B. de Vries (Convener). ***Building Information Modelling (BIM) and virtual construction.*** *Gerontechnology 2012;11(2):65;* doi:10.4017/gt.2012.11.02.101.00 **Participants**: *V. Balali* (USA), *J. Hovila* (Finland), *L. Kang* (Korea), and *E. Viljamaa* (Finland). **ISSUE** Data models for automation in civil engineering. **CONTENT** Building Information Modelling (BIM) has focussed mostly on the building sector. Lately initiatives for bridges and roads have been launched by local authorities, sometimes in complete isolation, sometimes as an extension to existing BIMs. Today there is a need for standardization of data models in the civil engineering domain. In this symposium current trends and past experiences in the development and application of data models for automation in civil engineering are investigated and discussed. Ongoing international as well as local efforts in the Netherlands to facilitate integrated design, automated construction and computerized monitoring and maintenance of infrastructural artefacts are reflected upon by key researchers and practitioners. A spectrum of approaches and purposes to capture and process data, information, and knowledge is brought together to investigate existing and potential synergetic effects that could result from collaboration of different initiatives and research programs and to sketch roadmap scenarios for the future research agenda. **STRUCTURE** During the symposium, each participant will give a short introduction to their focus area and background of less than 15 minutes. These presentations will conclude by outlining challenges that could potentially profit from joint efforts of the various initiatives. In the subsequent panel discussion these approaches are compared, common interests are identified, and possible future roadmaps are sketched out. **CONCLUSION** This symposium will illustrate and discuss the current landscape of data modelling approaches for infrastructures from different perspectives. Future research areas and potential collaboration between initiatives will have been identified.

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Keywords: building information modelling, infrastructure, data modelling
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V. Balali, M. Golparvar-Fard, J.M. de la Garza. ***Video-based highway asset recognition and 3D localization.*** *Gerontechnology 2012;11(2):65-66;* doi:10.4017/gt.2012.11.02.322.00 **Purpose** Asset management is a critical element to the operation, maintenance, and preservation of transportation infrastructure systems. Efficient data collection is a key element on high-quantity low cost assets such as road signs, traffic signals, light poles, and guardrails. Despite its importance, asset data collection is performed manually and is time-consuming[1]. The volume of the data to be collected also impacts the quality of data. There is a need for asset data collection that can provide useable asset inventories to departments of transportations for further analysis and condition assessment purposes[2]. Over the past few years, several researchers have proposed techniques to recognize automatically individual types of assets from 2D-video streams. Three studies[3-5] have proposed methods to automatically detect traffic signs. Despite the reasonable accuracies reported, the proposed methods are primarily limited to detecting one type of asset, and in several cases the algorithms are validated with limited datasets. To address these limitations, we present a novel video-based recognition and 3D-reconstruction algorithm which can efficiently create records of locations and up-to-date status of highway assets. The task is particularly challenging, as highway assets have significant intra-class variability. In addition, different weather conditions and occlusions can adversely impact the detection accuracy. **Method** The proposed method takes an input of video streams collected with an array of cameras mounted on an inspection vehicle and combines 2D-recognition with 3D-reconstruction algorithms. First, a set of thresholded frames containing candidates for assets is identified. Using a new Support Vector Machine classifier and based on the color channels at pixel level, a set of bounding boxes are initially extracted. Next, using a new shape recognition algorithm based on Haar-like features, the 2D- candidates are further refined and categorized based on their shape and appearance. These candidates are placed into a new texture and color recognition algorithm, where–by using a multiple binary SVM classifier–they are further classified into particular predefined types of assets. In the meantime, a computationally effective image-based 3D-reconstruction algorithm takes the same video frames and reconstructs a dense 3D-point-cloud model of all visible objects. Using a new 3D-shape segmentation algorithm, 3D-points are hierarchically clustered to form a potential set of assets. This algorithm classifies 3D assets such as guardrails (*Figure 1*) and light poles which are not detectable from single video frames. Finally using the connectivity semantics embedded between the video frames and 3D-points in the reconstructed point cloud, all assets are localized in 3D. **Results & Discussion** Experimental results are presented on a 2.2 mile two-lane experimental road which features a variety of highway assets. Point Grey cameras were used to capture video frames with spatial resolution of 2080x1552 at 60 frames/s. The benefits and limitations of the proposed method in detection, classification, and localization of multiple types of highway assets are discussed in detail.

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Keywords: asset condition assessment, 3D reconstruction

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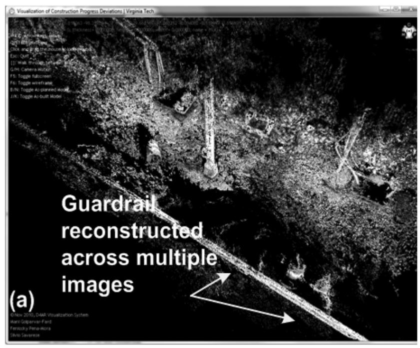

Figure 1. The result of 3D image-based reconstruction algorithm (1,437,001 points; 120 images)

R. HEIKKILÄ, J. HOVILA. ***National guidelines for bridge information modelling and automation.*** *Gerontechnology 2012;11(2):66;* doi:10.4017/gt.2012.11.02.342.00 **Purpose** National bridge information modeling guidelines have been developed in Finland at the behest of the Finnish Transport Agency. The aim was to set, for the first time, national standard of producing and utilizing 3D-information modeling and automation in bridge engineering in Finland. **Method** In the guidelines, the terminology of different main design phases of bridges and information models is introduced. More specific information model contents and technical guidelines are then determined. A comparison is made between the Finnish guidelines and the draft Norwegian modeling guidelines[1]. **Results & Discussion** In Finland and Norway these guidelines aim to promote the use of 3D-modeling and automation in the infrastructure, including bridges, roads, and railways. There are many reasons why these types of guidelines are necessary for the industry. More international collaboration will be needed in the next development phase to arrive at comprehensive and useful guidelines and standards.

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Keywords: 3D, information modeling, bridges

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H-S. MOON, H-S. KIM, L-S. KANG, C-H. KIM. ***BIM functions for optimized construction management in civil engineering.*** *Gerontechnology 2012;11(2):67;* doi:10.4017/gt.2012.11.02.251.00 **Purpose** The aim of this study is to suggest configuration methodologies of active building information model (BIM) functions that enable to practically control limitations by optimizing schedule overlapping linked to its space models after analyzing workspace conflict analysis for a bridge model. This study also suggests development methodologies of active BIM-functions, linking an optimized method and improved strategies of future BIM-operation model through an analysis of limitations of a passive BIM-operation system for architectural projects. **Method** The existing BIM-system manually performed a simplified comparison review of 3D-shapes and its virtual reality (VR) analysis with visual manipulation of 3D-models in a virtual environment[1]. Such BIM-functions require a separate analysis process to organize BIM-output data as reprocessed business data. This has many limitations when directly utilizing the visual information produced by commercial BIM-systems as practical operation data. Accordingly, this study develops functions of an active BIM-system so that the managers can directly analyze practical requirements by integrating an optimized analysis algorithm with the BIM-system to improve the passive BIM-operation environments. As a method of configuring the active BIM-functions, an optimized algorithm for establishing resolution strategies for workspace conflicts is constructed. As functions for supporting active BIM-operations, this study utilizes fuzzy and genetic algorithm (GA) approaches. These approaches will be used to develop visualized risk assessment model and workspace conflict optimization model based on active BIM. **Results & Discussion** By enhancing fragmentary analysis functions of simplified 3D-models with the development of an active BIM-system, the BIM-system can utilize output information derived from a process of analysis, evaluation and control of the BIM-models as a practical operation information model for both design and construction phase. Therefore, it is expected that an active BIM can simplify data analysis and the system operation process for managers with virtual object models and expand the active BIM-system to the life cycle of civil engineering projects.

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Keywords: active BIM, passive BIM, optimization, risk assessment, workspace conflict
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E. VILJAMAA, I. PELTOMAA, J. HOVILA, R. HEIKKILÄ. ***Advanced process control for infrastructure building processes.*** *Gerontechnology 2012;11(2):67-68;* doi:10.4017/gt.2012.11.02.229.00 **Purpose** In this research, novel information integration technology and advances in wireless communication, positioning and machine control systems were combined into a general control method for an improved multi-contractor infrastructure building process. More intense competition and new environmental regulations in the field of infrastructure building are forcing companies to revise and intensify their processes. There is a clear need for tools enabling more efficient process management. In this research, the objective was to find out how to improve process management through more efficient information exploitation. **Method** We conducted a literature review and interviews with professionals in the field to find out requirements for improvements in process management (*Figure 2*). **Results & Discussion** Based on the requirements revealed by the literature and interviews, the developed control method exploits common ontology models to integrate design and construction time process data with the help of advanced communication, positioning, and machine control applications. In addition to construction time process control, the utilization of the developed control method also potentially intensifies operations before and after the project. The developed method for example makes offer requesting, project control and maintenance potentially more efficient and therefore makes processes safer, more cost-efficient, eco-efficient, and greatly helps the product data management. The development of

the method is the first step and the results will be verified in a next research phase by practical implementation.

Keywords: infrastructure building, information integration, semantic methods
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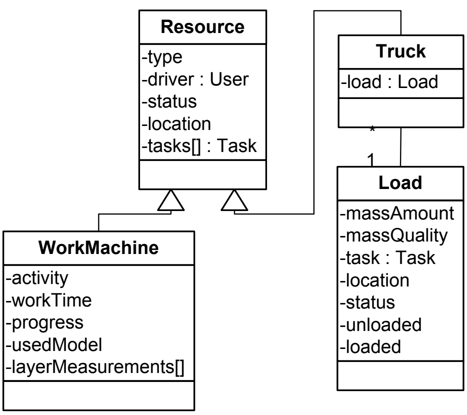

Figure 2. An ontology snippet of sub-contractor resource