industry (flight simulators) and in architecture (by example Strathclyde University has a system for impaired people [2]), led the initiators of the BMSC to investigate if the same technology and methodology could be used in the building industry. Ultimately, it was decided to build the facility.

1.2. Construction process simulation

Construction process simulation research has been focused mainly on the development of a construction planning analysis tool. Already in 1994, Martin Fischer started the development of 4D-CAD at Stanford University [3]. Similar examples can now be found at VTT [4] and many other universities [5,6]. All these systems have in common the support of the construction manager in his/her planning tasks by linking the building activities in the planning process and the building components in the CAD model. Such a link allows for a visual check of the construction

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