Digital building surveying and planning
Integrative approaches with commercial object-oriented CAAD systems

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As a result of growing activity in the field of renovation and building within existing built contexts, modern digital tools and methods are increasingly in demand. Support of the planning process means: the step-by-step capture of building-relevant information, a rule and parameter-based development of solutions and the combination of traditional and automated methods and technologies used for model creation (building surveying) and model transformation (planning). This article discusses general requirements and the results from our own research and development as well as illustrating how building surveying can already contribute to the planning process more effectively using currently available tools.

Keywords: Planning, Building surveying, Process model, CAAD, IT-planning tools, renovation, 3D-model, information systems

Planning in existing built contexts – current approaches and future requirements for building surveying

Conversion and renovation projects are characterised by a continually changing information basis. As building progresses new information becomes available and very often these can have a significant effect on building measures which follow. Current practice in information capture and administration does not take this dynamic process into consideration. There is currently only IT-support of localised aspects. As a result a continuous administration of information throughout the process is not available. This can lead to losses between the different trades involved in the planning process. At present building surveying is considered as one process, planning as a second process. If existing data does not appear to be feasible or is insufficient, someone who is not involved in the planning process is asked to survey and verify the available data. One way or the other as much information as possible is collected as accurately and in as much detail as possible (fig.1). Afterwards, the planner decides which information is useful and relevant. A better approach would be to integrate building surveying with the planning process so that a continual interaction between information capture and planning becomes possible (Lagerqvist 1996; Petzold 2001).

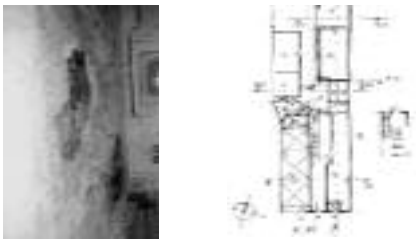

Figure 1. Process oriented, sequential surveying of a typical situation

verbal descriptio raw digital data

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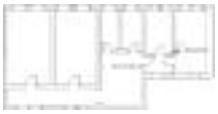
The requirements of the planning process should determine which information should be captured, when and in which order it should be captured, and what level of detail is required (fig. 2).

Level 1
taxonomy

Level 2
sketch



Level 3
2D-plan oriented

Level 4
3D-model oriented

Figure 2. Different levels of detail for describing building substance (in this case building geometry)

For consistent planning throughout the entire planning process the information must be structured according to the planning requirements and the building at hand. Both traditional and new straightforward ways of structuring information should be usable or must be developed. All captured data must be connected with one another in an "informational structure". This must be able to cater for both strictly predefined structural relationships as well as individual project-specific relationships.

A concept for planning-oriented information capture

In order to achieve a better integration of building information into the planning process a number of concepts and prototypes have been developed as part of the InfAR research project, which increase the relevance and usability of survey-data within the planning process (Donath et al. 2001; Petzold 2001; Donath 2003).

The Information container – a basis for structuring information

A structured approach to capture and storage of building information is an essential prerequisite for making use of this information throughout the entire duration of the planning process. The information to be captured can be reduced to that information which is relevant for its later use in the planning process. The concept envisages an ordering system for the entire planning process flexible enough to be able to accommodate situation-specific extensions. For the purposes of describing an existing built construction, two primary structures are of importance: the spatial structure, an overview of all spatial elements (rooms) within the building structure and the building element structure, a hierarchical classification of all elements within the building.

In addition to surveying geometric data, formal (specific building data), informal (text, images, sketches etc.) and relational data (proba-

ble structural relationships) can be captured. The captured data is stored within an information container that can be used within both the spatial structure as well as the building element structure

Figure 3. Information container

(fig.3). Geometric data is “only one attribute” of such an information container.

A basis – the Experimental platform “Freak”

The concept of the system follows a modular building-block system. Different modules for information capture and planning can be combined as required (fig. 4). The individual modules form a continuous, extensible, flexible and in real-time dynamically adaptable system which cover all aspects from the initial site visit to detailed planning. Each tool is developed for an individual aspect taking into account its role within and the requirements of the entire planning system. Selected aspects have been developed as prototypes in the experimental platform “Freak” (fig.4).

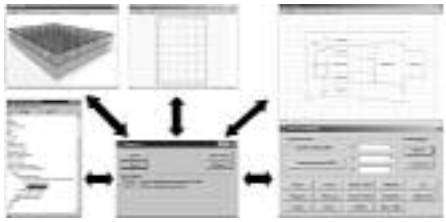


Figure 4. Server and different applications of the experimental platform "Freak"

Figure 5a. Definition of building elements in Palladio X5

Figure 5b. Positioning of building elements with TachyCAD and Tachymeter

Realising a planning philosophy using commercially available software products Palladio X5 + TachyCAD

The process as described above can in part be achieved using currently available software products. Different software modules can be employed in combination with reference to a standardised working platform (ADT Architectural Desktop by Autodesk”). Both the CAAD-system Palladio X5 (acadGraph 2003) and the Tachymetry software TachyCAD (kubit 2003) are conceived as extensions to ADT and as such can be employed

as tools in a platform for realising the planning-oriented capture of building information. Of particular relevance is the ability to use the Tachymeter as a 3D-mouse (fig. 5b) to directly position Palladio X5 elements (fig 5a) within an overall coordinate system.

The different modifiers defined in ADT and usable with Palladio X5 can also be used with the Tachymeter. The ability to adapt standardised building elements to their actual object geometry is essential in order to able to model existing buildings with all their irregularities within an object-oriented system. This approach allows the typical 2D-geometric building survey to be expanded into a quantifiable building-element related 3D-model. Palladio can also be used as a first stage for sketching out a rough building model (fig. 6a) which can then be 'intensified' using surveying methods to develop as precise and detailed a 3D-model (fig. 6b). This combination means that it can be used as planning tool at both a simple and highly detailed level. A high density of information can be employed selectively throughout the entire process.

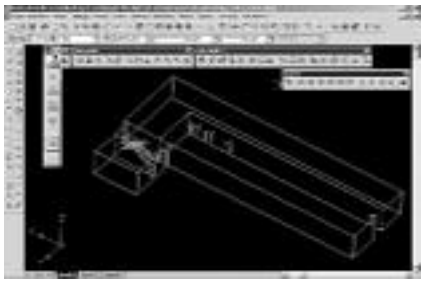


Figure 6a. Sketch model

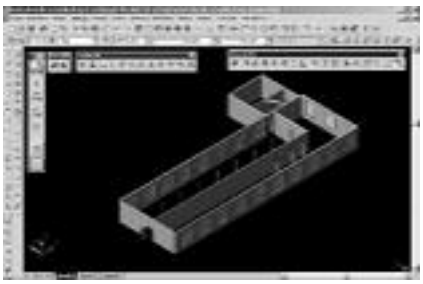


Figure. 6b. Extended and intensified detail model

Future working methods and planning tools

The process of integrated planning for existing buildings can happen within the classical support through CA(A)D-systems. The specific logic of complex, individual buildings and their functional structures can be integrated within an informational structure for capturing, administering and planning with planning-related data. It looks likely that laser-scanner systems, automated image assessment etc. will nevertheless not be able to fulfil all that is promised. More likely and more conceivable is a more flexible approach to planning. Working drawings can serve as a basis for exact 2D-plans and, as necessary, detailed 3D-models. More detailed information can be called up through individual building elements. Where exact dimensions and relational positioning prove absolutely necessary for the planning, the hand-made sketch can serves as a structural anchor and information basis for the development of a topological-geometrical model. A variety of tools and methods can be used in combination depending upon the individual situation.

References

Lagerqvist, B.: The conservation information system: Photogrammetry as a base for designing documentation in conservation and cultural resources management. Göteborg Studies in Conservation, Nr. 4, 1996

Petzold, F.: Computergestützte Bauaufnahme als Grundlage für die Planung im Bestand. Dissertation, Bauhaus-Universität Weimar, 2001

Donath, D.: Die Auseinandersetzung mit dem Bauwerk - Notwendigkeiten im Planen und Bauen. IKM 2003, Weimar, Print in preparation.

D. Donath, F. Petzold, T. Thurow: Planning relevant survey of buildings - starting point in the revitalization process of existing building - requirements, concepts, prototypes and visions. The CIPA Archives for Documentation of Culture Heritage, Volume XVIII – 2001, pp. 565-572

acadGraph: http://www.acadgraph.de/start.html

kubit: http://www.kubit.de