Session Report:

INFORMATION TECHNOLOGY TO IMPROVE DESIGN AND CONSTRUCTION

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Interactive 4D Project Management System
by Dr. Martin Fischer, Ms. Kathleen Liston, and Dr. Benedict R. Schwegler
Current Status and Future Development of Construction CALS/EC in Japan
by Mr. Takeya Isobe
Engineering and Construction Collaboration Using Information Technology
by Professor Wilson Tang, Professor Paul Chang, and Professor Liang Liu

Dr. Martin Fischer

Mr. Takeya Isobe

Prof. Paul Chang

1. SUMMARY

This summary highlights key technologies and issues from the three manuscripts comprising this session on Information Technology to Improve Design and Construction Practices. The authors presented technically interesting and a forward looking view of technologies to improve construction practices. Dr. Martin Fischer of Stanford University discussed Advanced Visualization and Simulation in Construction Project Decision-Making. Professor Paul Chang addressed his joint work on Engineering and Construction Collaboration Using Information Technology. Dr. Isobe from CTI Engineering spoke on Current Status and Future Development of Construction CALS/EC in Japan.

They offered examples about the construction industry's needs for better information technology management and timely communications. While, information technology has revolutionized industries in the manufacturing and service sectors, such changes have so far been less radical within the construction industry. Few construction organizations are fully using the power of information technology. The construction industry is fragmented, and as a result it has been difficult to achieve the types of information technology change evident in other manufacturing and service sector industries. Some design and construction organizations are moving towards integrated uses of information technology but they represent a small percent of the overall community.

The central message from these presentations is a renewed sense to incorporate information technology into design, management, and construction practices to work more efficiently and smarter in a global and interactive manner. Organizations that are adaptive to change will have many opportunities available to create new ways of performing engineering and construction through collaborations that will achieve improved quality control and get the finished product into the marketplace faster.

To meet this challenge, the authors recommend the design community seek out and identify those available information technologies beyond using 3D CAD approaches. They challenged us to automate current procedures, practices, and processes and get project team members working together from a variety of technical disciplines and organizations. They illustrated the benefits of using enhanced 3D modeling techniques that are extended to 4D (incorporates time – the construction schedule). The authors described how integrated data techniques are applied in practice. They note information technology is an enabler and the extent of information technology use in the construction process is determined by construction clients.

2. PRESENTATION HIGHLIGHTS

These presentations introduced improved project management information systems using visualization and computer graphics to improve information flow and decision making in construction project management. Summaries of each speaker's presentations follow.

Dr. Fischer et al's paper presented an interactive 4D modeling system. The concept incorporates time (construction schedule) and links between levels of product detail and process model to view and understand the graphic representation of the design concept. Dr. Fisher spoke about computer visualization techniques produced during the design stage and used in a Computer Automated Virtual Environment (CAVE). This setting allowed for the creation of virtual reality fly-throughs that greatly assist the construction management project team members and end users communicate their needs through viewing the construction process through the simulations to identify possible problems and optimize construction. Quicker decisions can be

made between owner and design project management team since the 4D modeling system will simulate the constructed facility at various stages of its future construction based on the design drawings and available construction information. The owner, project manager, and construction management team can consider various design and schedule scenarios over time. Spatial constants, scheduling implications due to various material arrival times, flow of work, potential environmental consequences will be made available.

Professor Chang et al presented an application of information technology for engineering and construction collaborations. IT allows all persons in the design and construction process to collaborate remotely and access information quickly through the Internet. Several examples were offered including the worldwide web and Internet; wireless communications; 3D and 4D visualization and computer graphics, hand-held/wearable computers and multimedia data collaborations and video conferencing; and business-to-business on line transactions are expected to eliminate the distributor and shorten the time to site at reduced costs. The Internet permits for improved quality control and quality assurance during the construction phase such as applications and approvals of building permits and code compliance; ability to create A/E/C teams that operate in different global regions; electronic file exchanges for shop formatting and design enhancement/revisions; and in-the-field data collection including text, images, sound, and video for the creation of construction reports.

Mr. Isobe spoke about the Ministry of Land, Infrastructure, and Transport (MOLIT) (formerly the Ministry of Construction) 1997 initiated program, Continuous Acquisition and Life-Cycle Support/Electronic Commerce (CALS/EC) program aimed at public works projects. This eight-year project (1997-2004) is designed to exchange electronic information for creating an information clearing house on public works projects and a secure system to tender bids and to certify information. While this system has not been proven at the local level, much standardization is underway to assure document formats are compatible for uniformity as they are used throughout Japan’s 10-regions and 47-prefectures. Mr. Isobe noted that productivity would be enhanced through CALS/EC data management as it processes the vast amount of data and is the latest technology available to effectively manage the rapid progress of information technology. Also, he notes that outsourcing data management is critical to improving uniform quality and economy of the constructed facility. Mr. Isobe noted a concern that the local governments may experience greater difficulty using the system if they have too fewer staff skilled in using this sophisticated program. The national government organizations may have less difficulty as they have a greater number of staff educated in information technologies. Employing adequate information technology skills will require a strong focus on continuing education programs. Mr. Isobe noted that there is a vast amount of public works design and construction data that needs to be converted into electronic format. In his view much of this data conversion can effectively be performed by outsourcing, especially in the regions.

3. **CONCLUSION**

As we heard this afternoon, information technology does not yet allow for a fast and successful implementation of interactive modeling systems due to the many inconsistent data standards. Also, construction organizations today make little use of 4D modeling. However, a number of construction related initiatives seem to be proceeding in a promising direction with respect to an integrated computer-aided facility management of the life cycle of construction products. It was pointed out that much additional work is needed in a variety of areas and they could be performed on a collaborative basis between the building research organizations, the building owners, the construction management team, and government.

We heard, information technology reduces the obstacles of distance and time and results in

nearly instantaneous and seamless communication. We learned of some examples where the design and construction community has benefited from using advanced information technology to improve its economic impact on engineering and construction practices. As illustrated by the speakers, we learned about the emerging interactive electronic information infrastructure that is more robust and has greater built in security as is shapes the future of the design and construction planning. These tools greatly assist the designers and contractors by providing advanced decisionmaking and expert system tools that improve the life cycle quality and economy of constructed facilities. These three presentations permitted us to take a glimpse into the future to see improved design and construction practices through information technology.

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