Optimizing the design process of complex structures

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Summary

„i-BID Archive“ stands for **I**nteractive **B**uilding **I**nformation **D**ocuments Archive. It is a software application based on PDF technology that automatically generates an interactive archive from the data of a 3D structural model. Within the archive all information pertaining to a construction can be stored together in form of electronically linked PDF documents. This eliminates the annoying walk to the archive, because all the data will be available at a mouse click. ìi-B ID Archiveî can easily import any changes to the structural model into the PDF drawings and PDF calculation documents. In this way, the high quality archive can be updated with very little effort during the life cycle of the construction. Hence, ìi-BID Archiveî is interesting for builders and planning engineers when planning and maintaining complex structures.

Keywords: CAE, CAD, PDF document, electronic archive, 3D structural model, building, structural drawing, structural calculation

1. Introduction

Back in 1970, there were about 1,600,000 people employed in the German building trade, which was regarded as the barometer for the German economy. In 2007, only about 700,000 people remained employed in this industry. The German building trade has suffered painful losses over the last decade. Building firms, architects and engineers have been under extreme pressure to secure the existence of their companies. A combination of perseverance, courage and creativity was especially vital in this challenging, competitive situation in order to survive and to secure jobs.

Even in this age of computer-aided planning processes, personnel costs are still a significant factor. Although, efficiency of employees can be fostered, labor costs can only be reduced to a limited level.

Processing data from structural design programs into documents that can be revised, expanded, structurally proofed, distributed and archived takes an enormous amount of time. It also harbors many sources of error, especially when structures get very complex.

This insight led the author to develop the software ìi-BID Archiveî ñ the ì**i**nteractive **B**uilding **I**nformation **D**ocuments Archiveî ñ f or program-controlled generation of structural documents and drawings based on PDF technology. This involves using one program interface to export data from a 3D structural model, process it and store it as linked structural documents and drawings in one electronic building archive.

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2. Development of " i-BID Archive"

The link between the structural data and the PDF documents is an item reference consisting of four pairs of digits. The digit pairs correspond to the properties of a structural item and contain information on the component and its position in the building.

An item reference is assigned as a hyperlink to a member in the plan of item references (PDF document).

An intelligent search algorithm compares node numbers, cross-sectional numbers, directional vectors and local member alignments with the data of a reference member, and recognizes every member in this member alignment depending on the chosen combination of these search criteria. The item reference is assigned to the reference member of the member alignment.

These drawings not only contain all relevant information on the building, but are also the first of their kind to allow direct interaction using the computer mouse to access additional data from calculation results and other essential structural data (Figure 1).

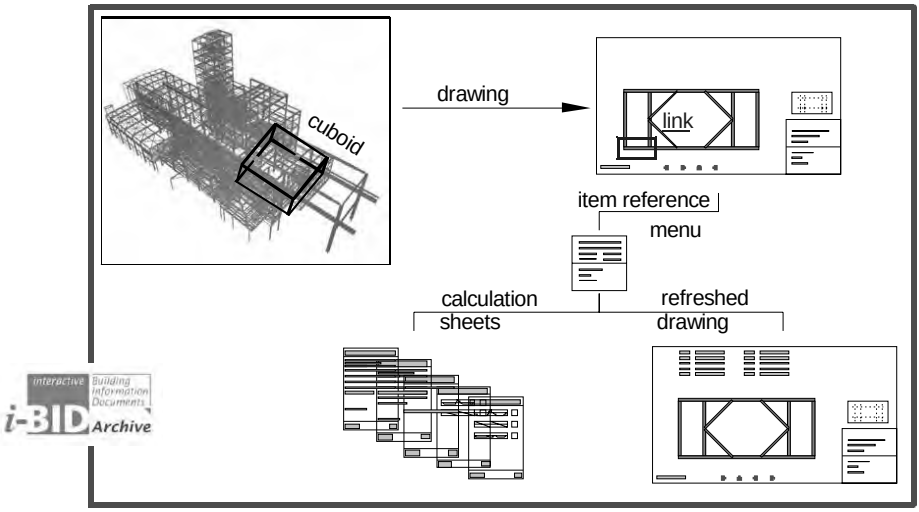

Figure 1 Interactive linking between CAE model and PDF documents

3. Application

This innovative method was first used to create a structural analysis of a 40-year-old industrial complex of a major industrial firm in Hamburg, Germany. It was this method that made the project feasible.

In a 3D structural model, about 20,000 finite elements were drawn, analyzed and finally evaluated using the ìi- BID Archiveî software. An electronic archive, consisting of PDF documents covering about 21,000 pages and 100 structural drawings was delivered to the client on schedule.
Presentation

[1] This presentation is about the creation and development of the methods used and their application by taking a look at a specific example of a complex structure.
This method will be discussed after a video presentation on the use of the program, and the talk will conclude with an outlook on the developments we have planned.